Federal Democratic Republic of Ethiopia
Ministry of Education

Project for Capacity Development for Improving Learning Achievement in Mathematics and Science Education in the Federal Democratic Republic of Ethiopia (LAMS)

Project Completion Report

October 2017

Japan International Cooperation Agency (JICA)

International Development Center of Japan Inc.
Koei Research & Consulting Inc.

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ACRONYMS AND ABBREVIATIONS

CA	City Administration
CDID	Curriculum Development and Implementation Directorate
CEB	City Education Bureau
CEMASTEA	Center for Mathematics, Science and Technology Education in Africa
COMSTEDA	Conference for Mathematics, Science and Technology Education in Africa
CPD	Continuous Professional Development
CTE	College of Teacher Education
EB	Education Bureau
EGSECE	Ethiopian General Secondary Education Certificate Examination
EMIS	Education Management Information System
EPRMD	EMIS, Planning and Resource Mobilization Directorate
ESDP	Education Sector Development Program
ETB	Ethiopian Birr
GEQIP	General Education Quality Improvement Project
GOE	Government of Ethiopia
IDCJ	International Development Center of Japan Inc.
INSET	In-service education and training
JART	Japan Association for Research on Testing
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
KRC	Koei Research & Consulting Inc.
LAMS	Project for Capacity Development for Improving Learning Achievement in Mathematics and Science Education
M&E	Monitoring and Evaluation
MCQ	multiple-choice question
MLC	Minimum Learning Competency
MoE	Ministry of Education
MS	Microsoft
MSIC	Mathematics and Science Improvement Center
NEAEA	National Educational Assessment and Examinations Agency
NLA	National Learning Assessment
NSC	National Steering Committee
PDF	Portable Document Format
PDM	Project Design Matrix
PISA	Programme for International Student Assessment
PO	Plan of Operation
PRESET	Pre-service education and training
PS	primary school
PSLCE	Primary School Leaving Certificate Examination
R/D	Record of Discussion
REB	Regional Education Bureau
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Educational Quality
SDGs	Sustainable Development Goals
SMASEE	National Pilot Project for Strengthening Mathematics and Science Education in Ethiopia
SNNPR	Southern Nations, Nationalities, and Peoples' Region

SS	secondary school
TC	Technical Committee
TELDD	Teachers and Educational Leaders Development Directorate
TELLRD	Teachers and Educational Leaders, Licensing and Re-licensing Directorate
TIMSS	Trends in International Mathematics and Science Study
ToT	Training of Trainers
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
VSOC	Vision and Spirit for Overseas Cooperation Co., Ltd.
WG	Working Group
WS	Workshop

EXECUTIVE SUMMARY

1 OUTLINE OF THE PROJECT

LAMS (Project for Capacity Development for Improving Learning Achievement in Mathematics and Science Education in the Federal Democratic Republic of Ethiopia) is a technical cooperation project jointly implemented for three years (2014~2017) by the Federal Ministry of Education of Ethiopia (MoE) and the Japan International Cooperation Agency (JICA).

It aims to reform Ethiopia's educational assessment systems by strengthening the capacity of officials who are directly or indirectly engaged in item writing for national or regional exams.

The central activity of the project is the Workshop. Around 90 experts and teachers, both federal and regional levels, are organized into five Working Groups (Mathematics, Biology, Chemistry, Physics, and Assessment and Evaluation) and received practical training on item development and workbook development.

There are seven outputs specified for the project to achieve:

Output 1: Enhanced capacity of the Working Group members;
Output 2: Item pools for Grades 7 and 8, and sample item pools for Grades 4 and 10;
Output 3: Enhanced capacity of those who are engaged in item writing for national and regional exams;
Output 4: Workbooks for Grades 7 and 8;
Output 5: INSET module on assessment;
Output 6: PRESET module on assessment; and
Output 7: Action Plan to utilize the developed materials.

2 PROJECT INPUTS

From the JICA side, ten experts have been assigned to this project. Total man-months of the project were 119.01. From the MoE side, around 90 experts and teachers have been assigned as the Working Group members. All 11 Regions/Cities have sent 6 members each.

As part of the project input, JICA conducted the two-week counterpart training in Japan three times during the three years. A total of 38 officials, experts and teachers took part in the training.

3 PROJECT ACTIVITIES

Among the various activities implemented by the project, the most important and central one was the **Workshop**. Ten Workshops were held during the project period. In the Workshop, the participants carried out two main activities: item development for the item pools [Output 2] and workbook development [Output 4]. At the second Workshop, they set their targets for item development as follows: 1,000 items each for Grades 7 and 8 (covering all units) and 200 items each for Grades 4 and 10 (covering 2 sample units). They have achieved all of these targets as shown below:

Table 1 Question Items Developed at the Ten Workshops

Working Group	Grades 7 and 8	Grade 4	Grade 10	Total
Mathematics	2,536	410	325	3,271
Biology	2,296	408	391	3,095
Chemistry	2,190	207	222	2,619

Physics	2,141	270	289	2,700
Assessment & Evaluation	357	--	--	357
Total	**9,520**	**1,295**	**1,227**	**12,042**

Some of the items for Grades 7 and 8 were field-tested on real students. The purpose of these **field tests** was to provide real data for item analysis to be performed by the Workshop participants. The field tests were conducted seven times in total testing 2,834 items. A total of 6,416 students participated.

Items for Grades 7 and 8 were further screened and selected to be stored in the item pools. Federal-level experts did the screening and selection at the **Item Selection Workshops**. Through the six Item Selection Workshops, they reviewed 9,551 items and finally selected 8,643 items, rejecting 908 items.[1]

Table 2 Question Items Selected for the Item Pools (Grades 7 and 8)

Working Group	Reviewed Total	Selected Total	Rejected Total
Mathematics	2,619	2,446	173
Biology	2,424	2,103	321
Chemistry	2,261	2,028	233
Physics	2,247	2,066	181
Assessment & Evaluation	--	--	--
Total	**9,551**	**8,643**	**908**

The selected items are stored in the **item pools**, which are open to the public. The item pools are uploaded on the MoE website for anyone's access, while one DVD storing all the data is distributed to each Woreda Education Office.

The **Workbooks** for Grades 7 and 8 have been developed by the same Working Group members at the Workshops. As a principle, the Workbooks should cover all the units specified in the curriculum but, at the same time, they were made as slim as possible. In May 2017, a small verification survey was conducted with about 90 students for each subject/grade and 16 teachers to verify the Workbooks' appropriateness and usefulness. Responses to the questionnaires were overwhelmingly positive among the students and teachers irrespective of the subject and grade. This small survey has amply verified that the LAMS Workbooks have good merits and are eagerly awaited by students and teachers alike. It is strongly recommended that MoE or Regional Education Bureaus take initiative to print and distribute them throughout the country.

The **INSET module** on assessment consists of four main parts: the first part on the concept of educational assessment; the second part on question item development; the third part on item analysis; and the fourth part on a case study of teaching scientific knowledge and concept, featuring a new classroom assessment method. This module is designed to become part of the INSET module currently used by MSIC.

The **PRESET module** was developed by TELDD by revising an existing module on assessment. The revised module was verified in June 2016 and is now distributed to CTEs.

The **Endline Survey** was carried out to evaluate the impact of LAMS on various aspects. It consisted of seven studies. Out of them, six studies analyzed the impact of LAMS from various perspectives and reached more or less the same conclusion: LAMS has had a significant positive impact on the capacity and views of the participants. It can be safely concluded that LAMS has succeeded in bringing about the intended change.

[1] The discrepancy between the total number developed at the Workshops (9,520) and the total number reviewed at the Item Selection Workshops (9,551) is due mainly to the "homework" items submitted at later Workshops. Some of them were not properly counted in.

The seventh study reviewed the consistency between the syllabus and PSLCE/EGSECE following the same study done in the Inception Survey. It found no significant improvement. This is not surprising, however, because LAMS did not directly target the quality of items of these national exams.

The **counterpart training in Japan** was conducted three times during the project period. One of the objectives was to understand that textbooks, learning materials and national examinations are prepared consistently with the national curriculum. A total of 38 officials, experts and teachers took part in this two-week training.

4 ACTION PLAN

Output 7 of LAMS is the Action Plan to utilize the materials developed by the project. Three basic policies are:

Policy 1: Capacity development is the primary output of LAMS though it is intangible. How to mobilize the developed capacity should be one important consideration in this Action Plan.

Policy 2: To ensure sustainability of the LAMS outputs, the existing systems like MSIC's INSET training should be fully mobilized and utilized.

Policy 3: Budget necessary for utilization/dissemination should come either from the Federal Ministry of Education or the Regional Education Bureaus once LAMS is finished.

One of the main actions to be taken after LAMS is to provide printed item pools and Workbooks for some pilot schools for the teachers' and students' trial use.

5 REVISION OF PDM

The original PDM (Project Design Matrix) was revised specifying some indicators to evaluate the project's achievements. Four main indicators newly introduced were:

1) Workshop participants' understanding about the importance of curriculum consistency;

2) Percentage of the field-tested items satisfying the two conditions below simultaneously: Difficulty >= 0.25 and Discrimination index >= 0.10;

3) Quality of the field-tested items in terms of the average score of item quality evaluation (0~6 points); and

4) Workshop participants' satisfaction.

Their respective targets were set as follows:

1) 28.6% (2014)==> 50% (2017)

2) 52.0% (Workshop 2)==>70.0% (Workshop 7)

3) 3.35 (Workshop 2)==>4.00 (Workshop 7)

4) 80% (Workshops 7 and 8)

6 ACHIEIVEMENT OF PROJECT OBJECTIVES

This project's super goal is that "students' learning achievement at Grades 7 and 8 is improved." Its overall goal is that "pedagogical basic foundation is prepared mainly at Grades 7 and 8 to improve students' learning achievement." Its project purpose is that "quality of curriculum strategy to improve students' learning achievement in mathematics and

science education at target grades is enhanced."

To evaluate the project's achievement, there are two main ways: One way is to see if the project has accomplished the seven outputs as prescribed in the R/D; the other way is to check if the project has achieved the targets of four indicators newly specified in the revised PDM.

With Respect to Seven Outputs

Output 1: Capacity of Subject Working Groups' Members

Capacity of the Subject Working Group members has been significantly improved.

Output 2: Item Pools and Sample Item Pools

Item Pools for Grades 7 and 8 have been constructed and made public. All subject Working Groups have accomplished the target number of items (1,000 each). Sample Item Pools for Grades 4 and 10 have also been constructed storing more than 200 items per subject per grade as their target.

Output 3: Capacity of the Human Resources on Development of Item Banks

Capacity of the personnel who work on the Item Banks has also been enhanced along with fellow Working Group members.

Output 4: Workbooks

Workbooks for Grades 7 and 8 have been developed by the Working Group members.

Output 5: INSET Module on Assessment

INSET Module on Assessment has been jointly developed by MSIC and the JICA Expert Team for LAMS.

Output 6: PRESET Module on Assessment

PRESET Module on Assessment has been revised and validated by TELDD.

Output 7: Action Plan

Action Plan to utilize the LAMS materials has been approved by the National Steering Committee.

With Respect to Four Indicators

Indicator 1: Understanding about the Importance of Curriculum Consistency

The rate of the participants who strongly agree with the view that "the curriculum (syllabus), textbooks and PSLCE should be mutually consistent" was:

2014 28.6%
2015 51.2%
2017 46.5%

It is clear that the participants of the LAMS Workshops have better understood the importance of curriculum consistency than before the project started. However, the PDM target of 50% of "Yes, I agree very much" in 2017 was not achieved.

Indicator 2: The Rate of Items Satisfying the Two Conditions Simultaneously

The rate of the "good" items (which satisfy both difficulty >= 0.25 and discrimination index >= 0.10) was 52.2% at the second Workshop but reached 73.5% at the seventh Workshop. Thus, this particular PDM indicator achieved its target, verifying LAMS' impact on the quality of items developed by the Workshop participants.

Indicator 3: Quality of Field-Tested Items

To judge an item's overall quality, LAMS employed a simple method. With each item, following scores are calculated:

Item Evaluation Score = Stem Score + Options Score + Innovation Score

where *Stem Score* evaluates stem's clarity, appropriateness, English, and so on; *Options Score* evaluates options' appropriateness, distractors' effectiveness, plausibility, clarity, logical order, English, and so on; and *Innovation Score* evaluates the item's presentation and innovativeness. These three scores take either 0, 1 or 2. Thus, the *Item Evaluation Score* can range from 0 (worst) to 6 (best).

All items developed at the second and the seventh Workshop and field-tested underwent this evaluation. The number was 270 and 480, respectively. The overall average of the Item Evaluation Score was:

Workshop 2	3.35
Workshop 7	3.86

Though the value of 3.86 for Workshop 7 did not attain the 4.0 target specified in the PDM, it nonetheless testifies the positive impact of LAMS on the item writing skills of the participants.

Indicator 4: Satisfaction of the Workshop Participants

At the end of each Workshop, participants were asked to fill in a questionnaire. According to the results, the rate of the participants who were satisfied with the Workshop was as follows:

"Very satisfied" and "Satisfied" with the Workshop

Workshop 7	89.2%
Workshop 8	94.2%
Average	*92.1%*

"Very satisfied" and "Satisfied" with their own achievement

Workshop 7	87.9%
Workshop 8	97.8%
Average	*93.7%*

Thus the PDM target of 80% was achieved.

With Respect to Project Purpose and Overall Goal

With respect to the project purpose, LAMS at least seems improving "curriculum strategy" by gradually constructing a backward loop from assessment to textbooks and curriculum. Some participants who are responsible for the development of curriculums and textbooks seem to have realized that the current textbooks and curriculums need review and improvement.

As for the overall goal and super goal, it is still premature to judge anything about their achievement. However, at least one thing can be cited: item development is just one small part of educational activity and its significance is very much limited at most. Viewed in the overall scope of education, LAMS is just one tiny endeavor aiming at the betterment of education in Ethiopia. Nonetheless, through the project over the past three years, it has become clear that Ethiopia should pay more serious attention to Grade 1 pupils and the lessons given to them. Assessment of Grade 7 and 8 students' achievement in mathematics and science unambiguously indicates that classroom lesson reform and improvement should

start at lower grades, probably at the very start, Grade 1. If LAMS can facilitate Ethiopian officials' fostering a consensus about the point above, it would be considered to be a firm step towards the goals of improving students' academic achievement.

Results of Evaluation Based on DAC Evaluation Criteria

Relevancy: This project is relevant both to Ethiopia's national policy and plan and to Japanese policy towards Ethiopia and for educational cooperation. Its relevancy is judged high.

Effectiveness: Out of seven outputs, five tangible outputs have been completed as specified. Intangible outputs, Workshop participants' capacity development, were significant as indicated by the results of the Endline survey. Overall, this project can be said to have achieved its project purpose effectively.

Efficiency: The project completed all the outputs specified in the R/D. The input needed to achieve it, however, was slightly more than the initial estimate. Its efficiency may be judged slightly low.

Impact: The some 90 participants who have acquired the knowledge of curriculum consistency and skills to write good items are expected to disseminate what they learned under the project to other colleagues in their office. Thus the project will gradually have impact on the students' learning achievement in respective regions.

Sustainability: In terms of the utilization of the project outputs, there has been some progress. However, overall level of utilization should remain low and some concern is inevitable about the sustainability of the project.

Suggestions to Achieve the Project Goals

The central part of the "pedagogical basic foundation" should be the curriculum (or syllabus as called in Ethiopia) and textbooks. It is strongly suggested that the curricula and textbooks for all grades and all subjects should be thoroughly reviewed and revised. The point of the revision should be "refinement." They need refinement to become student-friendly and easy to understand.

To improve students' learning achievement, the key lies in the teaching/learning at the early grades of primary education. It is recommended to review the teaching contents of all subjects and teaching methods for grades 1 to 4 students and make the students understand the basic contents better.

In Ethiopia, "elitism" is still very common in education but this should be totally changed to a democratic view that all students have an equal right to understand better and to perform better. This perceptional shift would be a prerequisite for better quality education and, furthermore, for nation building as envisaged in the national plan.

7 LESSONS GAINED FROM THE PROJECT

Based on the lessons gained from the project, LAMS has proposed two actions:

Reorganization of the INSET Curriculum

Ethiopian teachers should be trained on how to write question items appropriate for every-day classroom assessment. The current INSET curriculum should be reorganized to accommodate these needs, by expanding the classroom assessment session to include this specific subject.

Reform of the Mathematics Curriculum, Textbooks and Classroom Lessons for Low

Graders

Throughout LAMS, we have been worried by the low achievement of many Grade 7 and Grade 8 students. This failure was particularly severe with Mathematics. Their low achievements are the accumulated results of continuous failure to understand what they were taught at lower grades, very possibly at Grade 1. A research report published by MSIC in August 2016 verifies this inference.[2]

For Ethiopia to improve its mathematics education, a substantial reform is necessary beginning with Grade 1. Revising the syllabi and the textbooks is required. Teachers should be given additional training about how to better teach and how to take care of all pupils in the class. No such reform will be easy. Nonetheless, improvement is absolutely necessary starting from low grades, particularly Grade 1.

[2] Mathematics and Science Education Improvement Center. (2016). *Research on basic arithmetic (grade 1 – 4)*. Addis Ababa: MSIC.

1 OUTLINE OF THE PROJECT

1.1 Background

Ethiopia has achieved a significant improvement in education over the past two decades. The gross enrollment rate for primary education was 32% in 1990 but reached 95% in 2012.[1] The enrollment rate for secondary education has also been rapidly increasing in recent years. It is evident that the series of Education Sector Development Programs (ESDP) has made a considerable contribution to this rapid progress since 1997.

There remain, however, a number of challenges and issues to be tackled concerning the quality of education. The government of Ethiopia therefore considers the improvement of education quality one of its priority issues. At the same time, in order to accelerate the development of the industrial sector, the government of Ethiopia has adopted a national policy placing an emphasis on mathematics and science education from primary through higher education. Reflecting these policy orientations, ESDP IV, the previous program covering 2010/11 to 2014/15, paid a specific attention to educational quality improvement and human resource development particularly in science and technology.[2] In the current ESDP V, however, its attention has shifted to equity and inclusiveness and, as a result, direct reference to science and technology has been subdued at least in priorities.[3] Nonetheless, science and technology education remains one of Ethiopia's priority areas as a crucial means to achieve the lower middle-income country status by 2025.[4]

The Ministry of Education (MoE) in cooperation with JICA implemented the National Pilot Project for Strengthening Mathematics and Science Education in Ethiopia (SMASEE) for the purpose of establishing a model of in-service teachers training (INSET) targeting primary school teachers of mathematics and science for Grades 7 and 8. While this project achieved a significant improvement in teachers' perspectives and teaching skills, a lesson has been learnt: Implementing SMASEE alone is not enough; it is necessary to address other institutional issues simultaneously such as curriculum, teaching and learning materials, teacher qualification, learning assessment and examination systems, educational administration and finance. It was against this backdrop that both Governments of Ethiopia and Japan agreed to implement a project to reform the assessment and examination systems particularly to improve the quality of mathematics and science education.

MoE has made great efforts to achieve its education objectives. For instance, Curriculum Development and Implementation Directorate has revised the General Education Curriculum, in which active learning and a competency-based approach have been newly introduced. Mathematics and Science Improvement Center, previously called SMASEE Case Team, has worked to establish an INSET model. National Educational Assessment and Examinations Agency has regularly conducted the National Learning Assessment (NLA), based on the Minimum Learning Competencies (MLC) set out in the National Curriculum. Regional and National Examinations have also been improved and refined.

For students to attain the expected level of learning effectively, it is necessary that the three

[1] Federal Ministry of Education. (2013). *Education statistics annual abstract.* Addis Ababa. Table 2.1.

[2] The five main priorities of ESDP IV were: 1) Quality and internal efficiency, 2) Equity in access, 3) Adult education, 4) Strengthening the focus on sciences and technology, and 5) Improving management capacities. Federal Ministry of Education. (2010). *Education sector development program IV*. Addis Ababa.

[3] ESDP V indicates following five priorities: 1) Provide equal opportunities and participation for all, with special attention to disadvantaged groups, 2) Deliver quality education that meets the diverse learning needs of all children, youth and adults, 3) Develop competent citizens who contribute to social, economic, political and cultural development through creation and transfer of knowledge and technology, 4) Promote effective leadership, management and governance at all levels in order to achieve educational goals by mobilizing and using resources efficiently, and 5) Assist children, youth and adults to share common values and experiences, and to embrace diversity. Federal Ministry of Education. (2015). *ESDP V second final draft*. Addis Ababa. p.23.

[4] National Planning Commission. (2015). *The second growth and transformation plan (GTP II) (2015/16~2019/20) (Draft)*. Addis Ababa. p.16.

components of the teaching/learning process, that is, "curriculum," "classroom teaching" and "learning assessment," should be consistent in their principles and contents. The curriculum represents the national policy defining what each student should learn and understand (intended curriculum). The intended curriculum is instilled into students through textbooks and classroom teaching (implemented curriculum). The student digests the lessons and understands the subject, attaining the level of learning as expected by the curriculum (attained curriculum). The student's understanding (i.e., attained curriculum) should be correctly assessed and verified by means of appropriately designed examinations. Only when these three components share the same set of principles and contents, the teaching/learning process as a whole can be effective and high-quality education can be achieved.

This Project aims to pursue the consistency in the three components, particularly focusing on the third one, learning assessment. To this end, the Project tries to strengthen both horizontal and vertical linkages among the stakeholders. The horizontal linkage means to involve a number of agencies working in the field of learning assessment. The vertical linkage is to be realized by the Project's implementation structure consisting of the National Steering Committee at the policy level, the Technical Committee at the middle tier, and the Working Groups comprising of practitioners (item developers/writers and officers in charge of examinations). Close collaboration among various agencies and officers will be the key to secure the consistency of the teaching/learning process and realize the higher level of learning achievement among the students.

1.2 Goals and Objectives

This Project's **super goal** is that "students' learning achievement at Grades 7 and 8 is improved." Its **overall goal** is that "pedagogical basic foundation is prepared mainly at Grades 7 and 8 to improve students' learning achievement." Its **project purpose** is that "quality of curriculum strategy to improve students' learning achievement in mathematics and science education at target grades is enhanced."

1.3 Executing Agencies

Following agencies will work for this Project as the Ethiopian executing agencies:

- Mathematics and Science Improvement Center (MSIC)
- National Educational Assessment and Examinations Agency (NEAEA)
- Curriculum Development and Implementation Directorate (CDID)
- Teachers and Educational Leaders Development Directorate (TELDD)
- 11 Regional Education Bureaus (REBs)

Among them, MSIC serves as the National Coordinator of this Project.

1.4 Organizational Structure for Implementation

The structure for the implementation of this Project is shown in Figure 1.4.1. It is organized with three tiers, each of which representing the policy level, executive level and practitioner level.

At the top is the National Steering Committee, to be overseen by State Minister. The composition of the National Steering Committee is:

1. Director, EMIS, Planning and Resource Mobilization Directorate, MoE (Chairperson);
2. Representative of Ministry of Finance and Economic Cooperation;
3. Heads of National Regional State Education Bureaus;
4. Director General, National Educational Assessment and Examinations Agency;
5. Director, Curriculum Development and Implementation Directorate, MoE;

6. Director, Teachers and Educational Leaders Development Directorate, MoE;
7. Head, Mathematics and Science Improvement Center, MoE (Secretary);
8. Chief Representative of JICA Ethiopia Office;
9. JICA Experts; and
10. Subject specialists and assessment and examination experts as deemed necessary (observers).

The Technical Committee is chaired by Head of the Mathematics and Science Improvement Center and reports to the National Steering Committee. Its composition is:

1. Head, Mathematics and Science Improvement Center, MoE;
2. Director, National Educational Assessment Directorate, NEAEA;
3. Director, National Examinations Directorate, NEAEA;
4. Director, Curriculum Development and Implementation Directorate, MoE;
5. Director, Teachers and Educational Leaders Development Directorate, MoE;
6. JICA Experts; and
7. MoE and other subject specialists as deemed necessary.

Five Working Groups consist of Experts of MoE and central agencies and Experts of 11 REBs.

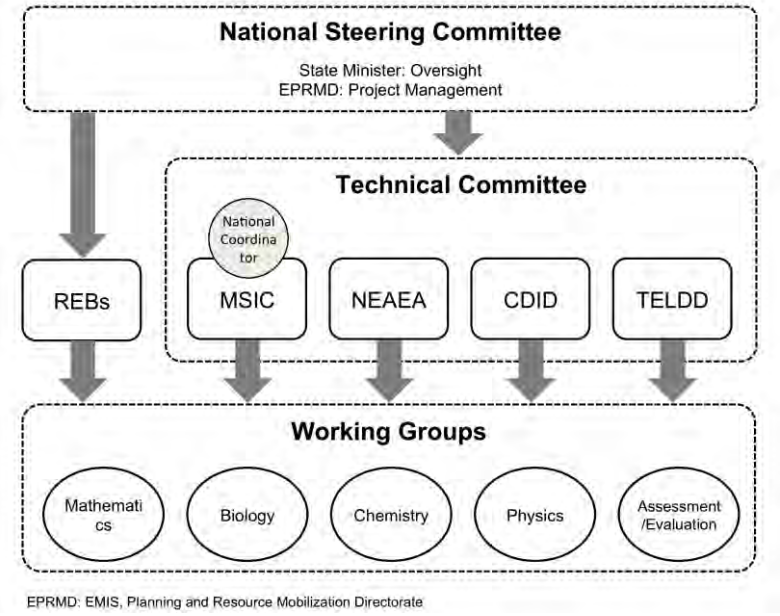


Figure 1.4.1 Project Implementation Structure

1.5 Outputs

There are seven outputs specified for the Project to achieve:

Output 1 (for Subject Working Group members):

Capacity of subject Working Groups' members on mathematics and science education is enhanced.

Output 2 (for Subject Working Group members and Assessment/Evaluation Working Group members):

Item pools in mathematics and science education for Grades 7 and 8, and sample item pools

in mathematics and science education for Grades 4 and 10 are developed.

Output 3 (mainly for NEAEA and REBs):

Capacity of the following human resources on development of item banks is enhanced.

- Item writers and experts for NLA item bank on mathematics and science for Grades 4, 8 and 10 (NEAEA);
- Subject experts for PSLCE item bank for Grade 8 and EGSECE item bank for Grade 10 both on mathematics and science (NEAEA)[5]; and
- Item writers for PSLCE items for Grade 8 (REBs).

Output 4 (mainly for CDID):

"Workbooks on mathematics and science for Grades 7 and 8" are developed.

Output 5 (mainly for MSIC):

"Assessment session modules on mathematics and science education for Grades 7 and 8" based on the "Item Pool for Grades 7 and 8" are elaborated as one of the CPD (Continuous Professional Development) modules.

Output 6 (mainly for TELDD):

"Assessment session modules on mathematics and science education for Grades 7 and 8" based on the "Item Pool for Grades 7 and 8" are elaborated as one of the CTE (College of Teacher Education) modules.

Output 7 (mainly for CDID, MSIC and TELDD):

Action plans, clarifying the utilization of the developed materials, are prepared.

1.6 Time Frame

The duration of the Project is three years from October 2014 to September 2017. This period is divided into three project years as follows:

Year 1 October 2014~September 2015 (about 12 months)
Year 2 October 2015~February 2017 (about 17 months)
Year 3 April 2017~September 2017 (about 6 months)

1.7 Principles of the Project

This Project upholds three working principles:

Principle 1 Ethiopia-driven
Principle 2 Gradualism
Principle 3 Japanese experiences as a reference

1.7.1 Principle 1: Ethiopia-Driven

This Project shall be driven by the Ethiopian stakeholders. It is so not only because the item banks will be developed solely by the officers and item writers of the related agencies but also because this Project is profoundly about how to change people's perception. As its project purpose states, this Project aims to enhance the "quality of curriculum strategy." In other words, its objective is to make the assessment of students' learning achievement (as in the form of PSLCE and EGSECE) more responsive to and consistent with the National Curriculums, particularly the Minimum Learning Competencies. This task may seem to be

[5] PSLCE stands for Primary School Leaving Certificate Examination. EGSECE stands for Ethiopian General Secondary Education Certificate Examination.

one of very technical nature. It is not. It is a highly cognitive task, requiring a drastic shift in our perception about students' learning assessment.

A perceptional shift (or in more popular terms, "paradigm shift") will never be effective if it is imposed from outside. A real perceptional shift will take place in a person's mind only when he or she learns or realizes something new spontaneously through his or her own thinking or experience. If this Project aims at this kind of change in people's mindset, it should be such that it can provide ample and spontaneous opportunities for the stakeholders to undergo a perceptional shift of their own. Thus, this Project should be driven entirely by the Ethiopian stakeholders.

The Japanese experts assigned to this Project will only assist the Ethiopian stakeholders to drive the Project. They will be facilitators, assisting to draw an accurate road map and providing some useful inputs from time to time.

1.7.2 Principle 2: Gradualism

"Gradualism" is a new term meaning that we will take steps gradually, avoiding jumping to the conclusion that we should drastically change the existing system. We will always keep paying due respect to the current system and, nonetheless, trying to find ways to improve it further.

Gradualism also implies that close collaboration between Ethiopian stakeholders and Japanese experts is a must. In order to find the ways to improve the current system, someone needs an outsider's view. It is one primary function of the Japanese expert to review the Ethiopian system as an "outsider" and provide hints for its betterment. The suggestions may not be so drastic or radical, being true to the principle of "gradualism." But, hopefully, their utility will be high for the Ethiopian stakeholders.

1.7.3 Principle 3: Japanese Experiences as a Reference

With respect to educational assessment, Japan has a long history of trial and error over the past century and a huge pile of practical experiences both at the policy level and at the classroom level. These experiences will without doubt provide some good reference to the Ethiopian stakeholders. One of the primary functions of the JICA Expert Team should therefore be to sift and digest the Japanese experiences and provide them for the Ethiopian counterpart to refer to.

2 PROJECT INPUTS

2.1 Work Flow

See Appendix 4 for Work Flow of Year 1, Year 2 and Year 3.

2.2 Work Plan

See Appendix 5 for Work Plan for Year 1, Year 2 and Year 3.

2.3 Experts Assignment

Ten experts have been assigned to this project. Their assignment chart is shown in Appendix 6 for each year. Total man-months are as shown in Table 2.3.1:

Table 2.3.1 Assigned Man-Months by Year

Project Year	Duration	In Ethiopia (M/M)	In Japan (M/M)	Total (M/M)
Year 1	Oct 2014~Sept 2015	34.23	7.00	41.23
Year 2	Oct 2015~Feb 2017	45.17	8.10	53.27
Year 3	April 2017~Sept 2017	18.81	5.70	24.51
Total	**--**	**98.21**	**20.80**	**119.01**

2.4 Working Group Members

Five Working Groups consist of Experts of MoE and central agencies and Experts and teachers of 11 REBs. Each subject Working Group is responsible for implementing all of the project activities.

The composition of the subject Working Groups (Mathematics, Biology, Chemistry, and Physics Working Group) are:

1. Mathematics and Science Improvement Center National Trainers of each subject;
2. Curriculum Development and Implementation Experts of each subject;
3. Teachers Development Experts; and
4. Other specialists of each subject assigned by MoE or by National Regional State Education Bureaus.

The Assessment and Evaluation Working Group is co-chaired by Director of National Educational Assessment Directorate and Director of National Examinations Directorate. The composition of the Assessment and Evaluation Working Group is:

1. Director, National Educational Assessment Directorate, NEAEA;
2. Director, National Examinations Directorate, NEAEA;
3. National Educational Assessment Experts;
4. National Examination Experts;
5. Regional Examination Experts;
6. Regional Assessment Experts; and
7. Other Assessment and Examination Experts assigned by NEAEA, MoE or Regional Education Bureaus.

The latest Working Group members are listed by subject in Section 3.2 below while the complete lists are attached as Appendix 7.

2.5 Counterpart Training

In each Project Year, LAMS dispatched a delegation of Ethiopian officials/experts to take part

in the counterpart training in Japan. The delegation comprised 10 members (First Year), 17 members (Second Year) and 11 members (Third Year). Each training course lasted for two weeks. Detail programs and results are described in Section 3.12 Counterpart Training in Japan.

2.6 Equipment Provided

Equipment necessary for the project activities and provided to the counterpart agencies is listed in Appendix 10.

3 PROJECT ACTIVITIES

3.1 Workshops

3.1.1 Framework of the Workshop

The Workshop represents the principal activity of LAMS. LAMS' outputs 1, 2, 3 and 4 are all to be derived from the series of Workshops to be conducted under LAMS. Table 3.1.1 summarizes the framework of the Workshops.

Table 3.1.1 Framework of the Workshops

Framework		Remarks
Frequency	Once in 3 or 4 months (3 times in Year 1; 5 times in Year 2; 2 times in Year 3: Total 10 times)	
Duration	4 ~ 6 days per workshop	6 days from the fourth Workshop
Venue	Appropriate places outside MoE	See Section 3.1.2 for details
Participants	Subject Working Groups members from MoE-related agencies, REBs, and primary school teachers Assessment and Evaluation Working Group members from MoE-related agencies and REBs	See Section 3.1.3 for details
Chairperson and Secretary	Chairperson and Secretary are selected and appointed by respective Working Groups	Appointed at the first Workshop
Program	Each Workshop consists of four main activities that are repeated each time: 1) Writing question items [*individual work*] 2) Reviewing and rewriting the question items developed [*group work and individual work*] 3) Analyzing the question items referring to the field test results [*group work*] 4) Rewriting and finalizing the question items field-tested [*individual work*] Some selected question items are field-tested after the Workshop and the results of item analysis are presented at the next Workshop. Therefore, each Workshop starts with the third activity (analyzing the question items referring to the field test results) and moves on to the fourth, the first and the second. From the fourth Workshop, one more activity, workbook development (Output 4), was added based on the agreement between JICA Expert Team and all the participants. In addition, some extra activities like Special Lectures and Special Training were arranged as necessary.	See Figure 3.1.1 for the program structure See Section 3.1.4 for detailed programs

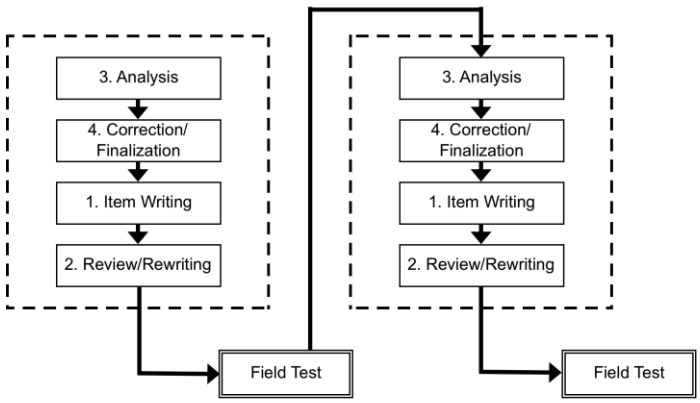


Figure 3.1.1 Structure of the Workshop Program

3.1.2 Summary: Dates and Venues

Originally, nine Workshops were planned according to the Terms of Reference. However, considering the total workload and targets, the JICA Expert Team added one more Workshop to the plan. Table 3.1.2 shows the dates and venues of respective Workshops.

Table 3.1.2 Workshop Dates and Venues

Project Year	Workshop	Dates	Venue
Year 1	Workshop 1	January 13~16, 2015	Executive Hotel, Adama
	Workshop 2	March 23~April 3, 2015	Executive Hotel, Adama
	Workshop 3	July 20~24, 2015	Rift Valley Hotel, Adama
Year 2	Workshop 4	November 16~21, 2015	Executive Hotel, Adama
	Workshop 5	March 7~12, 2016	Rift Valley Hotel, Adama
	Workshop 6	June 27~July 2, 2016	Rift Valley Hotel, Adama
	Workshop 7	October 31~November 5, 2016	Ras Amba Hotel, Addis Ababa
	Workshop 8	January 23~28, 2017	Ras Amba Hotel, Addis Ababa
Year 3	Workshop 9	April 24~28, 2017	Rift Valley Hotel, Adama
	Workshop 10	July 10~15, 2017	Rift Valley Hotel, Adama

3.1.3 Summary: Attendance

Whereas Table 3.1.3 summarizes the number of participants in each Workshop by Working Group, Table 3.1.4 shows the number of participants in each Workshop by organization.

Table 3.1.3 Number of Participants by Working Group

Working Group	WS1	WS2	WS3	WS4	WS5	WS6	WS7	WS8	WS9	WS10
Mathematics	16	16	17	18	16	17	9	12	15	15
Biology	18	17	15	21	16	16	10	14	12	15
Chemistry	17	17	16	19	16	13	10	11	13	11
Physics	14	16	15	19	19	17	10	13	16	16
Assessment & Evaluation	14	11	12	10	6	5	10	4	5	5
Total	**79**	**77**	**75**	**87**	**73**	**68**	**49**	**54**	**61**	**65**

Table 3.1.4 Number of Participants by Organization

Organization	WS1	WS2	WS3	WS4	WS5	WS6	WS7	WS8	WS9	WS10
MSIC	13	15	13	19	18	16	11	16	14	15
NEAEA	6	5	6	4	0	0	3	0	0	2
CDID	4	3	4	4	3	3	4	0	3	2
TELDD	2	1	3	3	0	1	1	0	0	0
Sub-total	*25*	*24*	*26*	*30*	*21*	*20*	*19*	*16*	*17*	*19*
Addis Ababa	5	5	5	3	4	3	0	0	2	2
Afar	5	5	4	7	4	5	2	2	5	4
Amhara	3	4	4	5	2	3	2	1	1	0
Benishangul-Gumuz	5	5	5	6	6	5	6	5	4	6
Dire Dawa	5	5	5	6	6	5	6	6	6	6
Gambella	5	5	5	6	6	6	1	5	3	1
Harari	5	5	5	6	6	5	1	4	5	6
Oromia	6	5	4	5	5	5	4	4	4	4
SNNPR*	5	5	4	4	5	4	5	3	6	7
Somali	5	4	3	4	4	5	1	5	6	5
Tigray	5	5	5	5	4	2	2	3	2	5
Sub-total	*54*	*53*	*49*	*57*	*52*	*48*	*30*	*38*	*44*	*46*
Total	**79**	**77**	**75**	**87**	**73**	**68**	**49**	**54**	**61**	**65**

Note: *Southern Nations, Nationalities, and Peoples' Region

3.1.4 Summary: Programs

The program of each Workshop is shown from Table 3.1.5 to Table 3.1.15.

Table 3.1.5 Program of the First Workshop

Time	2015			
	Jan 13 (Tue)	**Jan 14 (Wed)**	**Jan 15 (Thu)**	**Jan 16 (Fri)**
9:00~ 10:30	*Opening* *Introduction to LAMS*	*Critical review of question items*	*Item Study (1)*	*Discussion on how to utilize Item Study Scheduling*
Tea Break				
11:00~ 12:30	*Orientation* *Self-Introduction* *Selection of Chairperson and Secretary*	*Review of Day 1* *Comparison with question items revised by JICA experts* *Some results of LAMS mock achievement tests*	*Item Study (2)*	*Discussion and decision on the target number of item development* *Wrapping up and closing*
Lunch				
13:30~ 15:00	*Free discussion on* *- Our roles and duties* *- My expectation*	*How to check question Items*	*Item Study (3)*	
Tea Break				
15:30~ 17:00	*(continued)*	*Critical review of PSLCE items developed by REBs*	*Item Study (4)*	

Table 3.1.6 Program of the Second Workshop: First Batch
Biology/Chemistry/Assessment and Evaluation [March 23~27]

Time	2015				
	Mar 23 (Mon)	**Mar 24 (Tue)**	**Mar 25 (Wed)**	**Mar 26 (Thu)**	**Mar 27 (Fri)**
9:00- 10:30	*Opening* *Results of Field Tests*	*Item Correction*	*Item Writing 1 (Knowledge Level)*	*Item Writing 5*	*Examples of Good Items*
Tea Break					
11:00- 12:30	*Wrong Answer Analysis 1*	*Item Correction* *Item Selection*	*Item Writing 2 (Knowledge Level)*	*Item Writing 6*	*Closing*
Lunch					
13:30- 15:00	*Wrong Answer Analysis 1*	*Report by Chairpersons* *"Application Level" Items 1*	*Item Writing 3 (Knowledge Level)*	*Special Lecture 1*	
Tea Break					
15:30- 17:00	*Wrong Answer Analysis 2*	*"Application Level" Items 2*	*Item Writing 4 (Application Level)*	*Special Lecture 2*	

Table 3.1.7 Program of the Second Workshop: Second Batch
Mathematics/Physics [March 30~April 3]

Time	2015				
	Mar 30 (Mon)	**Mar 31 (Tue)**	**April 1 (Wed)**	**April 2 (Thu)**	**April 3 (Fri)**
9:00- 10:30	*Opening* *Results of Field Tests* *Wrong Answer Analysis 1*	*Item Correction*	*Item Writing 1 (Knowledge Level)*	*Item Writing 5 (Application Level)*	*Examples of Good Items*
Tea Break					
11:00- 12:30	*Wrong Answer Analysis 1*	*Item Selection*	*Item Writing 2 (Knowledge Level)*	*Item Writing 6*	*Closing*
Lunch					
13:30- 15:00	*Wrong Answer Analysis 1*	*"Application Level" Items 1*	*Item Writing 3 (Knowledge Level)*	*Item Writing 6*	

Tea Break					
15:30-17:00	*Wrong Answer Analysis 2*	*"Application Level" Items 2*	*Item Writing 4 (Application Level)*	*Special Lecture*	

Table 3.1.8 Program of the Third Workshop

Time	2015				
	July 20 (Mon)	**July 21 (Tue)**	**July 22 (Wed)**	**July 23 (Thu)**	**July 24 (Fri)**
8:30-10:00	*Opening Report by the participants of CP training in Japan*	*Results of Field Tests and Item Analysis*	*Item Writing 1 (Knowledge Level)*	*Item Writing 4 (Application and Higher Level)*	*Item Review*
Tea Break					
10:30-12:00	*Exercise on Manual Item Analysis*	*Results of Field Tests and Item Analysis (continued) Wrong Answer Analysis*	*Item Writing 2 (Knowledge Level)*	*Item Writing 5 (Application and Higher Level)*	*Closing*
Lunch					
13:00-14:30	*Exercise on Manual Item Analysis (continued) Exercise on Item Analysis Using Excel*	*Item Correction*	*Item Writing 3 (Knowledge Level)*	*Item Writing 6 (Application and Higher Level)*	
Tea Break					
15:00-16:30	*Exercise on Item Analysis Using Excel (continued) Demonstration of Advanced Programs (IATA, TAP)*	*Homework Review*	*Special Lecture*	*Item Writing 7*	

Table 3.1.9 Program of the Fourth Workshop

Time	2015						
	Nov 16 (Mon)	**Nov 17 (Tue)**	**Nov 18 (Wed)**		**Nov 19 (Thu)**	**Nov 20 (Fri)**	**Nov 21 (Sat)**
8:30~10:00	*Opening*	*Field Tests and Item Analysis*	Special Training A	Special Training B	*Item Writing 1 (Knowledge Level)*	*Item Writing 3 (Application and Higher Level)*	*Item Review*
Tea Break							
10:30~12:00	*Workbook Development*	*Wrong Answer Analysis*	Special Training A	Special Training B	*Item Writing 2 (Knowledge Level)*	*Item Writing 4 (Application and Higher Level)*	*Closing*
Lunch							
13:00~14:30	*Workbook Development*	*Homework Review*	*Special Lecture 1*		*Item Review (Knowledge Level)*	*Item Review (Application and Higher Level)*	
Tea Break							
15:00~16:30	*Workbook Development*	*Item Correction*	*Special Lecture 2*		*Item Correction*	*Item Correction*	

Table 3.1.10 Program of the Fifth Workshop

Program: 4 Subject Working Groups

Time	2016					
	March 7 (Mon)	**March 8 (Tue)**	**March 9 (Wed)**	**March 10 (Thu)**	**March 11 (Fri)**	**March 12 (Sat)**
8:30~10:00	*Opening*	*Field Tests and Item Analysis*	*Homework Review*	*Item Writing 1 (Knowledge*	*Item Writing 3 (Application and*	*Item Review*

					Level)	*Higher Level)*	
Tea Break							
10:30~ 12:00	*(continued) Workbook Development 1*	*Wrong Answer Analysis 1*	*Item Correction*		*Item Writing 2 (Knowledge Level)*	*Item Writing 4 (Application and Higher Level)*	*Closing*
Lunch							
13:00~ 14:30	*Workbook Development 2*	*Wrong Answer Analysis 2*	Special Lecture A	Special Training C	*Item Review (Knowledge Level)*	*Item Review (Application and Higher Level)*	
Tea Break							
15:00~ 16:30	*Workbook Development 3*	*Item Correction*	Special Lecture B	Special Training C	*Item Correction*	*Item Correction*	

Program: Assessment and Evaluation Working Group

Time	2016					
	March 7 (Mon)	**March 8 (Tue)**	**March 9 (Wed)**	**March 10 (Thu)**	**March 11 (Fri)**	**March 12 (Sat)**
8:30~ 10:00	*Opening*	*Field Tests and Item Analysis*	*Homework Review*	*Item Writing 1 (Knowledge Level)*	*Item Analysis Using Excel*	*Item Review*
Tea Break						
10:30~ 12:00	*(continued) Workbook Development 1*	*Wrong Answer Analysis 1*	*Item Correction*	*Item Writing 2 (Knowledge Level)*	*Test Analysis*	*Closing*
Lunch						
13:00~ 14:30	*Workbook Development 2*	*Wrong Answer Analysis 2*	Special Lecture A	Special Training C	*Item Review (Knowledge Level)*	*Test Construction 1*
Tea Break						
15:00~ 16:30	*Workbook Development 3*	*Item Correction*	Special Lecture B	Special Training C	*Item Correction*	*Test Construction 2*

Table 3.1.11 Program of the Sixth Workshop

Program: 4 Subject Working Groups

Time	2016					
	June 27 (Mon)	**June 28 (Tue)**	**June 29 (Wed)**	**June 30 (Thu)**	**July 1 (Fri)**	**July 2 (Sat)**
8:30~ 10:00	*Opening*	*Field Tests and Item Analysis*	*Item Correction*	*Item Writing 1 (Knowledge Level*	*Item Writing 3 (Application & Higher Level*	*Item Review*
Tea Break						
10:30~ 12:00	*(continued) Workbook Development 1*	*Wrong Answer Analysis 1*	*Homework Review*	*Item Writing 2 (Knowledge Level)*	*Item Writing 4 (Application & Higher Level)*	*Closing*
Lunch						
13:00~ 14:30	*Workbook Development 2*	*Wrong Answer Analysis 2*	*Item Correction*	*Item Review (Knowledge Level)*	*Item Review (Application & Higher Level)*	
Tea Break						
15:00~ 16:30	*Workbook Development 3*	*Special Lecture*	*Workbook Development 4*	*Item Correction*	*Item Correction*	

Program: Assessment and Evaluation Working Group

Time	2016					
	June 27 (Mon)	**June 28 (Tue)**	**June 29 (Wed)**	**June 30 (Thu)**	**July 1 (Fri)**	**July 2 (Sat)**
8:30~ 10:00	*Opening*	*Field Tests and Item Analysis*	*Item Correction*	*Item Writing 1 (Knowledge Level)*	*Item Analysis Using Excel 1*	*Item Analysis Using Excel 5*
Tea Break						
30 ~ 12	*(continued)*	*Wrong Answer*	*Homework*	*Item Writing 2*	*Item Analysis*	*Closing*

	Workbook Development 1	*Analysis 1*	*Review*	*(Knowledge Level)*	*Using Excel 2*	
Lunch						
13:00~ 14:30	*Workbook Development 2*	*Wrong Answer Analysis 2*	*Item Correction*	*Item Review (Knowledge Level)*	*Item Analysis Using Excel 3*	
Tea Break						
15:00~ 16:30	*Workbook Development 3*	*Special Lecture*	*Workbook Development 4*	*Item Correction*	*Item Analysis Using Excel 4*	

Table 3.1.12 Program of the Seventh Workshop

Program: 4 Subject Working Groups

Time	2016					
	Oct 31 (Mon)	**Nov 1 (Tue)**	**Nov 2 (Wed)**	**Nov 3 (Thu)**	**Nov 4 (Fri)**	**Nov 5 (Sat)**
9:00~ 10:30	*Opening*	*Field Tests and Item Analysis*	*Item Correction*	*Item Writing 1 (Knowledge Level)*	*Item Writing 3 (Application & Higher Level)*	*Item Review*
Tea Break						
11:00~ 12:30	*Workbook Development 1*	*Wrong Answer Analysis 1*	*Homework Review*	*Item Writing 2 (Knowledge Level)*	*Item Writing 4 (Application & Higher Level)*	*Closing*
Lunch						
13:30~ 15:00	*Workbook Development 2*	*Wrong Answer Analysis 2*	*Item Correction*	*Item Review (Knowledge Level)*	*Item Review (Application & Higher Level)*	
Tea Break						
15:30~ 17:00	*Workbook Development 3*	*Special Lecture*	*Workbook Development 4*	*Item Correction*	*Item Correction*	

Program: Assessment and Evaluation Working Group

Time	2016					
	Oct 31 (Mon)	**Nov 1 (Tue)**	**Nov 2 (Wed)**	**Nov 3 (Thu)**	**Nov 4 (Fri)**	**Nov 5 (Sat)**
9:00~ 10:30	*Opening*	*Field Tests and Item Analysis*	*Item Correction*	*Item Writing 1 (Knowledge Level)*	*Item Analysis Using Excel 1*	*Item Analysis Using Excel 5*
Tea Break						
11:00~ 12:30	*Workbook Development 1*	*Wrong Answer Analysis 1*	*Homework Review*	*Item Writing 2 (Knowledge Level)*	*Item Analysis Using Excel 2*	*Closing*
Lunch						
13:30~ 15:00	*Workbook Development 2*	*Wrong Answer Analysis 2*	*Item Correction*	*Item Review (Knowledge Level)*	*Item Analysis Using Excel 3*	
Tea Break						
15:30~ 17:00	*Workbook Development 3*	*Special Lecture*	*Workbook Development 4*	*Item Correction*	*Item Analysis Using Excel 4*	

Table 3.1.13 Program of the Eighth Workshop

Time	2017					
	Jan 23 (Mon)	**Jan 24 (Tue)**	**Jan 25 (Wed)**	**Jan 26 (Thu)**	**Jan 27 (Fri)**	**Jan 28 (Sat)**
9:00~ 10:30	*Opening*	*Field Tests and Item Analysis Wrong Answer Analysis 1*	*Item Correction*	*Item Writing 1 (G4 Knowledge Level)*	*Item Writing 3 (G4 Application & Higher Level)*	*Item Review*
Tea Break						
11:00 ~ 12:30	*Workbook Development 1*	*Wrong Answer Analysis 2*	*Additional Item Writing 1*	*Item Writing 2 (G4*	*Item Writing 4 (G4 Application*	*Closing*

				Knowledge Level)	*& Higher Level)*	
Lunch						
13:30~ 15:00	*Workbook Development 2*	*Item Correction*	*Additional Item Writing 2*	*Item Review (G4 Knowledge Level)*	*Item Review (G4 Application & Higher Level)*	
Tea Break						
15:30~ 17:00	*Workbook Development 3*	*Homework Review*	*Workbook Development 4*	*Item Correction*	*Item Correction*	

Table 3.1.14 Program of the Ninth Workshop

Program: Mathematics

Time	2017				
	April 24 (Mon)	**April 25 (Tue)**	**April 26 (Wed)**	**April 27 (Thu)**	**April 28 (Fri)**
8:30~ 10:00	*Opening*	*Item Selection 4*	*Item Correction*	*Workbook Development 4*	*Item Review*
Tea Break					
10:30~ 12:00	*Item Selection 1*	*Item Writing 1 (G10 Knowledge/ Application Level)*	*Workbook Development 1*	*Workbook Development 5*	*Closing*
Lunch					
13:00~ 14:30	*Item Selection 2*	*Item Writing 2 (G10 Knowledge/ Application Level)*	*Workbook Development 2*	*Workbook Development 6*	
Tea Break					
15:00~ 16:30	*Item Selection 3*	*Item Review (G10 Knowledge/ Application Level)*	*Workbook Development 3*	*Workbook Development 7*	

Program: Biology

Time	2017				
	April 24 (Mon)	**April 25 (Tue)**	**April 26 (Wed)**	**April 27 (Thu)**	**April 28 (Fri)**
8:30~ 10:00	*Opening*	*Item Writing 2 (G10 Knowledge/ Application Level)*	*Item Correction*	*Workbook Development 4*	*Item Review*
Tea Break					
10:30~ 12:00	*Additional Item Writing 1 (G7/8 Knowledge/ Application Level)*	*Item Writing 3 (G10 Knowledge/ Application Level)*	*Workbook Development 1*	*Workbook Development 5*	*Closing*
Lunch					
13:00~ 14:30	*Additional Item Writing 2 (G7/8 Knowledge/ Application Level)*	*Item Review 1 (G10 Knowledge/ Application Level)*	*Workbook Development 2*	*Workbook Development 6*	
Tea Break					
15:00~ 16:30	*Item Writing 1 (G10 Knowledge/ Application Level)*	*Item Review 2 (G10 Knowledge/ Application Level)*	*Workbook Development 3*	*Workbook Development 7*	

Program: Chemistry

Time	2017				
	April 24 (Mon)	**April 25 (Tue)**	**April 26 (Wed)**	**April 27 (Thu)**	**April 28 (Fri)**
8:30~ 10:00	*Opening*	*Additional Item Writing 4 (G7/8 Knowledge/ Application Level)*	*Item Correction*	*Workbook Development 4*	*Item Review*
Tea Break					

10:30~ 12:00	*Additional Item Writing 1 (G7/8 Knowledge/ Application Level)*	*Additional Item Writing 5 (G7/8 Knowledge/ Application Level)*	*Workbook Development 1*	*Workbook Development 5*	*Closing*
Lunch					
13:00~ 14:30	*Additional Item Writing 2 (G7/8 Knowledge/ Application Level)*	*Item Review 1 (G7/8 Knowledge/ Application Level)*	*Workbook Development 2*	*Workbook Development 6*	
Tea Break					
15:00~ 16:30	*Additional Item Writing 3 (G7/8 Knowledge/ Application Level)*	*Item Review 2 (G7/8 Knowledge/ Application Level)*	*Workbook Development 3*	*Workbook Development 7*	

Program: Physics

Time	2017				
	April 24 (Mon)	**April 25 (Tue)**	**April 26 (Wed)**	**April 27 (Thu)**	**April 28 (Fri)**
8:30~ 10:00	*Opening*	*Item Review 1 (G7/8 Knowledge/ Application Level)*	*Item Writing 2 (G10 Knowledge/ Application Level)*	*Workbook Development 4*	*Item Review*
Tea Break					
10:30~ 12:00	*Additional Item Writing 1 (G7/8 Knowledge/ Application Level)*	*Item Review 2 (G7/8 Knowledge/ Application Level)*	*Workbook Development 1*	*Workbook Development 5*	*Closing*
Lunch					
13:00~ 14:30	*Additional Item Writing 2 (G7/8 Knowledge/ Application Level)*	*Item Correction*	*Workbook Development 2*	*Workbook Development 6*	
Tea Break					
15:00~ 16:30	*Additional Item Writing 3 (G7/8 Knowledge/ Application Level)*	*Item Writing 1 (G10 Knowledge/ Application Level)*	*Workbook Development 3*	*Workbook Development 7*	

Program: Assessment and Evaluation

Time	2017				
	April 24 (Mon)	**April 25 (Tue)**	**April 26 (Wed)**	**April 27 (Thu)**	**April 28 (Fri)**
8:30~ 10:00	*Opening*	Follow the subject group's activity	*Test Construction 3*	*Workbook Development 4*	*Item Review*
Tea Break					
10:30~ 12:00	Follow the subject group's activity	Follow the subject group's activity	*Workbook Development 1*	*Workbook Development 5*	*Closing*
Lunch					
13:00~ 14:30	Follow the subject group's activity	*Test Construction 1*	*Workbook Development 2*	*Workbook Development 6*	
Tea Break					
15:00~ 16:30	Follow the subject group's activity	*Test Construction 2*	*Workbook Development 3*	*Workbook Development 7*	

Table 3.1.15 Program of the Tenth Workshop

Program: Mathematics

Time	2017					
	July 10 (Mon)	**July 11 (Tue)**	**July 12 (Wed)**	**July 13 (Thu)**	**July 14 (Fri)**	**July 15 (Sat)**

8:30~ 10:00			*Item Writing 1 (G10 Application & Higher Level)*	*Item Correction*	*Workbook Development 4*	*Workshop Review*
Tea Break						
10:30~ 12:00			*Item Writing 2 (G10 Application & Higher Level)*	*Workbook Development 1*	*Workbook Development 5*	*Presentation on Training in Japan Closing Ceremony*
Lunch						*Lunch Party*
13:30~ 15:00			*Item Review 1 (G10 Application & Higher Level)*	*Workbook Development 2*	*Workbook Development 6*	
Tea Break						
15:30~ 17:00			*Item Review 2 (G10 Application & Higher Level)*	*Workbook Development 3*	*Workbook Development 7*	

Program: Biology

Time	2017					
	July 10 (Mon)	**July 11 (Tue)**	**July 12 (Wed)**	**July 13 (Thu)**	**July 14 (Fri)**	**July 15 (Sat)**
8:30~ 10:00			*Item Writing 1*	*Item Writing 5*	*Workbook Development 2*	*Workshop Review*
Tea Break						
10:30~ 12:00			*Item Writing 2*	*Item Review*	*Workbook Development 3*	*Presentation on Training in Japan Closing Ceremony*
Lunch						*Lunch Party*
13:30~ 15:00			*Item Writing 3*	*Item Correction*	*Workbook Development 4*	
Tea Break						
15:30~ 17:00			*Item Writing 4*	*Workbook Development 1*	*Workbook Development 5*	

Program: Chemistry

Time	2017					
	July 10 (Mon)	**July 11 (Tue)**	**July 12 (Wed)**	**July 13 (Thu)**	**July 14 (Fri)**	**July 15 (Sat)**
8:30~ 10:00	*Item Writing 1 (G10 Knowledge Level)*	*Item Review 1 (G10)*	*Item Writing 7 (G7&8 Application & Higher Level)*	*Workbook Development 1*	*Workbook Development 5*	*Workshop Review*
Tea Break						
10:30~ 12:00	*Item Writing 2 (G10 Knowledge Level)*	*Item Correction 1*	*Item Writing 8 (G7&8 Application & Higher Level)*	*Workbook Development 2*	*Workbook Development 6*	*Presentation on Training in Japan Closing Ceremony*
Lunch						*Lunch Party*
13:30~ 15:00	*Item Writing 3 (G10 Application & Higher Level)*	*Item Writing 5 (G7&8 Knowledge Level)*	*Item Review 2 (G7&8)*	*Workbook Development 3*	*Workbook Development 7*	
Tea Break						
15:30~ 17:00	*Item Writing 4 (G10 Application & Higher Level)*	*Item Writing 6 (G7&8 Knowledge Level)*	*Item Correction 2*	*Workbook Development 4*	*Workbook Development 8*	

Program: Physics

Time	2017

	July 10 (Mon)	July 11 (Tue)	July 12 (Wed)	July 13 (Thu)	July 14 (Fri)	July 15 (Sat)
8:30~ 10:00		*Workbook Development 1*	*Workbook Development 5*	*Item Writing 1 (G10 Knowledge Level)*	*Item Writing 3 (G10 Application & Higher Level)*	*Workshop Review*
Tea Break						
10:30~ 12:00		*Workbook Development 2*	*Workbook Development 6*	*Item Writing 2 (G10 Knowledge Level)*	*Item Writing 4 (G10 Application & Higher Level)*	*Presentation on Training in Japan Closing Ceremony*
Lunch						*Lunch Party*
13:30~ 15:00		*Workbook Development 3*	*Workbook Development 7*	*Item Review (G10 Knowledge Level)*	*Item Review (G10 Application & Higher Level)*	
Tea Break						
15:30~ 17:00		*Workbook Development 4*	*Workbook Development 8*	*Item Correction*	*Item Correction*	

3.1.5 Summary: Developed Items

The number of developed items. Through the ten Workshops, 12,042 question items were developed in total. The number of items developed in each Workshop by Working Group is summarized in Table 3.1.16. As a breakdown, Table 3.1.17, Table 3.1.18, and Table 3.1.19 show the numbers of items developed for Grades 7 and 8, Grade 4, and Grade 10, respectively.

Table 3.1.16 Question Items Developed (All Grades)

WG	WS1	WS2	WS3	WS4	WS5	WS6	WS7	WS8	WS9	WS10	Total
Mathematics	94	250	340	423	508	458	297	576	184	141	3,271
Biology	93	157	275	419	381	379	250	546	345	250	3,095
Chemistry	52	182	290	368	360	296	168	382	249	272	2,619
Physics	105	167	272	328	377	342	187	387	319	216	2,700
Assessment & Evaluation	47	86	155	69	--	--	--	--	--	--	357
Total	**391**	**842**	**1,332**	**1,607**	**1,626**	**1,475**	**902**	**1,891**	**1,097**	**879**	**12,042**

Table 3.1.17 Question Items Developed (Grades 7 and 8)

WG	WS1	WS2	WS3	WS4	WS5	WS6	WS7	WS8	WS9	WS10	Total
Mathematics	94	250	340	423	508	458	297	166	0	0	2,536
Biology	93	157	275	419	381	379	250	146	196	0	2,296
Chemistry	52	182	290	368	360	296	168	175	222	77	2,190
Physics	105	167	272	328	377	342	187	117	224	22	2,141
Assessment & Evaluation	47	86	155	69	--	--	--	--	--	--	357
Total	**391**	**842**	**1,332**	**1,607**	**1,626**	**1,475**	**902**	**604**	**642**	**99**	**9,520**

Table 3.1.18 Question Items Developed (Grade 4)

WG	WS1	WS2	WS3	WS4	WS5	WS6	WS7	WS8	WS9	WS10	Total
Mathematics	--	--	--	--	--	--	--	410	0	0	410
Biology	--	--	--	--	--	--	--	400	8	0	408
Chemistry	--	--	--	--	--	--	--	207	0	0	207
Physics	--	--	--	--	--	--	--	270	0	0	270
Assessment & Evaluation	--	--	--	--	--	--	--	--	--	--	--
Total	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**1,287**	**8**	**0**	**1,295**

Table 3.1.19 Question Items Developed (Grade 10)

WG	WS1	WS2	WS3	WS4	WS5	WS6	WS7	WS8	WS9	WS10	Total
Mathematics	--	--	--	--	--	--	--	--	184	141	325
Biology	--	--	--	--	--	--	--	--	141	250	391
Chemistry	--	--	--	--	--	--	--	--	27	195	222
Physics	--	--	--	--	--	--	--	--	95	194	289
Assessment & Evaluation	--	--	--	--	--	--	--	--	--	--	--
Total	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**447**	**780**	**1,227**

The targets. As is seen in the tables above, all four Subject Working Groups have achieved their specific targets set in the second Workshop as shown in Table 3.1.20.

Table 3.1.20 Targets of Item Development by Subject

Working Group	Grade 7 (All topics)	Grade 8 (All topics)	Grade 4 (At least 2 topics)	Grade10 (At least 2 topics)	Total
Mathematics	1,000	1,000	200	200	2,400
Biology	1,000	1,000	200	200	2,400
Chemistry	1,000	1,000	200	200	2,400
Physics	1,000	1,000	200	200	2,400
Assessment & Evaluation	--	--	--	--	--
Total	**4,000**	**4,000**	**800**	**800**	**9,600**

The Assessment and Evaluation Working Group has conducted exercises similar to other Subject Working Groups throughout the ten Workshops but was not assigned any specific target numbers as its outputs. In the exercises up to the fourth Workshop, the members of the Assessment and Evaluation Working Group wrote items of their own specialty. Therefore this Group's items covered all four subjects. After the fifth Workshop, they started joining Subject Working Group of their own specialty to write items and develop the Workbooks. The items they developed in the first four Workshops were later classified according to their subject and included in the respective subjects' items developed by the Subject Working Groups.

Assignment of units. To accomplish the targets specified above, each Subject Working Group allocated the units to be covered by respective Workshops. Tables 3.1.21 to 3.1.24 summarize the assignments. Units for Grades 4 and 10 were discussed and decided at the seventh Workshop.

Table 3.1.21 Unit Assignment: Mathematics

Work-shop	Grade	Unit	Title	No. of Compe-tencies
2	G7	Unit 1	Rational Numbers	16
	G7	Unit 2	Linear Equations and Inequalities	2
	G7	Unit 3	Ratio, Proportion and Percentage	7
3	G7	Unit 5	Geometric Figures and Measurement (5.1 and 5.2)	27
4	G7	Unit 5	Geometric Figures and Measurement (5.3)	25
5	G8	Unit 1	Squares, Square Roots, Cubes and Cube Roots	9
	G8	Unit 2	Further on Working with Variables	7
	G8	Unit 3	Linear Equations and Inequalities	14
6	G8	Unit 4	Similar Figures	9
	G8	Unit 5	Circles	12
	G8	Unit 7	Geometry and Measurement	8

7	G7 G8	Unit 4 Unit 6	Data Handling Introduction to Probability	12 4
8	G4 G4	Unit 3 Unit 5	Fractions and Decimals Shapes and Solids	18 13
9	G10 G10	Unit 2 Unit 5	Exponential and Logarithmic Functions Trigonometric Functions	21 31

Note: Unit, Title and Number of Competencies refer to the respective Syllabi.

Table 3.1.22 Unit Assignment: Biology

Work-shop	Grade	Unit	Title	No. of Compe-tencies
2	G7 G8	Unit 2 Unit 2	Cell Biology Cell Biology	11 12
3	G7 G8	Unit 3 Unit 3	Human Biology and Health Human Biology and Health	16 18
4	G7 G8	Unit 4 Unit 4	Plants Plants	23 8
5	G7 G8	Unit 5 Unit 5	Animals Animals	20 11
6	G7 G8	Unit 6 Unit 6	Environment Environment	20 16
7	G7 G8	Unit 1 Unit 1	Biology and Technology Biology and Technology	3 4
8	G4 G4 G4 G4	Unit 1.1 Unit 1.2 Unit 1.3 Unit 1.4	Our Body Needs Food Blood Circulation Puberty Family Planning	8 9 3 4
9	G10 G10	Unit 2 Unit 3	Heredity Human Biology and Health	17 62

Note: Unit, Title and Number of Competencies refer to the respective Syllabi.

Table 3.1.23 Unit Assignment: Chemistry

Work-shop	Grade	Unit	Title	No. of Compe-tencies
2	G7 G7	Unit 1 Unit 2	Chemistry and Its Importance Substance	6 29
3	G7 G7	Unit 3 Unit 4	The Language of Chemistry The Structure of Substances	23 25
4	G7 G8	Unit 5 Unit 2	Periodic Classification of Element Some Important Metals	16 27
5	G8	Unit 1	Classification of Compounds	49
6	G8 G8	Unit 3 Unit 5	Some Important Non-Metals Calculation Based on Formulas	13 16
7	G8	Unit 4	Environmental Chemistry	31
8	G4 G4 G4	Unit 2.1 Unit 2.2 Unit 2.4	Matter Natural Resources 1: Types of Natural Resources Water	6 2 1
9	G10 G10	Unit 1 Unit 4	Introduction to Organic Chemistry Chemistry in Industry and Environmental Pollution	87 52

Note: Unit, Title and Number of Competencies refer to the respective Syllabi.

Table 3.1.24 Unit Assignment: Physics

Work-shop	Grade	Unit	Title	No. of Compe-tencies
2	G7 G8	Unit 1 Unit 1	Physics and Measurement Physics and Measurement	26 24

3	G7	Unit 2	Motion	14
	G7	Unit 3	Force and Newton's Laws of Motion	32
	G8	Unit 2	Motion in One Dimension	12
4	G7	Unit 4	Work, Energy and Power	18
	G7	Unit 5	Simple Machines	12
	G8	Unit 3	Pressure	13
5	G7	Unit 6	Temperature and Heat	14
	G8	Unit 4	Heat Energy	11
6	G7	Unit 7	Sound	8
	G8	Unit 6	Light	23
7	G7	Unit 8	Electricity and Magnetism	26
	G8	Unit 5	Electricity and Magnetism	50
8	G4	Unit 2.2	Natural Resources 2: Weather and Climate	5
	G4	Unit 2.3	Energy	8
9	G10	Unit 1	Motion in Two Dimensions	61
	G10	Unit 4	Electromagnetism	43

Note: Unit, Title and Number of Competencies refer to the respective Syllabi.

3.2 Group-wise Achievement

In this Section, it is reported how five Working Groups have worked, what they have achieved and what issues remain with them.

3.2.1 Mathematics Working Group

1) Members of the Working Group

Table 3.2.1.1 shows the names of the members of the mathematics working group and their affiliations.

Table 3.2.1.1 Members of the Mathematics Working Group (as of July 2017)

	Name	Affiliation
1	Daniel Demissie Aga	MSIC
2	Tesfu Tezera Teyakie	MSIC
3	Ermias Chufamo Beshir	MSIC
4	Bimerew Kerie Tesfaw	MSIC
5	Yibeltal Solomon Mekbeb	TELDD
6	Assefa Teferi Ayle	CDID
7	Fikremariam Regassa Tefera	NEAEA
		Addis Ababa Education Bureau
8	Bilata Mekonnen Ayele	Afar REB
9	Dagnaw Asmare Belalchew	Amhara REB
10	Sebsibe Getahun Abebe	Benishangul-Gumuz REB
11	Gizachew Mitiku Abdi	Dire Dawa Education Bureau
12	Etsey Gidey Mehari	Gambella REB
13	Fantaye Aleme Shibeshi	Harari REB
14	Dejene Girma Awelachew	Oromia REB
15	Beteselassie Biru Gebregiorgis	SNNPR REB
16	Abdifetah Omer Hussein	Somali REB
17	Gebremedhin Gebru Tedla	Tigray REB
18	Mohammed Adem Mohammed	Afar (Teacher)
19	Leta Gela Dinqu	Oromia (Teacher)
20	Yohannes Wosene	SNNPR REB (Regional Trainer)

The position for Addis Ababa Education Bureau became vacant in March 2016 after the former member's retirement.

2) Achievement

Tables 3.2.1.2 to 3.2.1.4 summarize the group's achievement.

Table 3.2.1.2 Developed Items (All Grades): Mathematics

Workshop	Participants	Items for G7/G8	Items for G4	Items for G10	Total Items
1	16	94	--	--	94
2	16	250	--	--	250
3	17	340	--	--	340
4	18	423	--	--	423
5	16	508	--	--	508
6	17	458	--	--	458
7	9	297	--	--	297
8	12	166	410	--	576
9	15	--	--	184	184
10	15	--	--	141	141
Total	**151**	**2,536**	**410**	**325**	**3,271**

Table 3.2.1.3 Field Tested Items (Grade 7 and Grade 8): Mathematics

Work-shop	G7/8 Items Devel-oped	G7/8 Items Field-Tested*	Items per Test	Total Exami-nees	"Good" Items*	% of "Good" Items	Average Diffi-culty	Average Discrimi-nation
1	94	16	16	35	8	50.0	0.296	0.244
2	250	60	30	78	22	36.7	0.254	0.207
3	340	120	30	158	54	45.0	0.269	0.204
4	423	120	30	135	39	32.5	0.249	0.191
5	508	119	20	475	84	70.6	0.368	0.327
6	458	120	20	386	79	65.8	0.333	0.302
7	297	120	20	532	91	75.8	0.423	0.394
Total/ Average	**2,370**	**675**	**--**	**1,799**	**377**	**55.9**	**0.321**	**0.276**

Note: * Field tests were conducted for Grade 7 and 8 items up to the seventh Workshop.

** "Good" items mean those items which satisfy the following two conditions simultaneously:

Difficulty >= 0.25
Discrimination index >= 0.10

Table 3.2.1.4 Items Selected for Item Pools (Grade 7 and Grade 8): Mathematics

Workshop	Reviewed Items Total*	Items selected without modificati on	Items selected with modificati on	Selected Items Total	Rejected items Total	% of selection	% of rejection
1	**131**	84	34	**118**	**13**	90.1	9.9
2	**276**	215	43	**258**	**18**	93.5	6.5
3	**360**	184	122	**306**	**54**	85.0	15.0
4	**419**	265	137	**402**	**17**	95.9	4.1
5	**508**	297	185	**482**	**26**	94.9	5.1
6	**458**	288	152	**440**	**18**	96.1	3.9
7	**301**	196	88	**284**	**17**	94.4	5.6
8	**166**	112	44	**156**	**10**	94.0	6.0
9	**0**	0	0	**0**	**0**	-	-
10	**0**	0	0	**0**	**0**	-	-
Total	**2,619**	1,641	805	**2,446**	**173**	93.4	6.6

Note: * Reviewed items include those mathematics items developed by the Assessment and Evaluation Working Group.

The Mathematics Working Group has accomplished all the targets set for it. The group developed a total of 2,536 items for Grades 7 and 8. From among them, 2,446 have been selected for the item pools whose target was 2,000. They also developed 410 items for Grade 4 (target: 200) and 325 items for Grade 10 (target: 200).

In terms of item quality, the Group's performance as a whole is outstanding. Three main indicators of field-tested items (% of "good" items, average difficulty, average discrimination index) all improved substantially from the second Workshop (the benchmark Workshop) to the seventh Workshop (the last Workshop for which field tests were conducted). See Table 3.2.1.3 above:

% of "good" items	36.7% --> 75.8%
Average difficulty	0.254 --> 0.423
Average discrimination index	0.207 --> 0.394

The best indication of their skill development is that less and less items have been created that are unnecessarily complicated or difficult. The members have made four important perceptional changes:

i) They have understood there are two ways of "demanding" in the mathematics question items (*vertically* demanding and *horizontally* demanding);

ii) They have realized the importance of basic or knowledge-level question items;

iii) They have realized the importance of ability to develop basic or knowledge-level question items in a systematic way; and

iv) They have understood figures should be geometrically possible and correct.

These changes without doubt positively contributed to the overall and steady improvement of their performance throughout the Workshops and Field Tests.

3) Points Emphasized in the Workshops

i) "Vertically demanding items" vs. "horizontally demanding items"

As mathematics experts, the mathematics group members tended to think that they should develop "demanding" question items. They generally thought that "easy and simple" question items were not worthwhile or not their job. As a result, most question items they developed in the first and second Workshops had one common characteristic: unnecessarily too complicated. A typical example was:

The simplified form of $\frac{x}{3} - \left[\left(\frac{x}{5} + 1\right) - x\right]$ is

A. $\frac{2}{15}x$ B. $\frac{-7}{15}x - 1$ C. $\frac{17}{15}x - 1$ D. $\frac{17}{15}x + 1$

To test the student's competency of simplifying algebraic expressions with brackets, you do not need to give this complicated expression. A simpler one will suffice for that purpose. This item is unnecessarily too complicated.

To rectify this tendency, it was explained in the third Workshop that there are two ways of "demanding" and that the members were pursuing the wrong way. The two ways of "demanding" are: horizontally demanding and vertically demanding.

For instance, the very basic form of linear equation is $2x = 6$. From this, you can go either way to make it more demanding:

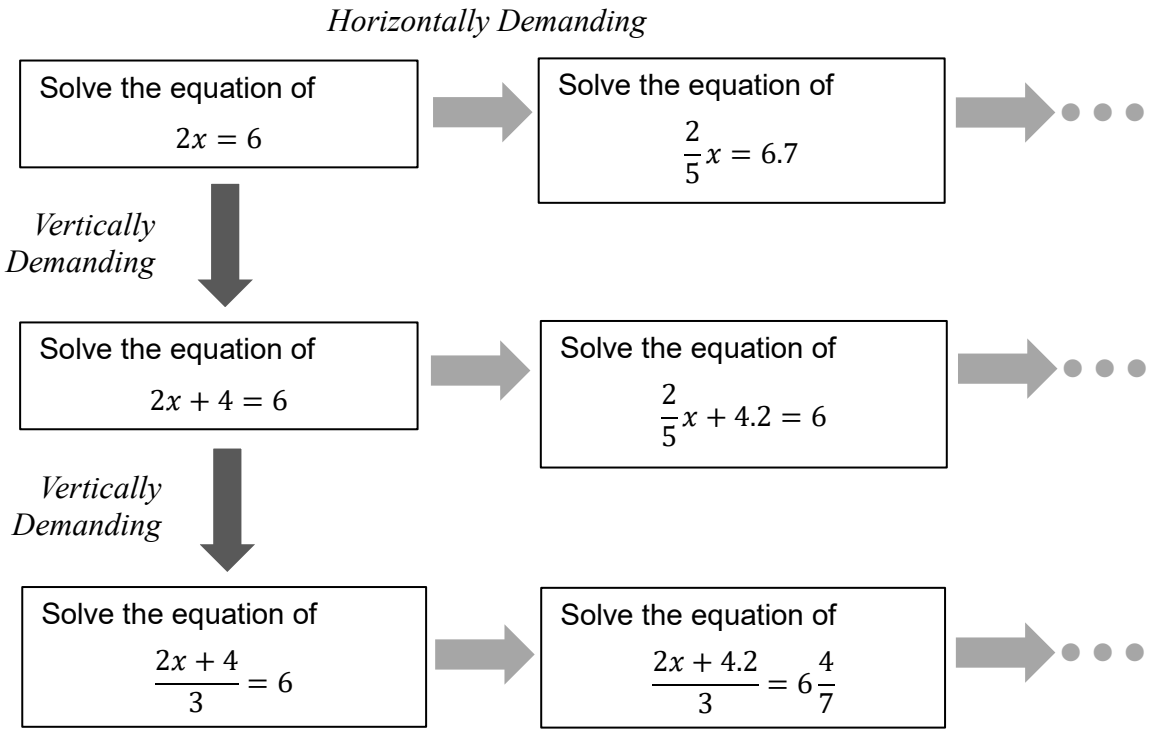


Figure 3.2.1.1 Two Different Ways of "Demanding"

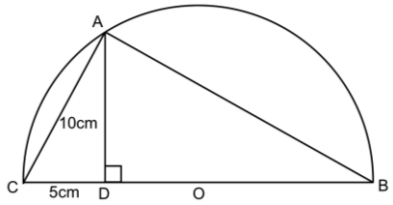
Since mathematics is nothing but a system of step-wise knowledge, students must be led to go **vertically** in this diagram. Leading them horizontally is far less important or meaningful. Therefore, mathematics item writers' primary requirement is to understand and master the whole structure of step-wise, vertical knowledge of each topic and to be able to write items of any step in a simple form.

After this explanation was given, the members have become less hesitant to write simpler basic items in a systematic way.

ii) Don't ask too many things at once

Another common way to make an item unnecessarily complicated is to ask many things in one item. Following is a typical example:

In the figure given below is a semicircle with center at O. AD⊥CB, AC=10cm and CD=5cm, then which of the following is true?



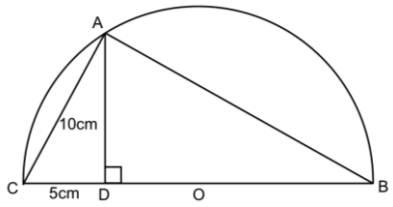
A. BC = 15cm
B. DB = 20cm
C. AD = 5√3cm
D. AB = 10√3cm

Key: D (Workshop 6)

Students have to find out the length of four line segments just to answer one question. This type of question items are very common in PSLCE, whose stem is typically read, "which of the following is true?" In actuality, this item is asking the students to solve four different items at once. Following the principle of "one item, one job," this item can be rewritten as

follows:

In the figure given below is a semicircle with center at O. AD⊥CB, AC=10cm and CD=5cm, then which of the following is true?



A. AB = 15cm
B. AB = 20cm
C. AB = 5√3cm
D. AB = 10√3cm

Key: D (Order of options should be rearranged)

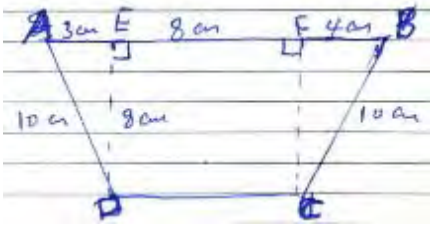
iii) Figures should be geometrically possible and correct

It was a welcome change that a figure started accompanying a geometry item on a routine basis. Nonetheless, some Working Group members kept drawing geometrically impossible figures. Some examples:

In the figure below, if CDEF is a square, what is the perimeter of trapezium ABCD?

A. 43cm
B. 36cm
C. 28cm
D. 27cm

Key: A (not correct)

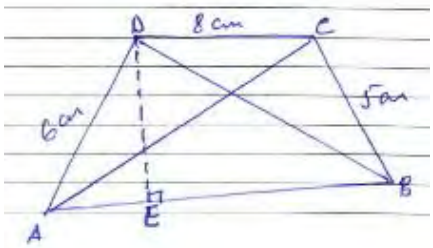


Triangles ADE and BCF are impossible with the three sides whose lengths are thus specified.

In the figure below, ABCD is a trapezium with AD=6cm, BD=12cm, DC=8cm and BC=5cm. Find the perimeter of trapezium ABCD if perimeter of ΔABD is 36cm.

A. 40cm
B. 37cm
C. 35cm
D. 30cm

Key: B (not correct)



With ΔABD, AD=6cm, BD=12cm and AB=18cm. This triangle cannot be drawn.

If the angles of a pentagon measure x, 2x, (x+10), (x-12) and (x+2), then what is the value of x?

A. 78° B. 90° C. 92° D. 100°

Key: B (not correct)

If $x=90^o$, then $2x=180^o$. Since one angle is 180^o, this figure cannot be a pentagon.

4) Remaining Issues

Going through ten Workshops, the mathematics Working Group members have definitely

acquired better item writing skills and developed critical eyes that can differentiate good items from poor items. Their level of achievement is laudable. One can nonetheless cite two remaining issue that should be tackled further not only by the mathematics Working Group members but also by Ethiopian mathematics educators in general.

i) Improve items in geometry

It was pointed out that some members are particularly weak at geometry. This problem is well indicated by the geometrically incorrect or impossible figures they draw in the items. LAMS recommends that MoE should take this weakness into consideration as a national agenda when they revise the curricula and textbooks and reform RRESET education in the future.

As far as item writing is concerned, two limitations in this respect can be readily pointed out.

Limitation 1: Not all geometry items are accompanied by figures

Geometry and figures are inseparable. In principle, a figure should accompany every geometry item.

It seems that some item writers do not provide figures to geometry items intentionally. This may be because the items are multiple-choice items. If a (correct and precise) figure is given in the item, the figure will unwittingly suggest which option is correct. Being afraid of this possibility, the item writers may opt to withdraw any figures from the items.

This notion is wrong, however. As emphasized above, geometry and figures are inseparable. Geometric concepts are best presented in figures and students are entitled to such presentations. Don't write geometry items without drawing figures.

Limitation 2: Not all figures are geometrically correct

Even if a figure is provided to an item, more often than not it is geometrically incorrect. Following are two examples taken from PSLCE 2016 and the mathematics textbook.

Example 1 (PSLCE 2016):

34. In the figure below, O is the center of the circle and $\overset{\frown}{BD} = 2\ \overset{\frown}{AC}$.

What is the measure of $\angle$ BAD?

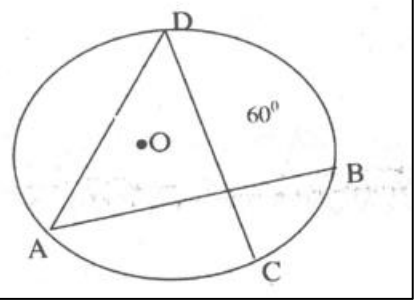
A. 60^0

B. 40^0

C. 80^0

D. 120^0

Key: B



This figure has three problems.

1. The circle rather looks like an ellipse.
2. The center is not correctly located.
3. $\widehat{BD}$ is not quite equal to $2\widehat{AC}$.

In addition, it is not clear to which angle "60º" refers in the figure.

See Figure 3.2.1.2 for the geometrically correct figure for Example 1. If you are afraid that this figure may give a strong clue to the students, then you adjust your options so that guessing becomes difficult. For instance, a better set of options are:

A. 25°
B. 30°
C. 35°
D. 40°

Since this item itself is a good one, it is highly regrettable that one careless and incorrect figure spoils its quality and value.

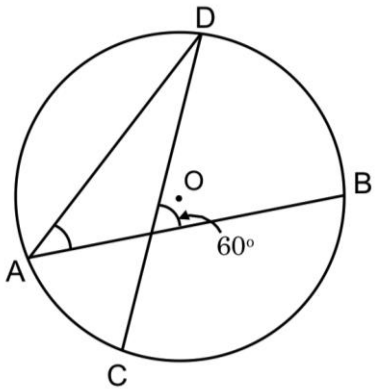
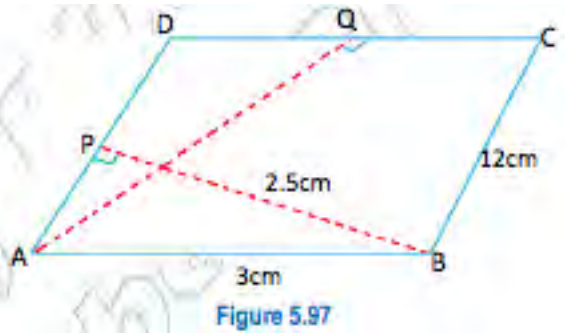


Figure 3.2.1.2 Geometrically Correct Figure for Example 1

Example 2 (Grade 7 textbook):

3. ABCD is a parallelogram in which AB = 3cm, BC = 12cm and the perpendicular from B to AD is 2.5cm. Find the length of the perpendicular from A to CD.



(Grade 7 Mathematics Textbook, Unit 5: Geometric Figures and Measurement, p.193)

This figure is grossly wrong and misleading. AQ and DC do not look perpendicular. The correct figure is shown in Figure 3.2.1.3.

Drawing correct figures is a must and "abc" for item writers particularly when dealing with geometry. In Ethiopia, even the mathematics textbooks show quite incorrect figures. This is very unfortunate for the students because appropriate figures greatly help them to grasp the concepts quickly and correctly. Incorrect figures will only confuse them and totally hamper their understanding.

Thus, providing a correct and precise figure for every geometry item should be a very practical but far-reaching target for Ethiopian item writers to strive for.

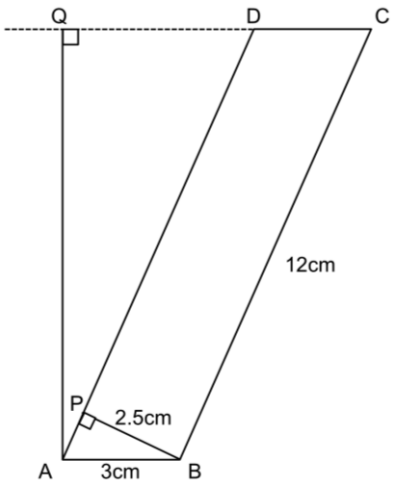


Figure 3.2.1.3 Geometrically Correct Figure for Example 2

ii) Try to develop items that make students "think"

Once the mathematics Working Group members have reached a higher level of competency, their next target should be to write items that make students "think," such one as does not copy typical items included in the textbook exercises. A good attempt is:

Example 3:

The linear equation y = 6x represents the total km, y, Abel runs after 'x' number of days.

How many kilometers will Abel run after 3 days?

A. 3 km
B. 6 km
C. 12 km
D. 18 km

Key: D （Workshop 5）

This is a simple application of linear function but this type is not commonly found in the textbook. The writer tried to create a new item from a new mold. The statistics from the item analysis, however, indicated that this item was too easy (difficulty = 0.80). All 19 students in the upper group answered correctly. This was a good attempt but failed to achieve a satisfactory level of quality. Nonetheless, the members should aim in this direction to go further upward.

Table 3.2.1.5 Item Analysis Statistics of Example 3

E_18	P	0.80	D	0.37	COR	0.36	N	69
	A	B	C	D*	PA	PB	PC	PD
All	6	1	5	55	0.09	0.01	0.07	0.80
Upper	0	0	0	19	0.00	0.00	0.00	1.00
Lower	2	0	4	12	0.11	0.00	0.21	0.63

3.2.2 Biology Working Group

1) Members of the Working Group

Table 3.2.2.1 shows the names of the members of the biology working group and their affiliations.

Table 3.2.2.1 Members of the Biology Working Group (as of July 2017)

	Name	Affiliation
1	Yusuf Aliye Said	MSIC
2	Ms. Etenesh Mekonnin Demena	MSIC
3	Mequanint Addis Hailu	MSIC
4	Ms. Tigist Getahun Gebremichael	MSIC
5	Desalegn Teshome Amare	MSIC
6	Abebe Garedew Amtate	TELDD
7	Solomon Belayneh Abebe	CDID
8	Minas Gebremeskel Weldesadik	NEAEA
9	Berhanu Fikru Firesenbet	Addis Ababa Education Bureau
10	Getahun Asrat Tachbel	Afar REB
11	Adiss Daka Rorissa	Benishangul-Gumuz REB
12	Arefat Musa Ali	Dire Dawa Education Bureau
13	Gatdor Deng Duop	Gambella REB
14	Njib Jemal Michael	Harari REB
15	Alemu Legesse	Oromia REB
16	Mosisa Dejene Challa	Oromia REB
17	Degu Zewdie Gizaw	SNNPR REB
18	Ahimed Omer Samale	Somali REB
19	Ms. Silas Araya Demwoz	Tigray REB
20	Daniel Nigatu Lema	Benishangul-Gumuz (Teacher)
21	Philip Owar Ojulu	Gambella (Teacher)
22	Peter John	Gambella REB
23	Workagegnehu Ashagire Gebremedhin	SNNPR REB

A member from Amhara REB retired after the eighth Workshop and no new member has been assigned to the ninth and tenth Workshops from the REB. A chemistry member from Gambella was transferred to the biology Working Group on his own request from the ninth Workshop.

2) Achievement

Tables 3.2.2.2 to 3.2.2.4 summarize the group's achievement through the ten Workshops.

Table 3.2.2.2 Developed Items (All Grades): Biology

Workshop	Participants	Items for G7/G8	Items for G4	Items for G10	Total Items
1	18	93	--	--	93
2	17	157	--	--	157
3	15	275	--	--	275
4	21	419	--	--	419
5	16	381	--	--	381
6	16	379	--	--	379
7	10	250	--	--	250
8	14	146	400	--	546
9	12	196	8	141	345
10	15	--	--	250	250
Total	**154**	**2,296**	**408**	**391**	**3,095**

Table 3.2.2.3 Field Tested Items (Grade 7 and Grade 8): Biology

Work-shop	G7/8 Items Devel-oped	G7/8 Items Field-Tested*	Items per Test	Total Exami-nees	"Good" Items*	% of "Good" Items	Average Diffi-culty	Average Discrimi-nation
1	93	17	17	40	12	70.6	0.483	0.331
2	157	60	30	69	37	61.7	0.370	0.280
3	275	120	30	155	73	60.8	0.359	0.290
4	419	120	30	170	51	42.5	0.314	0.198
5	381	120	30	339	94	78.3	0.386	0.337
6	379	120	30	282	71	59.2	0.311	0.281
7	250	120	30	355	91	75.8	0.442	0.398
Total/ Average	**1,954**	**677**	**--**	**1,410**	**429**	**63.4**	**0.366**	**0.300**

Note: * Field tests were conducted for Grade 7 and 8 items up to the seventh Workshop.

** "Good" items mean those items which satisfy the following two conditions simultaneously:

Difficulty >= 0.25
Discrimination index >= 0.10

Table 3.2.2.4 Items Selected for Item Pools (Grade 7 and Grade 8): Biology

Workshop	Reviewed Items Total*	Items selected without modificati on	Items selected with modificati on	Selected Items Total	Rejected items Total	% of selection	% of rejection
1	**112**	66	22	**88**	**24**	78.6	21.4
2	**198**	114	54	**168**	**30**	84.8	15.2
3	**304**	113	181	**294**	**10**	96.7	3.3
4	**458**	267	179	**446**	**12**	97.4	2.6
5	**381**	260	50	**310**	**71**	81.4	18.6
6	**381**	273	40	**313**	**68**	82.2	17.8
7	**247**	52	134	**186**	**61**	75.3	24.7
8	**146**	42	87	**129**	**17**	88.4	11.6
9	**197**	68	101	**169**	**28**	85.8	14.2

10	--	--	--	--	--	--	--
Total	**2,424**	1,255	848	**2,103**	**321**	86.8	13.2

Note: * Reviewed items include those biology items developed by the Assessment and Evaluation Working Group.

i) Achievement of target number of items

The total number of items for Grades 7 and 8 developed through the ten Workshops are 2,296 and among them, 2,103 have been selected for the item pools. They also developed 408 items for Grade 4 and 391 items for Grade 10. This means that they have achieved the target numbers (Total 2,000 items for G7 and G8, 200 items each for G4 and G10) of this project.

ii) Improvement of the ability to develop and select items with higher discrimination power

The number of Grade-7 and -8 items which were developed in the first seven Workshops and field-tested were 677 in total. The average discrimination index of all the 677 items is 0.300. Since items with discrimination power between 0.3-0.39 are often classified as "good discriminating" items (Sushma S. et al., 2013[6], Shete et al., 2015[7]), this indicates that biology Working Group members have acquired ability to develop and select items with high quality.

Beside this, the percentage of items whose discrimination power is higher than 0.3 in each field test improved gradually and reached 65.8 point at the last field test (Figure 3.2.2.1). This result shows that members' ability to develop and select items that have high discrimination power has been improved and strengthened through the Workshops.

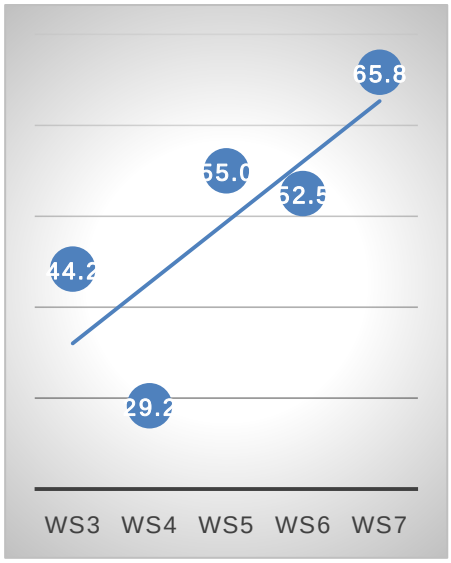


Figure 3.2.2.1 Percentage of Items with Discrimination Power Higher Than 0.3 in Each Field Test

3) Points Emphasized in the Workshops

Participants have improved their ability to develop good items step by step through the ten Workshops. It seems that there were three major steps.

[6] Sushma S. et al. (2013). Correlation between difficulty & discrimination indices of MCQs in formative exam. *Physiology South-East Asian Journal of Medical Education*, 7 (1), 45-50.

[7] Shete et al. (2015). Item analysis: An evaluation of multiple choice questions in Physiology examination. *Journal of Contemporary Medical Education*, 3 (3), 106-109.

Step 1: Understand how to develop items

Step 2: Develop more items using the NEAEA checklist and applying general patterns of item development

Step 3: Seek methods to develop application- and higher-level items with better quality

The issues found at each step, their countermeasures taken in the Workshops and their outcomes are described in the following paragraphs.

i) Step 1: Understand how to develop items (WS1~WS4)

Following issues were to be solved in this step:

Participants did not know well about: - the general procedure to develop items - the criteria to write good items

Many of the participants did not have enough experience to develop items. They wanted to know the standard procedure to develop items, variety of items suitable especially for multiple-choice questions (MCQs) and criteria that they should follow when they develop MCQs.

Measure 1: Introduce a standard process to develop items and show the relationships among competency, textbook and item clearly

A standard process to develop items was introduced and the relationships among competency, textbook and item were shown clearly at the second Workshop. The standard process introduced in the second Workshop was as follows.

Decide which competency you aim to assess ⇒ Read through syllabus of the target unit and examine competencies and explanations carefully ⇒ Read through related parts in the textbooks. It is recommended also to read through other reference books and related contents which learners learned in the previous units and will learn in the future ⇒ Examine, by utilizing the syllabus and textbooks, what kind of items are proper to assess the achievement of the target competency in question

Measure 2: Introduce MCQ items with various patterns

Following types of items were introduced in the Workshops.

- Asking knowledge or understanding
- Asking to select suitable words to fill in a blank
- Asking to select wrong parts in a stem
- Having tables, graphs or figures
- Having new experiments to ask learned contents
- Asking application of learned contents to their surroundings, etc.

Effectiveness of using tables, graphs and figures was particularly emphasized in several Workshops. Advantages of them are:

1) They can show necessary information in a brief form
2) They help the item developer to write application-level items relatively easily (e.g., learners are requested to think deeply in analyzing data in a graph)

Participants practiced to develop items with figures, tables of graphs. They were also advised not to develop items beyond the learning contents of the target unit.

Measure 3: Confirm the contents of "Checklist for Multiple-Choice Items" by NEAEA

"Checklist for Multiple-Choice Items" developed by NEAEA was shared among the participants at the third Workshop. They examined the contents together and confirmed the standard format and regulations of writing MCQs in Ethiopia. Then, they started pointing out problems of items that they had developed before and modified them by following the checklist.

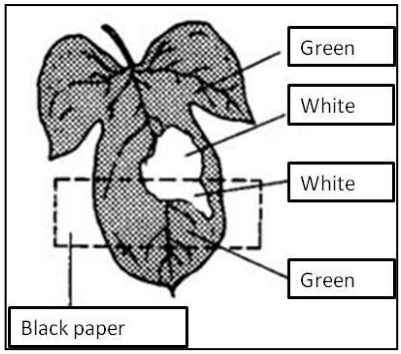
Outcome 1: More participants come to use graphs, tables and figures in items

Though only 3 out of 93 items that were developed at the first Workshop had graphs, tables or figures, the number of items with graphs, tables and figures increased up to 40 (out of 458) at the fourth Workshop and 28 (out of 381) at the fifth. Following is one example of items with a figure, which was developed at the fourth Workshop.

The diagram is a variegated leaf partly covered with black paper. The black paper covers parts of both white and green portion of the leaf. The leaf is then placed in the sun for 24 hours and is tested for starch. What would be the result of the test?

A. Only the green part which is not covered becomes blue black
B. Both the green and white part which is not covered become blue black
C. Only the green part which is covered becomes blue black
D. Only the white part which is covered become blue black

(4th Workshop)



Outcome 2: Some participants try to develop items that ask learners to apply science contents to their surroundings

Several typical application items were introduced at the second and third Workshops. One of them was "item which asks learners to apply what they have learned to their surroundings." This type of items describes the situation of (learners') surroundings and asks them what is happening and why, or how to deal with problems which occurred in the situation. Learners are expected to solve the item by utilizing what they have learned in the unit. Though it is very difficult to develop such type of items, some participants tried to develop them in the fourth and fifth Workshops. Following two items are examples.

A student was given different kinds of flowers to classify them based on their pollinating agents.
She selected a flower with bright colour, nectars, and attractive smell.
The pollinating agents of this flower are:

A. Wind and animals
B. Insects and birds
C. Water and wind
D. Cows and wind

(4th Workshop)

A veterinary doctor examined a sick sheep.
He found that the sheep showed weakness and debilitation.
What would his diagnosis be?

A. Anthrax
B. Liver fluke
C. Malaria
D. Trypanosomiasis

(5th Workshop)

Outcome 3: More participants started to develop test items following the "Checklist for Multiple-Choice Items" of NEAEA

Table 3.2.2.5 below shows examples of items developed in the first Workshop and fifth Workshop. As the NEAEA checklist was introduced several times at the Workshops, participants gradually acquired attitude to follow it. Participants frequently referred to the checklist and modified items that did not satisfy the guidelines.

Table 3.2.2.5 Difference between Items Developed at the 1st and 5th Workshops from the Viewpoint of NEAEA Criteria

Items developed at the 1st Workshop	Items developed at the 5th Workshop
- Include words in the stem that would otherwise be repeated in each option.	
The difference between plant and animal cells is: A. **plant cells have** small vacuoles B. **plant cells have** chloroplast C. **plant cells have** large vacuoles D. **plant cells have** irregular shape (1st Workshop)	Why is it advisable to leave some of the honey in the colony when harvesting honey? **Because it is used**: A. as a food for colony B. to turn an ordinary bee into a queen bee C. protection methods of sitting during harvest D. as mechanism of the bee keeper to defend the bees (5th Workshop)
- Place options in logical order.	
Which one of the following numbers tells the types of microscope? A. 3 B. 2 C. 4 D. 5 (1st Workshop)	How many chambers does a ruminant stomach have? A. 1 B. 2 C. 3 D. 4 (5th Workshop)
- Options are of similar length and are written in a similar style to the key.	
Why we must use the fine adjustment knob to bring the specimen into focus under a microscope? A. Not to allow too much light into the specimen (**37** letters) B. Not to break the slide with the specimen and not to affect the objective lenses (**65** letters) C. Because the coarse adjustment will not move if we are using medium and high power objective (**76** letters) D. It is possible to use the coarse adjustment with the medium or high power objective too (**72** letters) (1st Workshop)	Which of the following is true about maize stalk borer? A. The adult bores a hole in the stem and lays its eggs (**41** letters) B. The larva bores a hole in the stem and changes to pupa (**43** letters) C. The eggs are changed to larva in the hole (**33** letters) D. The pupa bores a hole in the stem and develop into adult (**45** letters) (5th Workshop)

ii) Step 2: Develop more items using the NEAEA checklist and applying general patterns of item development（WS4~WS7）

Issues expected to be solved at this step were:

Participants worried that they did not have clear criteria to classify items into knowledge or application type. They regarded a complex item as an application item and develop items with long sentences and unnecessary information

Many of the participants developed items that satisfied the "Checklist for Multiple-Choice Items" of NEAEA. Then, they became interested to know how their items would be evaluated by others. Some participants wrongly thought that if they developed items with longer sentences, they must be judged as application-level items. It is certain that long sentences can increase variety of items, but if learners lack required linguistic competencies to read and solve the item, they will fail to give the correct answer even if they have acquired the target competency. Such an item cannot assess whether the learners have achieved the target competency of biology or not. Following is an example of long and complex item.

> Abebe was studying a 40meter square habitat using a quadrate measurement. His quadrate was 0.5meter square. He recorded the average number of four quadrate measurements which showed 50 grasses, 6 clovers and 3 grasshoppers in a quadrate. Then he calculated the total population of these organisms in that habitat. Now, what was the total population?
>
> A. 140 grasses, 52 clovers, 46 grasshoppers
> B. 2,000 grasses, 240 clovers, 120 grasshoppers
> C. 4,000 grasses, 480 clovers, 240 grasshoppers
> D. 90 grasses, 46 clovers, 43 grasshoppers
>
> (450 letters including options)

Measure 1: Support participants to be able to have their own criteria for knowledge and application items through introduction of examples of TIMSS items and Bloom's taxonomy

Participants shared examples of TIMSS items and Bloom's taxonomy to be able to have their own criteria to distinguish knowledge-level and application-level items. This was not so much for the acquisition of accurate skills to classify items as for deeper understanding of application-level items to improve their quality.

Many of the participants agreed that if an item is asking learners just to recall what are written in the textbooks, it is basically knowledge-level item and if it asks more than recalling, the item can be an application-level item. A participant stated that even when an item asks learners to recall contents of the textbook, it sometimes can be an application-level item if "How" or "Why" is used in it. Participants also agreed with this opinion and concluded that it is difficult and not so important to classify an item accurately into knowledge type or application type.

Measure 2: More complex item ≠ Higher application item

In a session at the sixth Workshop, it was recommended for the participants to develop or modify items without using difficult or complex expressions, in order to avoid such a problem mentioned above. A sample modification of the item shown above was also proposed to the participants as below:

> Abebe wanted to estimate the total population in a 20 m^2 using quadrates. He set 4 of 1m^2 quadrate in it and calculated the average population, which showed 10 grasses and 5 clovers.
> What was the estimated population in the 20 m^2?
>
> A. 100 grasses and 50 clovers
> B. 40 grasses and 20 clovers
> C. 800 grasses and 400 clovers
> D. 200 grasses and 100 clovers
>
> (286 letters including options)

To reinforce the retention of this concept, Mr. Takele (LAMS) gave a special lecture entitled "How to write simple items" to the whole participants at the seventh Workshop.

Outcome 1: More participants have become able to find insufficient items from the viewpoint of consistency between target competency and items

The following item was examined at the "Review of Developed Items" session on the last day of the fifth Workshop. In this session, participants discussed whether items were good or not. If an item was found not good, they proposed possible modifications.

Which animal is a ruminant? A. Camel B. Donkey C. Goat D. Mule （5th Workshop）

Target competency of the above item is "Compare the ruminant stomach with the human stomach." Participants insisted that this item needed modifications because it was not consistent with the target competency. Though the competency requests learners to compare human stomach with ruminant stomach, the item did not mention human stomach. They proposed that at least "Human" should be included as an option.

Such kind of discussions and modifications rarely happened in the initial Workshops. They mainly looked through items examining whether items had mistakes or not, whether the stem and options were matching or not. This implies that participants gradually came to understand what the role of items is (to assess whether learners acquired the target competency or not), and became able to identify items that do not meet the role.

Outcome 2: The percentage of items with more than 200 words in their stems was reduced

The percentage of items with more than 200 letters in their stem was 4.85 point (15 out of 309 items) at the sixth Workshop. The percentage decreased to 0.40 point (1 out of 247 items) at the seventh Workshop. Besides this, the average number of letters in items with more than 200 letters was decreased from 281 (sixth Workshop) to 220 (seventh Workshop).

iii) Step 3: Seek methods to develop application- and higher-level items with better quality (WS6~WS10)

Issues to be solved were:

Though participants already learned and understood what application items were and became familiar with them, some of them still felt difficulty in developing application- and higher-level items

Measure 1: Apply tips to develop application items

Several participants stated that even if they had learned and understood what application items were, it was still difficult to develop good ones. To develop original application items is actually difficult, but there are several useful tips on how to develop application items of certain level relatively easily. Japanese Expert introduced them at a session in the sixth Workshop. Following is a tip introduced at the session.

Tip 1: When a target competency starts with "give examples" or contains "practical

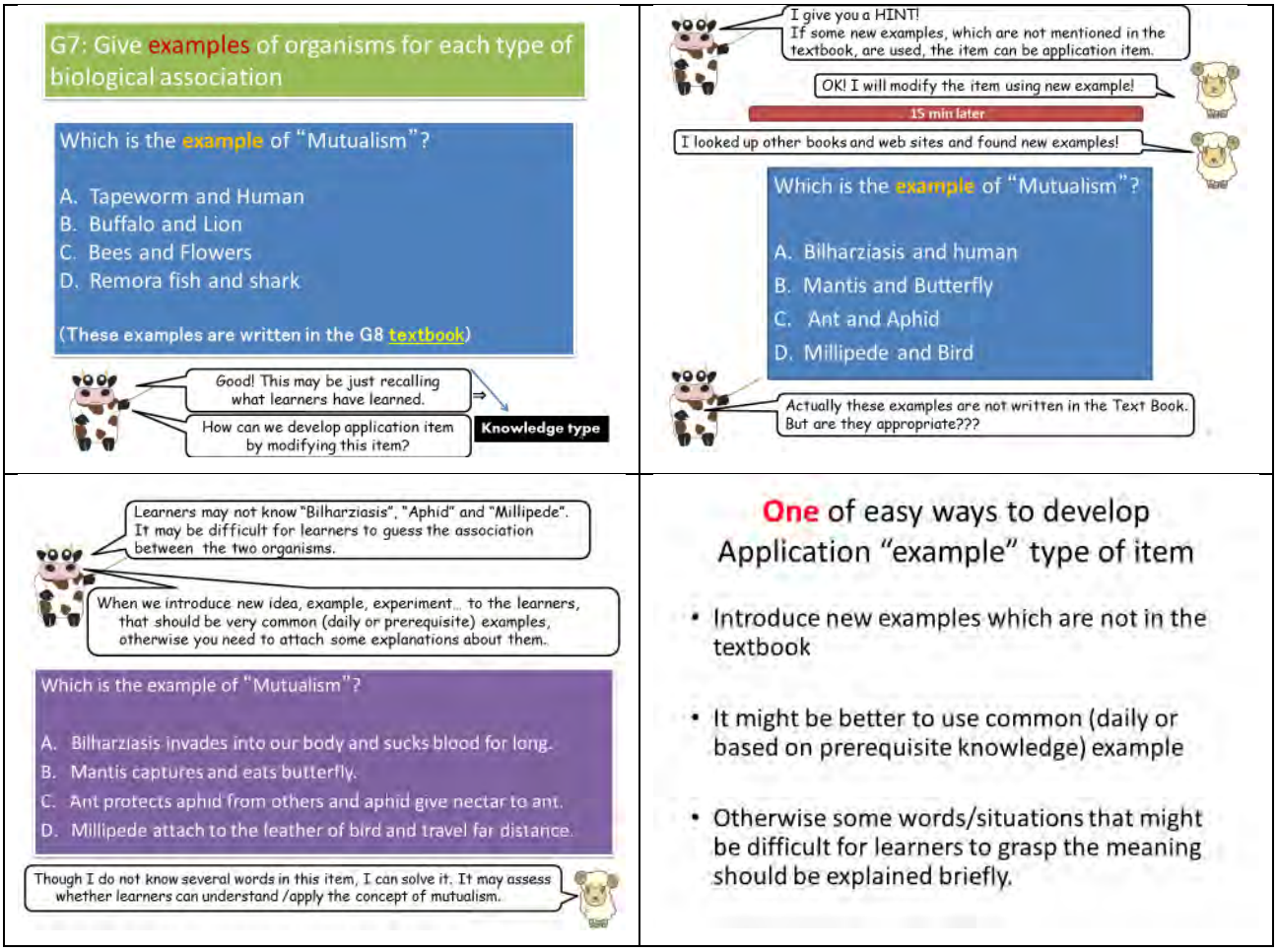
example"

In the G7 and G8 biology syllabi, there are six competencies that start with "give examples" and one competency that contains the phrase "practical example."

If the same examples given in the textbooks are used for the assessment of such competencies, items tend to be knowledge type. If one wants to develop an application-level item to assess such competencies, it is suggested to use examples that are not given in the textbooks so that learners should apply what they have learned to solve the item.

If examples are not in the textbooks but familiar to learners (e.g., examples from the daily life), you can use these examples as they are. If they are not so common, item writers should attach brief explanations about them.

As long as item writers can find such examples by referring to reference books, websites, etc., they can easily develop application-level items.



Measure 2: Share methods to develop application-level items with other participants

In addition to some tips to develop application-level items, the Japanese Expert recommended them to know ways of item development of others and asked several participants, who were confident in developing good application-level items, to present how they developed them. The presentation was delivered at the seventh Workshop. One participant classified application-level items into following five types, based on what he had learned in LAMS Workshops, and explained how he developed them with actual examples.

Table 3.2.2.5 Five Types of Application-Level Items Classified by a Participant

	Type	Explanation
1	Premise – Consequence	Predict what will happen by using prerequisite knowledge
2	Case study	Analyze given data of experiments and answer a series of items related to them
3	Incomplete scenario	Find insufficient part of given scenario
4	Analysis of visuals	Analyze new graphs, tables, figures by using prerequisite knowledge
5	The answer and the reason why	Give judgment and its reason at a time

Example of "Premise – Consequence" type of item

What will happen to the cells of a freshwater plant if the plant is placed in a container of salt water? They will:
A. swell because water will move into them.
B. swell because salt will move into them.
C. shrink because water will move out of them.
D. shrink because salt will move out of them.

Key: C

Outcome 1: Participants developed items applying tips to develop application-level items

A participant developed the following item:

Which of the following is an example of parasitism?

A. Epiphyte grows upon another plant but does not take food from the plant
B. Plover bird cleans teeth of crocodile and the bird gets food
C. Amoeba gets its food from human intestine by absorbing digested food
D. Tiger eats goat

Key: C

As options "A" and "D" were not introduced as examples of biological association in the G8 textbook, learners should apply what have learned about biological association to these new examples.

Outcome 2: Participants developed items applying methods of other participants to develop application-level items

After the presentation by a fellow participant mentioned above, several participants tried to develop items using scenarios seen in the daily life. The following item is one of the examples.

"A lady is curious to know why she looks like her grand farther instead of farther or mother.

Which branch of biology gives her the explanation to this case?"

Though this is not a good application-level item, the person could acquire actual skills to develop application-level items furthermore.

4) Remaining Issues

Though participants have acquired ability to develop items with certain quality through solving above issues in LAMS Workshops, there still remain some issues.

The results of the fourth and seventh field tests were examined. One hundred and twenty

items per each test were arranged, grouped by difficulty rate and the percentage of each group was calculated. Items in each group were distinguished by discrimination index (over 0.3 or less than 0.3) and shown in the graphs below.

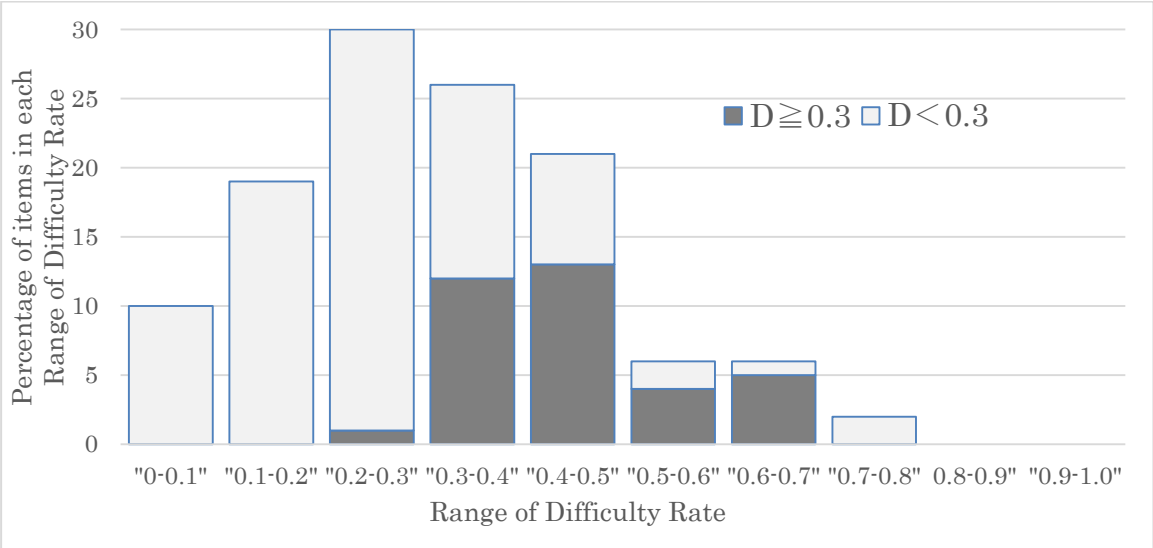


Fig 3.2.2.2 Percentage of Items and Discrimination Index Not Less Than and Less Than 0.3 in Each Range of Difficulty Rate at the Fourth Field Test

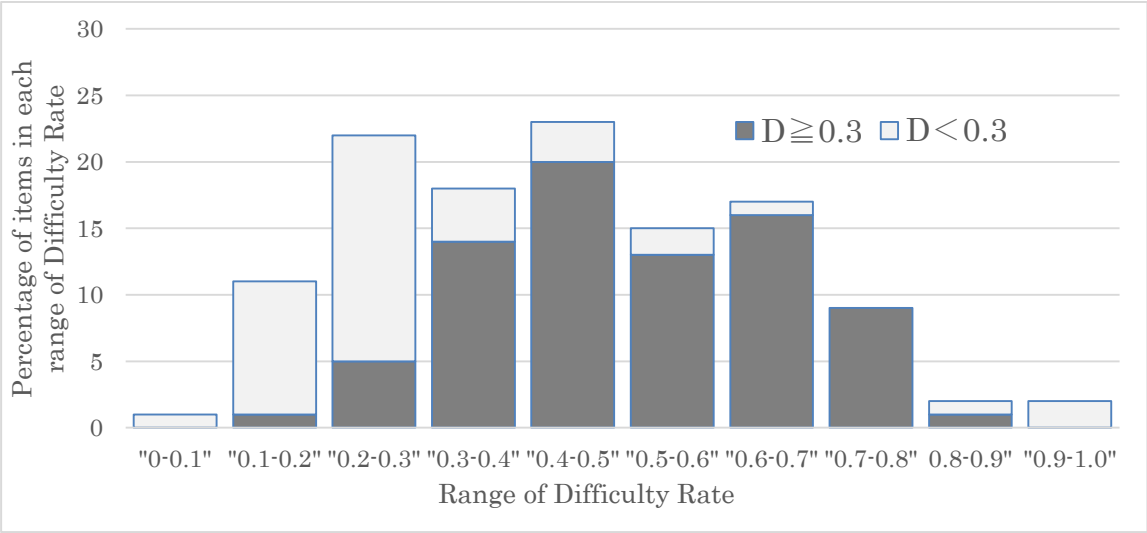


Fig 3.2.2.3 Percentage of Items and Discrimination Index Not Less Than and Less Than 0.3 in Each Range of Difficulty Rate at the Seventh Field Test

When the result of the seventh field test is compared with that of the fourth field test, percentage of items with discrimination index over 0.3 is increased remarkably in every difficulty rate range except in the lowest (0-0.1) and highest (0.9-1.0).

The percentage is increased even in the group with relatively difficult items (Difficulty rate: 0.2-0.3). This indicates that the percentage of good items, which are difficult to solve but learners who have higher ability to apply can solve reasonably, has increased.

Items in higher difficulty rate ranges tend to have high discrimination index in both the field tests. It indicates that it is difficult to discriminate learners by difficult application-level

items, but easy by easy knowledge-level items. Learning provided at school might affect the result directly.

It was emphasized in Workshops that it is preferable for exams to be composed of items with high discrimination power. The above results imply that items with higher difficulty rate, which means easy items, are more suitable for the accurate discrimination of present learners.

The types of items which have higher discrimination power vary, if the quality of learning at school changes.

There is a competency in G7 biology syllabus: Explain food web with example. Some may expect learners to be able to recall the examples in the biology textbook, whereas others may expect them to find examples from their surroundings and construct food web by utilizing knowledge they have learned. As the interpretation of a competency can vary widely depending on intentions of teachers, item developers, textbook writers and so on, item developers have responsibility to properly expect how Ethiopian learners should be in the future and develop items by examining competencies carefully.

Many of the participants are officers who deal with the national exams at region or national level. This might be a good opportunity for them to reexamine what kind of human resources are needed for future Ethiopia and how competencies can be interpreted for that purpose. That would result in the provision of education and examination items with higher quality.

3.2.3 Chemistry Working Group

1) Members of the Working Group

Table 3.2.3.1 shows the names of the members of the chemistry working group and their affiliations.

Table 3.2.3.1 Members of the Chemistry Working Group (as of July 2017)

	Name	Affiliation
1	G/Egziabher Araya	MSIC
2	Nesibu Mengistu	MSIC
3	Zelekew Teshome	MSIC
4	Yidnekachew Legese Mekonnen	MSIC
5	Shewangzaw Shiferaaw	TELDD
6	Nega Gichile	CDID
7	Worku G/Michael	NEAEA
		Addis Ababa Education Bureau
8	Seifu Belete	Afar REB
9	Mulugeta Mesfin	Amhara REB
10	Alemene Melaku	Benishangul-Gumuz REB
11	Aynalem Aboye	Dire Dawa Education Bureau
		Gambella REB
12	Dilnesaw Getachew	Harari REB High School Teacher
13	Hailu Tafesse	Oromia REB
14	Anteneh Abebe Shiferaw	SNNPR REB
15	Belete Sibhat	Somali REB
16	Kibeat H/Mikael	Tigray REB
17	Messele Terefe	Amhara Primary School Teacher
18	Askalu G/egziabher Glmedihn	Tigray Primary School Head Teacher

The position for Addis Ababa Education Bureau and Gambella REB remain vacant after retirement and transfer of the member to the biology Working Group, respectively.

2) Achievement

Tables 3.2.3.2 to 3.2.3.4 summarize the group's achievement.

Table 3.2.3.2 Developed Items (All Grades): Chemistry

Workshop	Participants	Items for G7/G8	Items for G4	Items for G10	Total Items
1	17	52	--	--	52
2	17	182	--	--	182
3	17	290	--	--	290
4	19	368	--	--	368
5	17	360	--	--	360
6	13	296	--	--	296
7	10	168	--	--	168
8	11	175	207	--	382
9	12	222	--	27	249
10	13	77	--	195	272
Total	**146**	**2,190**	**207**	**222**	**2,619**

Table 3.2.3.3 Field Tested Items (Grade 7 and Grade 8): Chemistry

Work-shop	G7/8 Items Devel-oped	G7/8 Items Field-Tested*	Items per Test	Total Exami-nees	"Good" Items**	% of "Good" Items	Average Diffi-culty	Average Discrimi-nation
1	52	16	16	30	11	68.8	0.514	0.424
2	182	59	30	83	34	57.6	0.282	0.243
3	290	120	30	181	65	35.9	0.292	0.248
4	368	119	30	158	73	61.3	0.369	0.266
5	360	120	30	343	84	70.0	0.366	0.293
6	296	120	30	302	65	54.2	0.304	0.225
7	168	120	30	390	94	78.3	0.402	0.329
Total/ Average	**1,716**	**674**	**--**	**1,487**	**427**	**63.2**	**0.345**	**0.274**

Note: * Field tests were conducted for Grade 7 and 8 items up to the seventh Workshop.

** "Good" items mean those items which satisfy the following two conditions simultaneously:

Difficulty >= 0.25
Discrimination index >= 0.10

Table 3.2.3.4 Items Selected for Item Pools (Grade 7 and Grade 8): Chemistry

Workshop	Reviewed Items Total*	Items selected without modificati on	Items selected with modificati on	Selected Items Total	Rejected items Total	% of selection	% of rejection
1	**54**	17	30	**47**	7	87.0	13.0
2	**188**	91	89	**180**	8	95.7	4.3
3	**322**	151	135	**286**	36	88.8	11.2
4	**387**	164	175	**339**	48	87.6	12.4
5	**358**	76	246	**322**	36	89.9	10.1
6	**308**	88	181	**269**	39	87.3	12.7
7	**168**	83	79	**162**	6	96.4	3.6
8	**176**	68	95	**163**	**13**	92.6	7.4
9	**223**	41	145	**186**	**37**	83.4	16.6
10	**77**	18	56	**74**	**3**	96.1	3.9
Total	**2,261**	797	1,231	**2,028**	**233**	89.7	10.3

Note: * Reviewed items include those chemistry items developed by the Assessment and Evaluation Working Group.

Before reading any achievements of the chemistry Working Group in the tables above, the

uniqueness of the sixth Workshop should be explained. In that Workshop, more than half of the competencies handled were of the fifth unit of Grade 8, "Calculation based on formulas." It covers some of the most difficult areas of chemistry at the primary level such as atomic mass, relative atomic mass, the mole concept, the composition of compounds and determination of formulas. It also requires high-level calculation skills. It is very likely that this unit was not taught with sufficient time in most of the schools in the country since it is set in the last part of the curriculum of primary education and is difficult to reach for average classes in the given lesson periods. The relatively small number of "good" items in the sixth Workshop may be the result of these factors.

Through the ten Workshops of the project, a total of 2,619 chemistry items were produced passing the targets of 1,000 for Grade 7 and 8 each, and 200 for Grade 4 and 10 each. The breakdown is 207 for Grade 4, 980 for Grade 7, 1210 for Grade 8 and 222 for Grade 10. As the members accumulated the experience of item writing, they improved their ability of it. The number of developed items continued to increase from the first Workshop to the fourth but declined after the fifth to the seventh with the decrease in the number of participants. Nonetheless, the number of developed items per participant continued increasing up to the sixth Workshop. This indicates that the ability of the participants to develop items has improved at least quantitatively. (As the time allocated to item writing activity at the Workshops 8, 9 and 10 was quite different, it is not appropriate to infer their ability from the number of items produced.)

The number of "good" items steadily increased from the first Workshop to the seventh whereas the percentage of the "good" items in the total field-tested items improved from the third to the seventh. At the sixth Workshop, however, although test time was extended from 30 to 40 minutes to give additional time for chemical calculations especially required in this test, both average difficulty index and average discrimination index dropped. Main reasons for this should be students' lack of calculation skills and the difficult nature of the topics covered. This should not be interpreted as a decline in the participants' ability to develop good items. Generally speaking, the ability of the participants to develop good items has steadily improved at least quantitatively.

In addition to item writing mentioned above, Workbooks of chemistry for Grades 7 and 8 were developed by the same working group members at the Workshops during the latter half of the project period. They are composed of 26 topics for Grade 7 and 25 for Grade 8 covering the whole learning areas of each grade. Each topic is composed of short explanations and examples followed by exercises. While in item writing activity they focused on a single competency in the syllabus and then wrote items consistent with it, in the workbook development they widened their careful consideration to other points such as the relation of different competencies and learning contents in a unit, learning flows in a topic or unit, and overlapping of the similar contents in different topics. Through those activities, the members have enhanced their ability of material development in chemistry education.

3) Points Emphasized in the Workshops

i) Try to develop items that are consistent with the competencies in the syllabus

The most basic point repeatedly emphasized in the Workshops is to develop items consistent with the competencies in the syllabus when tests are intended to assess if the students have acquired the competencies in the lessons. This point was particularly emphasized at the early Workshops in Year 1, where inconsistencies were frequently found among the first drafts of the items and pointed out by the peer participants and the JICA Expert as well. This situation later improved as the participants experienced more Workshops. However, the JICA Expert has kept emphasizing the importance of consistency between the items and the

competencies at every opportunity since there still were several inconsistent items developed mistakenly even in Year 2.

ii) Try to develop items at the application and higher level

Just as the other Working Groups did, the chemistry Working Group encouraged the development of good items both at the knowledge level and the application and higher level. Acquisition of knowledge is assessed at the former level and that of competencies in application, comparison, evaluation or other intellectual activities higher than memorization are performed at the latter level. After sharing the importance of item development at both levels, the JICA Expert emphasized the meaning of providing the items at the application and higher level: It is to discard the current national examinations and science lessons that are excessively oriented to memorization and eventually to improve science education in the country.

Rigid criteria were not set to distinguish these two levels since they are not practical. Instead TIMSS classification of the items was introduced as below for reference.

> Applying: Items in this domain require students to engage in applying knowledge of facts, relationships, processes, concepts, equipment, and methods in contexts likely to be familiar in the teaching and learning of science.

Compare/Contrast/ Classify	Identify or describe similarities and differences between groups of organisms, materials, or processes; and distinguish, classify, or sort individual objects, materials, organisms, and process based on given characteristic and properties.
Relate	Relate knowledge of an underlying science concept to an observed or inferred property, behavior, or use of objects, organisms, or materials.
Use Models	Use a diagram or other model to demonstrate knowledge of science concepts, to illustrate a process cycle relationship, or system, or to find solutions to science problems.
Interpret Information	Use knowledge of science concepts to interpret relevant textual, tabular, pictorial, and graphical information.
Explain	Provide or identify an explanation for an observation or a natural phenomenon using a science concept or principle.

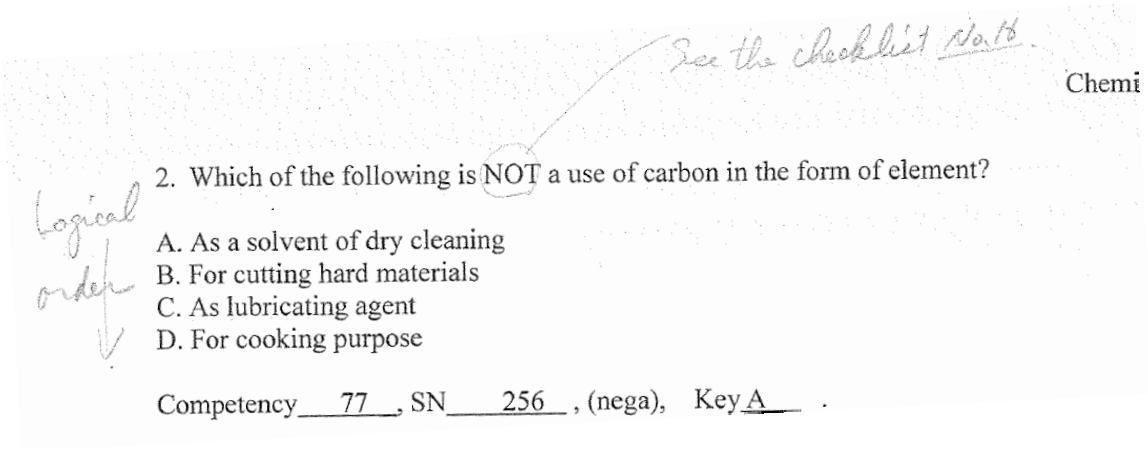
Source：TIMSS 2015, Assessment Framework

iii) Avoid negative expressions in the stems of items

The checklist for multiple-choice items, compiled by NEAEA, covers useful checking points for item development. The checklist was distributed to the participants and has been effectively used at the Workshops. Number 16 of the checklist, which is common advice on item development, is “Word the stem positively; avoid negative phrasing.” The JICA Expert has been emphasizing this point since the early Workshops. Nonetheless negative expressions are still often found in stems, and he had to repeat the same advice during Year 2.

As to the question of why negative expressions should be avoided in the stem, one participant answered because such a stem tended to be unclear. More than half of the participants seemed to agree with this answer.

On the other hand, some participants do not care about avoiding negative expressions. They think that if bold or capital letters are used for the word "not" or the word is underlined, it is permissible. They refer to Number 28 of the checklist, which states, "Because a negative stem causes confusion, its use should be avoided. If the stem can be expressed only negatively, make the font of the word 'not' bold." An example of a negative stem is shown below.


See the checklist No.18.

Chemi

2. Which of the following is NOT a use of carbon in the form of element?

Logical order

A. As a solvent of dry cleaning
B. For cutting hard materials
C. As lubricating agent
D. For cooking purpose

Competency 77, SN 256, (nega), Key A .

The target competency of the above item is "(The student will be able to) discuss the uses of elemental carbon." The JICA Expert provided the following explanation why this negative stem should be avoided:

Generally, incorrect or unreal things are not learned in the lessons while correct or real things are learned. In the example above, Option A, which is the key of the item, is unlikely to be taught in the lesson since it is incorrect. To find option A as the key by dropping B, C and D, all of which are correct, cannot be accepted as the direct fruit of learning in line with the competency. Therefore "NOT" in the stem should be avoided.

Following this explanation, a participant indicated that in the case of the item, "Which is NOT one of the major plant nutrients?" targeting the competency, "(Students will be able to) list the major plant nutrient," the item is asking about the direct fruit of learning since the major plant nutrients are limited to six elements and the students are expected to choose an option that is not any of the six elements. This idea was accepted by most of the participants.

iv) Arrange the options in logical order

This is Number 46 checking point on the checklist. At the fourth Workshop, several items were presented whose logic in the order of the options was unclear. Given these items, the participants discussed what the logical order of the options was.

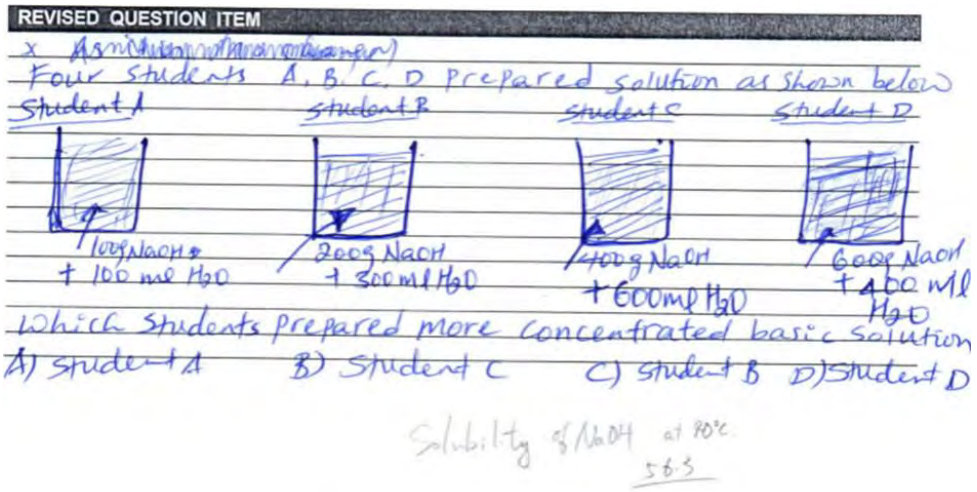
They well understood the logical order of the options: alphabetical order and increasing order are examples. The participants further introduced other possible logical orders, which are peculiar to chemistry, such as solid-liquid-gas, proton-neutron-electron, symbol-formula-equation, and atomic numbers. The order from simple to complex or *vice versa* was also presented by a participant.

After the discussion, one question was raised: Why should options be arranged in logical order? To this, one participant answered because it helped the students to grasp the meanings of the options. All the other participants agreed with him. The JICA Expert supplemented the answer by saying this: It helps the students to concentrate on the meaning of each option avoiding any other particular meaning being involved in the order of the options. It helps the students to find the key in a shorter time. Considering the logical order of the options may help the item writers view the items from a wider perspective,

including domain, balance and the other types of relations among the options.

v) Scientific data used in the items should be realistic

A participant developed an item in which the solution with the highest concentration was to be chosen by comparing sodium hydroxide solutions with different amounts of the solute and solvent without checking the solubility of sodium hydroxide. His first draft is shown below.



Since the solubility of sodium hydroxide in 100g of water is 56.5, all four solutions should be saturated and of the same concentration. The item does not make sense. The JICA Expert emphasized to the participants that any scientific data used in the item should be checked with the authorized data sources and the items should be realistic.

vi) Try to make an item of a simple structure rather than a complex one

The JICA Expert advised the participants that they could improve items with a low difficulty index (difficult items) by simplifying their structure without disturbing their consistency with the competency.

Among the field-tested items developed in the fifth Workshop, about 10% had options with pairs or triplets of information. Most of those items received a low value for difficulty index. The JICA Expert encouraged the writers to simplify the options' structure. He pointed out Number 43 on the checklist, which states, "Avoid the complex multiple-choice format/pairs or triplets of options (e.g., A and D; A, B and C, etc.)."

Below is an item developed for the competency of "(The students will be able to) give examples of metallic and non-metallic oxides." Following the JICA Expert's advice, the writer simplified the structure of the options from two substances to a single substance.

(Original item)

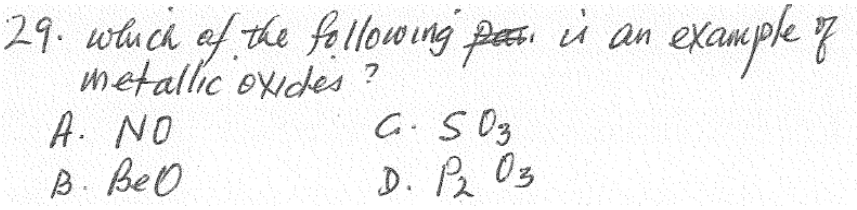
29. Which of the following pairs of oxides represents metallic oxides?

See the checklist #43. Shimbokan

A. BaO and SO_3
B. Na_2O and Al_2O_3
C. K_2O and P_2O_3
D. CaO and N_2O
Com 11,SN 236,Mekonnen ,Key B

C_29	P	0.24	D	0.15	COR	0.13	N	95

(Modified item)



However, some other writers did not heed the advice and a certain number of complex items were left without simplification.

vii) Arrange the basic contents for efficient learning in the Workbook

Workbook development as another major activity started at the middle of the series of the Workshops. In this activity, the members had to carefully select the relevant learning contents under an assigned topic to fill one spread or two pages. When they decided the contents, the JICA Expert advised them to prioritize basic ones and those closely linked to further learning.

For example, for the topic of "3.3 Chemical Formula – Binary Compounds" of Grade 7, the learning goal was set for the students to be able to write chemical formulas based on the use of valence numbers. However, the member in charge had valued the fact that some elements have plural valence numbers and kept certain space for it. Consequently, the space for explanation and exercises about valence number itself and how to write binary compounds became limited. After discussion, the member agreed to eliminate explanation of the plural valence numbers of elements and to focus more on writing chemical formulas based on the valence numbers. Valence number is the base for writing more complex formulas, too. As a result, the spread became more efficient for the students' learning.

4) Remaining Issues

In the previous *Progress Reports*, following four points were identified as the remaining issues.

i) There are differences in the levels of writing skills among the members
ii) The members are too dependent on the chemistry textbooks
iii) Skills to modify the item to raise the rate of correct responses are insufficient
iv) Skills of drawing diagrams on the computer are insufficient

The above issues have not yet been resolved and remain to be addressed. However, through the ten Workshops of the project, the general skills of item writing of individual members seem to have improved.

While there are differences in the levels of writing skills, active discussions on the item writing among the members seem to have compensated for it.

High dependency on the textbooks may link to the limitation in their understanding of chemistry contents as well as to the lack of good reference books available to them. This will improve in the future by the members' own day-to-day efforts rather than by limited chances of workshops or training.

Skills to modify the item to raise the rate of correct responses should be further improved. However, the idea that items with a low difficulty index should be avoided has been spreading and deepening among the members.

Limited time of computer drawing sessions at the Workshops could not change the level of the members' skills remarkably but more members have become aware of the importance of drawing and shown considerable eagerness to improve their skills in item development.

In addition to the above, several points emphasized in the Workshops as reported in the previous section should be kept in their mind. Items inconsistent with the competencies, items intended to be of the application and higher level but seeming to ask knowledge only, or items with negative expressions that seem to be changeable to positive ones are still observed even though the overall situation has been improving. Solutions to these issues cannot be expected in the short term but should be sought through long and continuous efforts.

3.2.4 Physics Working Group

1) Members of the Working Group

Physics Working Group consists of members from directorates of the Ministry of Education and the Regional Education Bureaus (REBs). Five members from MSIC, one member from CDID and one member from NEAEA are assigned, but from TELDD, no members are assigned. Eleven members are assigned from all REBs. Originally, the member from Harari REB was Mr. Nitsuhneh Tafesse but he was replaced at the second workshop by Mr. Kemal Abdulbasit, who was assigned to the Assessment and Evaluation Working Group at the first Workshop. Moreover, the original member from Benishangul-Gumuz REB was Mr. Tsegu Adere. He was replaced by Mr. Chemeda Dufeira at the fourth Workshop. In addition to them, three teachers from Dire Dawa, Harari and Somali regions have joined the physics Working Group since the fourth Workshop.

Table 3.2.4.1 shows the names of the members of the physics Working Group and their affiliations as of July 2017.

Table 3.2.4.1 Members of the Physics Working Group (as of July 2017)

	Name	Affiliation
1	Nega Deriba Worku	MSIC
2	Hailu Genebo Hirboro	MSIC
3	Dawit Belete Endeshaw	MSIC
4	Getachew Debela Mamo	MSIC
5	Dessie Melese Wassie	MSIC
6	Yosef Mihret Mengistu	CDID
7	Getaneh Tarekegn	NEAEA
8	Desta Mersha Odda	Addis Ababa Education Bureau
9	Girma Kifle Atnafu	Afar REB
10	Melkie Kifle Nigussie	Amhara REB
11	Chemeda Dufera Amejie	Benishangul-Gumuz REB
12	Tolemariam Burka Raje	Dire Dawa Education Bureau
13	Dereje Tefera Chekorso	Gambella REB
14	Kemal Abdulbasit Ahmed	Harari REB
15	Yusuf Mohammed Adem	Oromia REB
16	Tesfaye Fantahun Ali	SNNPR REB
17	Mohammed Mohamoud Abdilahi	Somali REB
18	Gebremeskel Gebreegziabher Meles	Tigray REB
19	Mulugeta Tafesse Debela	Dire Dawa (Teacher)
20	Mukbil Salim Asif	Harari (Teacher)
21	Ismael Mohammed Duale	Somali (Teacher)

2) Achievement

Group-wise activities at the Workshops are to develop items and to develop Workbooks for Grade 7 and Grade 8. Item development for Grade 7 and Grade 8 has been carried on since the first Workshop. Grade 4 items were developed at the eighth Workshop, and Grade 10

items were developed at the ninth and tenth Workshops. For each Workshop target units were assigned to participants, and participants developed items that are consistent with competencies for the unit. To develop Workbooks the contents were discussed at the fourth Workshop and participants began to develop drafts at the fifth Workshop.

Tables 3.2.4.2 to 3.2.4.4 summarize the group's achievement.

Table 3.2.4.2 Developed Items (All Grades): Physics

Workshop	Participants	Items for G7/G8	Items for G4	Items for G10	Total Items
1	14	105	--	--	105
2	16	167	--	--	167
3	15	272	--	--	272
4	19	328	--	--	328
5	19	377	--	--	377
6	17	342	--	--	342
7	10	187	--	--	187
8	13	117	270	--	387
9	16	224	--	95	319
10	16	22	--	194	216
Total	**155**	**2,141**	**270**	**289**	**2,700**

Table 3.2.4.3 Field Tested Items (Grade 7 and Grade 8): Physics

Work-shop	G7/8 Items Devel-oped	G7/8 Items Field-Tested*	Items per Test	Total Exami-nees	"Good" Items**	% of "Good" Items	Average Diffi-culty	Average Discrimi-nation
1	105	14	14	34	9	64.3	0.445	0.421
2	167	60	30	85	29	48.3	0.292	0.243
3	272	120	30	180	59	49.2	0.307	0.235
4	328	120	30	146	69	57.5	0.342	0.266
5	377	120	30	349	76	63.3	0.392	0.334
6	342	120	30	337	69	57.5	0.337	0.256
7	187	119	30	376	76	63.9	0.313	0.248
Total/ Average	**1,778**	**673**	**--**	**1,507**	**387**	**57.5**	**0.336**	**0.269**

Note: * Field tests were conducted for Grade 7 and 8 items up to the seventh Workshop.

** "Good" items mean those items which satisfy the following two conditions simultaneously:

Difficulty >= 0.25
Discrimination index >= 0.10

Table 3.2.4.4 Items Selected for Item Pools (Grade 7 and Grade 8): Physics

Workshop	Reviewed Items Total*	Items selected without modificati on	Items selected with modificati on	Selected Items Total	Rejected items Total	% of selection	% of rejection
1	**117**	95	4	**99**	**18**	84.6	15.4
2	**190**	150	18	**168**	**22**	88.4	11.6
3	**317**	286	19	**305**	**12**	96.2	3.8
4	**347**	288	44	**332**	**15**	95.7	4.3
5	**379**	217	142	**359**	**20**	94.7	5.3
6	**342**	302	14	**316**	**26**	92.4	7.6
7	**192**	41	125	**166**	**26**	86.5	13.5
8	**117**	22	71	**93**	**24**	79.5	20.5
9	**224**	57	149	**206**	**18**	92.0	8.0
10	**22**	22	0	**22**	**0**	100.0	0.0
Total	**2,247**	1,480	586	**2,066**	**181**	91.9	8.1

Note: * Reviewed items include those physics items developed by the Assessment and Evaluation Working Group.

A total of 2,700 items were developed by the physics Working Group. The number of items developed at each Workshop increased from the first Workshop to the fifth. However, the number decreased after the fifth Workshop largely because participants decreased. After that, the number of developed items reached its maximum at the eighth Workshop. Although the number of participants recovered slightly at this Workshop, the main factor for achieving the maximum number of developed items is longer time allocated for item developing. Until the seventh Workshop, periods for developing items were scheduled within two days at each Workshop. However, a half day was additionally secured for developing items at the eighth Workshop. Afterward the time allocated for developing items varied from Workshop to Workshop. Therefore it is difficult to simply compare the numbers of the developed items per Workshop. The number of developed items per participant is stated later.

Until the seventh Workshop, some selected items were field-tested and their results were analyzed. Items that passed the target standards are regarded as "good" items. The standards are as follows: difficulty is greater than 0.25 and discrimination index is greater than 0.10. The rate of "good" items continuously increased from the second Workshop to the fifth Workshop. The rate slightly declined at the sixth Workshop but recovered at the seventh Workshop. As a whole, the rate of "good" items is generally on the upward trend. Total number of "good" items is 387 out of 673 field-tested items. The percentage is 57.5%. Average difficulty and discrimination through the seven field-tests are 0.336 and 0.269, respectively.

Table 3.2.4.5 below summarizes the total number of items developed at each Workshop, the rate of those items with figures or tables and the rate of items with negative phrasing in the stem.

Table 3.2.4.5 Physics Working Group's Achievement Analysis

Work-shop	Partic-ipants	Items Devel-oped	Items per partic-ipant	Items with figures or tables	% of Items with figures or tables	Items with negative phrase in the stem	% of Items with negative phrase in the stem
1	14	105	7.5	5	4.8	7	6.7
2	16	167	10.4	27	16.2	9	5.4
3	15	272	18.1	52	19.1	17	6.3
4	19	328	17.3	70	21.3	20	6.1
5	19	377	19.8	37	9.8	42	11.1
6	17+1	342	19.0	95	27.8	37	10.8
7	10+1	187	17.0	79	42.2	12	6.4
8	13	387	29.8	67	17.3	65	16.8
9	16	319	19.9	90	28.2	17	5.3
10	15+2	216	12.7	46	21.3	22	10.2
Total	**154+4**	**2,700**	**17.1**	**568**	**21.0**	**248**	**9.2**

Note: At the sixth, the seventh and the tenth Workshops, additional numbers in participants mean members from the Assessment and Evaluation Working Group who joined the physics Working Group and developed items. At the tenth Workshop, only 15 member developed items out of 16 participants from the physics Working Group.

The number of developed items per participant is largest at the eighth Workshop. The reason is the longer working time as explained above. On average, one participant developed 17.1 items in each Workshop.

Items with figures or tables were steadily increasing until the seventh Workshop except at the fifth Workshop. Although it is not clear why the number declined at the fifth Workshop, the increase seemed to be a result of continuous advice to add figures or tables. At the seventh Workshop, 42.2% of items have figures or tables. The unit assigned to this Workshop was

unit 5 of Grade 8, "Electricity and magnetism." Items for this unit naturally had a lot of images accompanied. At the tenth Workshop, however, a participant commented on one item that "The figure is not necessary for this item." The writer of that item then revised the item by deleting the figure. After this incident, participants started carefully considering whether a figure is truly necessary for the item or not. On average 21.0% of developed items have figures or tables.

The rate of items with negative phrases in the stem was highest at the fifth Workshop. At the sixth Workshop the members discussed how to avoid negative phrases in the stem. After the discussion, the rate of items with negative phrases decreased at the seventh Workshop. However, some participants insisted on effectiveness of using negative phrases for certain competencies such as listing a number of items. Because of such a view prevailing among the participants, items with negative phrases were not completely eliminated. On average 9.2% of items have negative phrases in the stem.

Developing application and higher level items has been a big challenge from the beginning of the project. As for distinction between knowledge and application level, some examples of application-level items were given by the Japanese Expert. However, its effect is not clear.

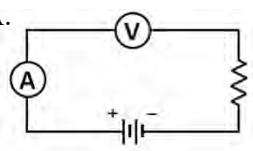
3) Points Emphasized in the Workshops

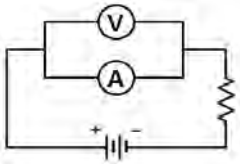
i) An item should be consistent with a competency

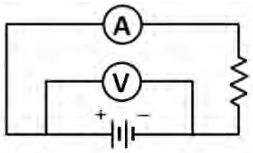
Every item should be consistent with a certain competency. Basically, one item should ask only one thing. However, some participants insisted that in some cases asking more than one thing in one item may be effective. Following is an example:

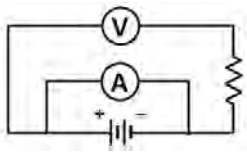
Example 1:

Which of the following circuit diagrams shows the correct connection of an ammeter and voltmeter?

A. 

B. 

C. 

D. 

Key: C （Revised item originally developed at Workshop 9）

Although the competency corresponding with this item is #75 for Grade 8, "Draw circuit diagrams using symbols of an ammeter and voltmeter," this item requires two things: how to connect a voltmeter and how to connect an ammeter. The argument therefore goes that if the item requires how to connect a voltmeter only, it will be difficult to prepare effective four options.

ii) The sentence of stem should be short and correct

The stem should be short, not adding any unnecessary information. The stem should also be grammatically, mathematically and scientifically correct.

Example 2-a:

In which of the following statement order sound travels in increasing speed?

A. Gas – liquid – solid
B. Liquid – solid – gas
C. Liquid – gas – solid

D. Solid – gas – liquid

Key: A （Developed at Workshop 6）

Speed of sound is not increasing, but different media transmit sound at different speed. Therefore this item was revised as follows:

Example 2-b:

Different media transmit sound at different speed. Which one of the following shows the correct arrangement of media in increasing order of their property to transmit sound?

Furthermore the first sentence is not necessary. Only the second sentence is possible.

Example 2-c:

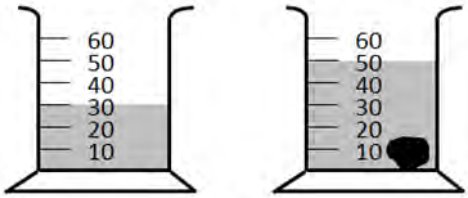
Which one of the following shows the correct arrangement of media in increasing order of their property to transmit sound?

Following is another example:

Example 3-a:

The figure below shows the liquid surface in a measuring cylinder before after a 2 kg stone is gently lowered into it. What is the volume of the stone?

A. 5 cm^3
B. 10 cm^3
C. 15 cm^3
D. 20 cm^3



Key: D （Developed at Workshop 9）

The 2 kg stone is too big to put in a measuring cylinder. It should be realistic like 50 g. Actually the mass of stone is not necessary to solve this item. Correcting the sentence of the stem, this item was revised as follows:

Example 3-b:

The figure below shows the liquid surface in a measuring cylinder before and after a stone is gently lowered into it. What is the volume of the stone?

iii) To make options should be considered well

Options should be plausible except the key. Options should be arranged in logical order and their homogeneity is important.

Example 4-a:

If force is in Newton (N) and N = kg m/sec^2, its dimension is [MLT^{-2}] and if A is in m^2, its dimension is [L^2]. What is the dimension of pressure if its unit is P = F/A.

A. MLT^{-2}
B. $ML^{-1}T^{-2}$
C. kg m/sec^2
D. ML^2T^{-2}

Key: B （Developed at Workshop 4）

Option C is heterogeneous and this item was revised as follows:

Example 4-b:

If the dimension of force is $[ML/T^2]$ and dimension of area is $[L^2]$, what is the dimension of pressure?

A. MLT^{-2}
B. $ML^{-1}T^{-2}$
C. ML^2/T^2
D. ML^2T^{-2}

iv) Using as many figures or tables as possible is preferable

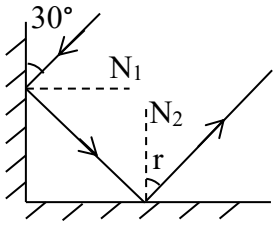
Using figures or tables was emphasized in the Workshops. Two more concrete points were added which should be kept in mind. They were:

- When symbols are used, it should be mentioned clearly what they mean.
- Figures should be drawn correctly.

Following are some examples:

Example 5:

A light ray strikes first mirror A and finally bounces back at mirror B. If the two mirrors are perpendicular with each other, what is the angle r? N_1 and N_2 are normal lines.



A. 15°
B. 30°
C. 60°
D. 120°

Key: B （Developed at Workshop 6）

This item includes symbols such as N_1 and N_2. They are clearly mentioned in the stem. It is good. However, the angle indicated as 30° is not accurate. It seems to be nearly 45°. To avoid students' confusion, the figure should be revised as Fig. 3.2.4.1. The answer of this item is B: 30°. Even if students can solve it correctly, the wrong figure makes students confuse. Even if the correct figure may give hints to students to guess the correct answer without thinking deeply, the figure should be accurate.

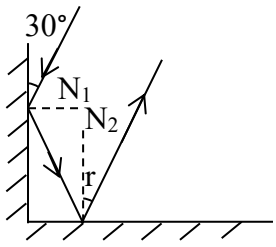


Figure 3.2.4.1

v) Avoid using negative phrases in the stem

As mentioned above, how to avoid using negative phrases in the stem was discussed at the sixth Workshop. Following is an example that uses a negative phrase in the stem.

Example 6:

Which one of the following is **NOT** temperature scale?

A. Celsius
B. Evaporation
C. Fahrenheit
D. Kelvin

Key: B （Developed at Workshop 5）

In general participants agreed to avoid using negative phrases in the stem. However, some participants insisted that negative phrases were useful in some particular cases. They said:

- If you do not use negative phrases, you can ask only one point.
- You can ask several points at the same time by using negative phrases.
- For a certain competency such as "List …," asking with negative phrases is useful.

Due to time limitation, the discussion could not reach a consensus. Although using negative phrases is not completely denied, participants agreed that they try to avoid using negative phrases as much as possible. As summarized in Table 3.2.4.5 above, the rate of items with negative phrasing in the stem decreased at the seventh Workshop. However, such items seem to remain at a certain rate.

vi) A variety of items are useful especially to develop application level items

To develop application level items some points of view were introduced:

- An item which urges students to consider the situation;
- An item which asks the reason; and
- An item which requires students to interpret a graph or a table.

Following is an example of item which is asking the reason:

Example 7:

A girl poured a small amount of water into a can and boiled it at 100 °C. She covered the can with a cork tightly and poured cold water over the can. Then she observed that the can was crushed. Why did it happen? This is because:

A. There was an increase in pressure within the can.
B. There was a decrease in pressure outside the can.
C. There was a decrease in pressure inside the can.
D. There was no change in pressure inside the can.

Key: C （Revised item originally developed at Workshop 4）

To discern between knowledge level and application level is difficult. For discussion, following examples 8 to 10 were presented at the fifth Workshop.

Example 8:

Among the following statements, which one is application of heat transfer by convection?

A. The earth is warmed up by the sun.
B. An egg is fried on a pan.
C. A finger is burned in very hot water.
D. A room is warmed up in every corner by air conditioner.

Key: D （Written for explanation at Workshop 5）

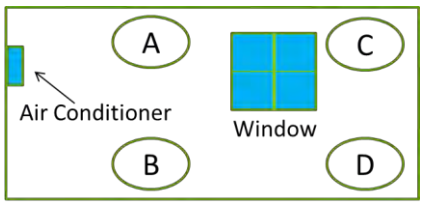
Example 8 is a knowledge-level item because students can answer by using knowledge from the textbook. Grade 8 textbook says, "Air conditioner, chimney and boiling water in a dish use convection."

Examples 9 and 10 were presented as application- and higher-level items for the same competency as example 8. Students can solve these items applying the knowledge of characteristics of warm air and cool air. Therefore examples 9 and 10 are application- and higher-level items.

Example 9:

In a room which area is cooled down faster in the figure below?

A. Upper and near the air conditioner
B. Lower and near the air conditioner
C. Upper and far from the air conditioner
D. Lower and far from the air conditioner



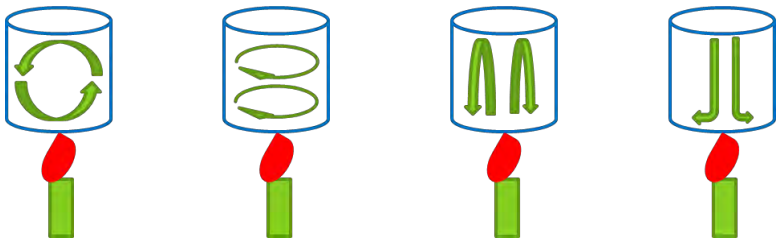
Key: B (Written for explanation at Workshop 5)

When heat is transferred by convection, cool air is going down. If students have the knowledge about the characteristic of cool air and the principle of convection, students can solve this item. Therefore example 9 is an application- and higher-level item.

Example 10:

When you warmed up the water in a beaker, small dusts were observed to move. Choose the figure that shows correct direction of the motion.

A. B. C. D.



Key: C (Written for explanation at Workshop 5)

When water is heated, warmed water is going up. Among the four figures, only figure C describes water going up from the heating point. Students consider it and get the key. This item requires several steps of thinking; therefore example 10 is an application- and higher-level item.

Example 11 was developed by a participant at the fifth Workshop and modified later for the field test.

Example 11:

What is 5 °F in Kelvin?

A. 15 K
B. 258 K
C. 273 K
D. 288 K

Key: B (Revised item originally developed at Workshop 5)

At the sixth Workshop, participants discussed whether this item was knowledge level or application level. Opinion was divided. They were:

- Just recalling the formula and substituting the value; then it is knowledge level.
- Converting units is not just recalling; it may be application level.
- This item needs conversion twice: from Fahrenheit to Celsius and from Celsius to Kelvin. Then it is application level.
- Items which need calculation to solve them are application level.

After the discussion, participants agreed to regard this item as the lowest level of application. Afterward they tried to develop higher-level items than this item.

4) Remaining Issues

Through ten Workshops participants showed progress to develop good items as mentioned above. However, there are some remaining issues.

i) There are problems in the syllabus

Through the project, participants developed items that are consistent with the competencies of the syllabus. However, the syllabus itself has some problems. For example, there is no competency specified for sub-unit 3.3 "Measuring air pressure" in Grade 8. Since there is no competency listed for the sub-unit, participants could not develop items for the sub-unit.

Moreover, some important contents that are mentioned in the textbook are not in the syllabus. For example, the Grade 8 textbook at unit 6 deals with images formed by a pair of plane mirrors with an angle and the formula to calculate the number of images. Questions regarding this phenomenon also appeared in the Primary School Leaving Certificate Examinations. Still the G8 syllabus does not include any competency about this.

Some inconsistent parts among syllabus, textbook and examinations should be modified.

ii) There are mistakes in the textbooks

Workshop participants developed items referring to the textbooks. However, there are some mistakes in the textbooks. This is very serious because in Ethiopia there are not so many reference books readily available and the textbooks are treated as the only authoritative resource books by many educators. Some educators may receive wrong information from the textbooks and may develop wrong items applying their misconceptions. Following are some examples.

In the Grade 8 textbook, at page 118, there is a following summary:

A. Similarity between electromagnet and a bar magnet
1. Both have the magnetic properties.
2. Both have similar magnetic field line patterns
3. Both have North and South poles.
4. Both attract metals.

Item 4 says "Both attract metals." However, magnets do not attract all metals. They attract only some metals such as iron, cobalt and nickel. This sentence is not accurate.

Another example is the following diagram in the Grade 8 textbook, page 126:

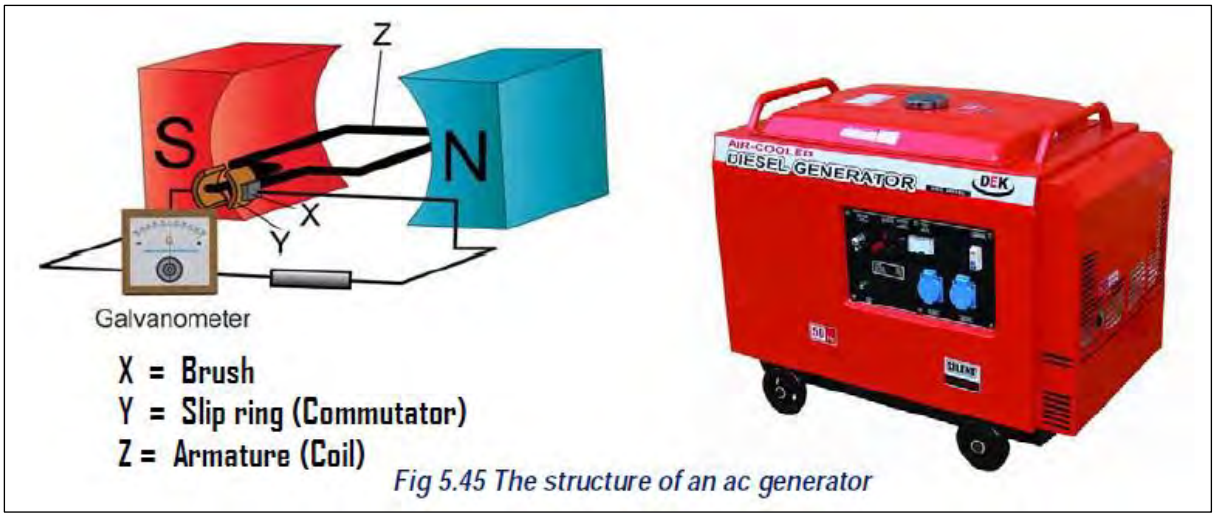


Fig 5.45 The structure of an ac generator

In the figure showing the structure of an AC generator, Y is explained as slip ring (commutator). If Y were a commutator, it should be called split ring not slip ring. As the ring splits in the figure, the generator is not an AC generator but a DC generator.

Such mistakes should be eliminated from the textbooks.

3.2.5 Assessment and Evaluation Working Group

1) Members of the Working Group

A list of all members of Assessment and Evaluation Working Group as of the 10th Workshop is shown in Table 3.2.5.1. Due to personnel reshuffling in REB/CEB, some members have been replaced (Somali) or remain vacant (Addis Ababa and Oromia).

Table 3.2.5.1 Members of the Assessment and Evaluation Working Group (as of July 2017)

	Name	Affiliation
1	Belayneh Teferra Cherinet	MSIC
2	Bekele Geleta	NEAEA
3	Abiy Kefyalew Aboret	NEAEA
4	Ashenafi Tesfaye Bogale	NEAEA
	(Bekalu Yayeh)	Addis Ababa Education Bureau
5	Mohammed Seid Hassen	Afar REB
6	Tesema Muluneh Fentie	Amhara REB
7	Degu Bihonegn Tegegne	Benishangul-Gumuz REB
8	Kasahun Mamo Abagero	Dire Dawa Education Bureau
9	Puot Gatwech Kuon	Gambella REB
10	Salahadin Abdurahman Mohammad	Harari REB
	(Habtamu Dugasa)	Oromia REB
11	Temesgen Gezahegn Tefera	SNNPR REB
12	Seid Abdi Ismail	Somali REB
13	Atikilt Gebremedhin Tesfay	Tigray REB

2) Achievement

From the first to third Workshop, the Assessment and Evaluation Working Group members developed items of their own majoring subject independently from other subject Working Groups. This arrangement was necessitated by NEAEA's concern so as not to leak

information regarding the item bank from the group members to others. After such risks were proved to be absent, the group members in the fourth Workshop started joining subject Working Groups of their own subject to develop items.

Other than item developing, a main activity specific to the group was to learn basic item analysis according to the Classical Test Theory by using MS Excel. From the fifth to ninth Workshop (except eighth), the members received lectures on the theory and exercised to calculate basic indices of item analysis. All the members have mastered how to obtain basic indices. The concrete learning contents were as follows:

Item analysis using MS Excel

Objectives of this activity are:
To obtain values of p and D from a set of test results for analyzing the quality of items; and
To compute coefficients, such as alpha and Item-Test, for examining the reliability and validity of the test.

Though some participants were not familiar with using the personal computer, they gradually acquired the skills to conduct item analysis. Their main tasks were to obtain the indicator of difficulty (p value) and discrimination index (D value). p value stands for the percentage of students who answered the question item correctly, while D value refers to power of the question item to discriminate better achievers from poor achievers. To facilitate the calculation work, a very small size of sample was prepared and given to the participants (10 items tested on 11 students). The members obtained the indices as shown in Table 3.2.5.2. At the end of the activity, the members drew graphs (Figure 3.2.5.1) to see if each question item fulfilled the target index of the project.

Table 3.2.5.2 Indices Obtained from the Sample Data

Indicators of Item Analysis	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10
Number of correct answers	11	3	8	1	4	3	5	2	6	5
Proportion of correct answers (p value)	1.00	0.27	0.73	0.09	0.36	0.27	0.45	0.18	0.55	0.45
Number of upper group students who responded correctly	3	1	1	0	2	1	2	2	3	1
p in upper group	1.00	0.33	0.33	0.00	0.67	0.33	0.67	0.67	1.00	0.33
Number of lower group students who responded correctly	3	0	2	0	2	0	1	0	0	2
p in lower group	1.00	0.00	0.67	0.00	0.67	0.00	0.33	0.00	0.00	0.67
Discrimination index (D value)	0.00	0.33	-0.33	0.00	0.00	0.33	0.33	0.67	1.00	-0.33

Note: Total number of examinees is 11. Upper group consists of 3 best performers (27%) and lower group of 3 poorest performers (27%).

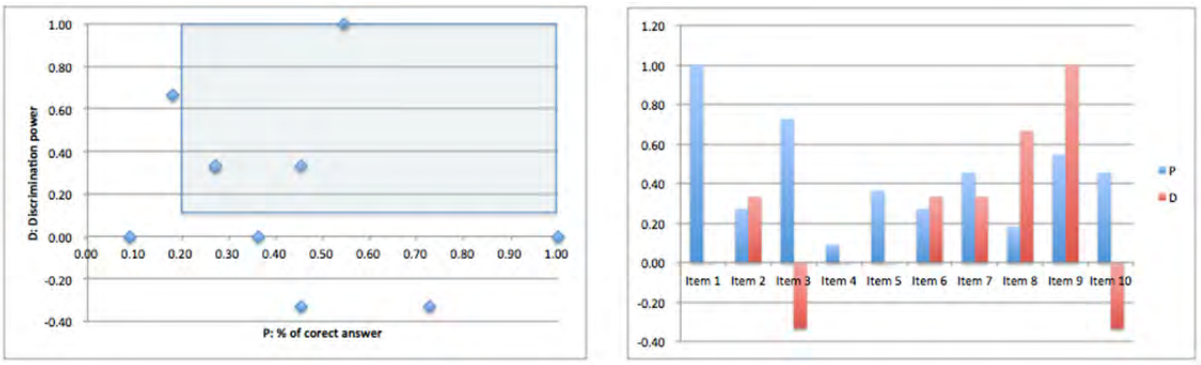


Figure 3.2.5.1 Example of Indices as a Result of Item Analysis Using MS Excel

In addition to item analysis, in the seventh and ninth workshops, the members learned the concept of test analysis by obtaining coefficient alpha (Figure 3.2.5.2), which Cronbach invented in the mid-20th century. The coefficient alpha indicates the level of internal consistency of a test, representing the reliability of the test.

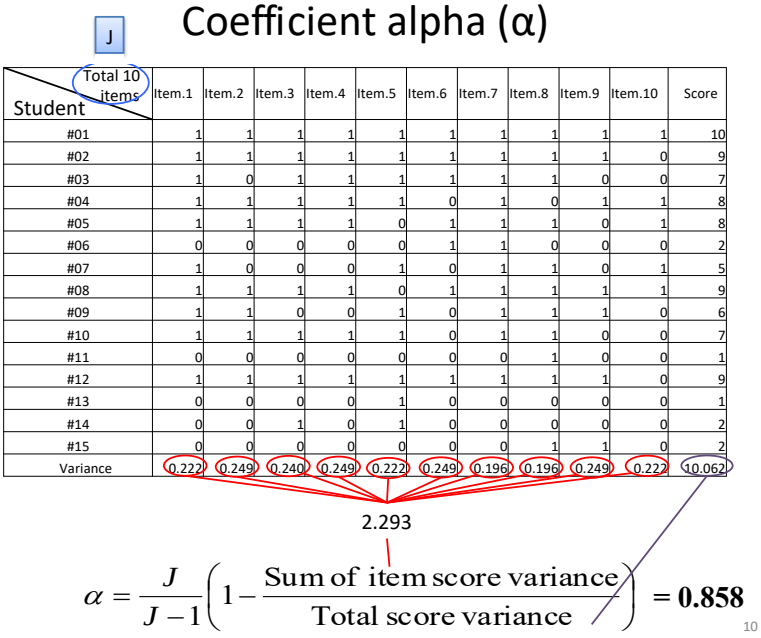


Figure 3.2.5.2 Coefficient Alpha Obtained by MS Excel

Most of the members have achieved the training target of item analysis by the end of the ninth Workshop.

3) Remaining issues

Though the group members have mastered basic item analysis, it is not certain that they will have opportunities in their respective REBs/CEBs to utilize the knowledge and skills they obtained in the Workshops. According to the group members, their main concern currently is to develop question items for the examinations. The task of examining reliability and validity of the test items has not been the central part of their professional work due to the lack of organizational and information system for test development such as cyclic field testing and verification of the items, and capacity for data construction and verification both in hard and soft resources. Outcomes of this project will be fully utilized when the respective regions can afford to build the capacity above and equip their educational assessment system

with the qualified experts who participated in the LAMS project.

3.3 Field Test

3.3.1 Framework of the Field Test

After each Workshop, some items were selected from all the items developed in that Workshop and compiled into test papers to conduct field tests in schools for item analysis. Then, the results of analysis were presented and utilized at the next Workshop to improve the items. For field-testing, Addis Ababa Education Bureau kindly cooperated with LAMS to select and appoint the target primary schools. MSIC and the JICA Expert Team jointly worked to select items, prepare test papers, and administer the tests at schools.

3.3.2 Summary: Field-Tested Items, Schools, Students and Dates

The field tests were conducted seven times in total. Summaries of each field test are shown in Table 3.3.1 to Table 3.3.7.

Table 3.3.1 Field Tests after the First Workshop

Working Group	No. of Items	Time Allocated	No. of Students	Grade	School	Date
Mathematics	16	30 min	35	8	Addis Birhan PS	Feb 23, 2015
Biology	17	20 min	40	8	Addis Birhan PS	Feb 23, 2015
Chemistry	16	20 min	30	8	Addis Birhan PS	Feb 23, 2015
Physics	14	30 min	34	8	Addis Birhan PS	Feb 23, 2015
Assessment & Evaluation	11	20 min	55	8	Jerusalem PS	March 17, 2015
Total	**74**	--	**194**	--	--	--

Note: PS is Primary School.

Table 3.3.2 Field Tests after the Second Workshop

Working Group	Test Type	No. of Items	Time Allocated	No. of Students	Grade	School	Date
Mathematics	A	30	40 min	36	8	Tsehay Chora PS	May 11, 2015
	B	30	40 min	42	8	Atse Libne Dingil PS	May 12, 2015
Biology	A	30	30 min	36	8	Tsehay Chora PS	May 11, 2015
	B	30	30 min	33	8	Atse Libne Dingil PS	May 12, 2015
Chemistry	A	30	30 min	36	7	Tsehay Chora PS	May 11, 2015
	B	30	30 min	47	7	Atse Libne Dingil PS	May 12, 2015
Physics	A	30	40 min	46	8	Tsehay Chora PS	May 11, 2015
	B	30	40 min	39	8	Atse Libne Dingil PS	May 12, 2015
Assessment & Evaluation	A	30	40 min	43	8	Tsehay Chora PS	May 11, 2015
	A	30	40 min	38	8	Atse Libne Dingil PS	May 12, 2015
Total	--	--	--	**396**	--	--	--

Table 3.3.3 Field Tests after the Third Workshop

Working Group	Test Type	No. of Items	Time Allocated	No. of Students	Grade	School	Date
Mathematics	A	30	40 min	42	8	Yeka Terara PS	Oct 5, 2015
	B	30	40 min	35	8	Bole Addis PS	Oct 2, 2015
	C	30	40 min	40	8	Menelik I PS	Oct 6, 2015
	D	30	40 min	41	8	Meskerem PS	Oct 6, 2015
Biology	A	30	30 min	46	8	Yeka Terara PS	Oct 5, 2015
	B	30	30 min	33	8	Bole Addis PS	Oct 2, 2015
	C	30	30 min	35	9	Bethlehem SS	Oct 1, 2015
	D	30	30 min	41	9	Bethlehem SS	Oct 1, 2015
Chemistry	A	30	40 min	49	8	Yeka Terara PS	Oct 5, 2015

	B	30	40 min	32	8	Bole Addis PS	Oct 2, 2015
	C	30	40 min	50	8	Belay Zeleke PS	Oct 7, 2015
	D	30	40 min	52	8	Belay Zeleke PS	Oct 7, 2015
Physics	A	30	40 min	49	8	Belay Zeleke PS	Oct 7, 2015
	B	30	40 min	51	8	Belay Zeleke PS	Oct 7, 2015
	C	30	40 min	43	8	Meskerem PS	Oct 6, 2015
	D	30	40 min	35	9	Entoto Amba SS	Sept 30, 2015
Assessment & Evaluation	A	30	40 min	37	8	Menelik I PS	Oct 6, 2015
	B	30	40 min	42	8	Meskerem PS	Oct 6, 2015
Total	--	**540**	--	**753**	--	--	--

Note: SS is Secondary School.

Table 3.3.4 Field Tests after the Fourth Workshop

Working Group	Test Type	No. of Items	Time Allocated	No. of Students	Grade	School	Date
Mathematics	A	30	45 min	32	8	Atse Nakutoleab PS	Jan 12, 2016
	B	30	45 min	29	8	Atse Nakutoleab PS	Jan 12, 2016
	C	30	45 min	36	8	Atse Naod PS	Jan 13, 2016
	D	30	45 min	40	8	Atse Naod PS	Jan 13, 2016
Biology	A	30	30 min	43	8	KokebeTsibha PS	Jan 6, 2016
	B	30	30 min	45	8	KokebeTsibha PS	Jan 6, 2016
	C	30	30 min	40	8	Bihere Ethiopia PS	Jan 13, 2016
	D	30	30 min	39	8	Bihere Ethiopia PS	Jan 13, 2016
Chemistry	A	30	30 min	43	8	KokebeTsibha PS	Jan 6, 2016
	B	30	30 min	43	8	KokebeTsibha PS	Jan 6, 2016
	C	30	30 min	37	8	Tigil Lenetsanet PS	Jan 11, 2016
	D	30	30 min	38	8	Tigil Lenetsanet PS	Jan 11, 2016
Physics	A	30	40 min	33	8	Addis Berhan PS	Jan 11, 2016
	B	30	40 min	33	8	Addis Berhan PS	Jan 11, 2016
	C	30	40 min	41	8	Tigil Lenetsanet PS	Jan 11, 2016
	D	30	40 min	40	8	Atse Naod PS	Jan 13, 2016
Total	--	**480**	--	**612**	--	--	--

Table 3.3.5 Field Tests after the Fifth Workshop

Working Group	Test Type	No. of Items	Time Allocated	No. of Students	Grade	School	Date
Mathematics	A	20	40 min	44	8	Bole Community PS	Apr 19, 2016
				23	8	Ourael PS	Apr 19, 2016
	B	20	40 min	45	8	Atse Theodros PS	Apr 20, 2016
				42	8	Bole Community PS	Apr 19, 2016
	C	20	40 min	45	8	Atse Theodros PS	Apr 20, 2016
				38	8	Dejach Geneme PS	Apr 21, 2016
	D	20	40 min	45	8	Abiyot PS	Apr 21, 2016
				48	8	Eshet PS	Apr 20, 2016
	E	20	40 min	36	8	Bole Gerji PS	Apr 25, 2016
				32	8	Major General Hayelom Araya PS	Apr 22, 2016
	F	20	40 min	31	8	Tinbite Ermiyas PS	Apr 22, 2016
				42	8	Misrak Dil PS	Apr 25, 2016
Biology	A	30	30 min	47	8	Bole Community PS	Apr 19, 2016
				43	8	Eshet PS	Apr 20, 2016
	B	30	30 min	50	8	Bole Gerji PS	Apr 25, 2016
				39	8	Dejach Geneme PS	Apr 21, 2016
	C	30	30 min	49	8	Abiyot PS	Apr 21, 2016
				45	8	Tesfa Kokeb PS	Apr 26, 2016
	D	30	30 min	33	8	Ras Abebe Aregay PS	Apr 22, 2016
				33	8	Tinbite Ermiyas PS	Apr 22, 2016

Chemistry	A	30	30 min	27	8	Ras Abebe Aregay PS	Apr 22, 2016
				37	8	Tinbite Ermiyas PS	Apr 22, 2016
	B	30	30 min	42	8	Bole Community PS	Apr 19, 2016
				45	8	Tesfa Kokeb PS	Apr 26, 2016
	C	30	30 min	46	8	Eshet PS	Apr 20, 2016
				49	8	Bole Gerji PS	Apr 25, 2016
	D	30	30 min	47	8	Abiyot PS	Apr 21, 2016
				49	8	Bole Gerji PS	Apr 25, 2016
Physics	A	30	40 min	46	8	Ourael PS	Apr 19, 2016
				45	8	Tesfa Kokeb PS	Apr 26, 2016
	B	30	40 min	43	8	Eshet PS	Apr 20, 2016
				47	8	Dejach Geneme PS	Apr 21, 2016
	C	30	40 min	39	8	Misrak Dil PS	Apr 25, 2016
				34	8	Major General Hayelom Araya PS	Apr 22, 2016
	D	30	40 min	51	8	Bole Gerji PS	Apr 25, 2016
				44	8	Bherawi PS	Apr 25, 2016
Total	--	**480**	--	**1,501**	--	--	--

Table 3.3.6 Field Tests after the Sixth Workshop

Working Group	Test Type	No. of Items	Time Allocated	No. of Students	Grade	School	Date
Mathematics	A	20	40 min	33	9	Ayer Amba SS	Oct 6, 2016
				44	9	Ayer Amba SS	Oct 6, 2016
	B	20	40 min	29	9	Dr. Haddis Alemayehu SS	Oct 7, 2016
				37	9	Dr. Haddis Alemayehu SS	Oct 7, 2016
	C	20	40 min	30	9	Dr. Haddis Alemayehu SS	Oct 7, 2016
				26	9	Dr. Haddis Alemayehu SS	Oct 7, 2016
	D	20	40 min	33	9	Dr. Haddis Alemayehu SS	Oct 7, 2016
				30	9	Dr. Haddis Alemayehu SS	Oct 7, 2016
	E	20	40 min	39	9	Dr. Haddis Alemayehu SS	Oct 7, 2016
				34	9	Dr. Haddis Alemayehu SS	Oct 7, 2016
	F	20	40 min	28	9	Dejach Balch Abanefso	Oct 5, 2016
				23	9	Dejach Balch Abanefso	Oct 5, 2016
Biology	A	30	30 min	43	8	Woyra PS	Oct 10, 2016
				50	8	Woyra PS	Oct 10, 2016
	B	30	30 min	49	8	Woyra PS	Oct 10, 2016
				46	8	Woyra PS	Oct 10, 2016
	C	30	30 min	28	9	Dejach Balch Abanefso	Oct 5, 2016
				19	9	Dejach Balch Abanefso	Oct 5, 2016
	D	30	30 min	21	9	Dejach Balch Abanefso	Oct 5, 2016
				26	9	Dejach Balch Abanefso	Oct 5, 2016
Chemistry	A	30	40 min	38	9	Ayer Amba SS	Oct 6, 2016
				42	9	Ayer Amba SS	Oct 6, 2016
	B	30	40 min	42	9	Ayer Amba SS	Oct 6, 2016
				38	9	Ayer Amba SS	Oct 6, 2016
	C	30	40 min	38	9	Ayer Amba SS	Oct 6, 2016
				37	9	Ayer Amba SS	Oct 6, 2016
	D	30	40 min	32	9	Dejach Balch Abanefso	Oct 5, 2016
				35	9	Dejach Balch Abanefso	Oct 5, 2016
Physics	A	30	40 min	50	8	Yemane Birhan PS	Oct 11, 2016
				49	8	Yemane Birhan PS	Oct 11, 2016
	B	30	40 min	50	8	Yemane Birhan PS	Oct 11, 2016
				49	8	Yemane Birhan PS	Oct 11, 2016
	C	30	40 min	45	8	Sibiste Negassie PS	Oct 12, 2016
				38	8	Sibiste Negassie PS	Oct 12, 2016

	D	30	40 min	29	9	Dejach Balch Abanefso	Oct 5, 2016
				26	9	Dejach Balch Abanefso	Oct 5, 2016
Total	--	**480**	--	**1,306**	--	--	--

Table 3.3.7 Field Tests after the Seventh Workshop

Working Group	Test Type	No. of Items	Time Allocated	No. of Students	Grade	School	Date
Mathematics	A	20	40 min	50	8	Nigat kokeb PS	Dec 29, 2016
				42	8	Netsanet Chora PS	Dec 29, 2016
	B	20	40 min	50	8	Nigat kokeb PS	Dec 29, 2016
				33	8	Netsanet Chora PS	Dec 29, 2016
	C	20	40 min	39	8	Karamara PS	Dec 28, 2016
				38	8	Netsanet Chora PS	Dec 29, 2016
	D	20	40 min	48	8	Karamara PS	Dec 28, 2016
				36	8	Karamara PS	Dec 28, 2016
	E	20	40 min	50	9	Kara Alo SS	Dec 26, 2016
				48	9	Kara Alo SS	Dec 26, 2016
	F	20	40 min	49	9	Kara Alo SS	Dec 26, 2016
				50	9	Kara Alo SS	Dec 26, 2016
Biology	A	30	30 min	49	8	Kaliti PS	Dec 27, 2016
				50	8	Kaliti PS	Dec 27, 2016
	B	30	30 min	42	8	Kaliti PS	Dec 27, 2016
				39	8	Karamara PS	Dec 28, 2016
	C	30	30 min	52	8	Kaliti PS	Dec 27, 2016
				32	8	Karamara PS	Dec 28, 2016
	D	30	30 min	47	8	Kaliti PS	Dec 27, 2016
				44	8	Karamara PS	Dec 28, 2016
Chemistry	A	30	30 min	49	9	Beshale SS	Dec 26, 2016
				49	9	Beshale SS	Dec 26, 2016
	B	30	30 min	48	9	Beshale SS	Dec 26, 2016
				49	9	Beshale SS	Dec 26, 2016
	C	30	30 min	50	9	Kara Alo SS	Dec 26, 2016
				50	9	Kara Alo SS	Dec 26, 2016
	D	30	30 min	47	9	Kara Alo SS	Dec 26, 2016
				48	9	Kara Alo SS	Dec 26, 2016
Physics	A	30	40 min	42	9	Kaliti SS	Dec 27, 2016
				49	9	Kaliti SS	Dec 27, 2016
	B	30	40 min	44	9	Kaliti SS	Dec 27, 2016
				47	9	Kaliti SS	Dec 27, 2016
	C	30	40 min	46	9	Kaliti SS	Dec 27, 2016
				49	9	Kaliti SS	Dec 27, 2016
	D	30	40 min	51	9	Kara Alo SS	Dec 26, 2016
				48	9	Kara Alo SS	Dec 26, 2016
Total	--	**480**	--	**1,654**	--	--	--

3.4 Item Selection Workshops

3.4.1 Framework of the Item Selection Workshop

Under LAMS, two kinds of item selection are necessitated: one is selection of items to be stored in the Item Pools; the other is selection of items to be field-tested.

Originally, item selection for the Item Pools was conducted as part of the Workshop activity with all Working Group members taking part. In the first trial at the second Workshop, however, it turned out that this way was ineffective taking by far longer time than anticipated. Given this result, LAMS changed its approach to the item selection for the Item Pools in two

ways: 1) only a few members will select the items; and 2) a special Workshop will be organized separately for this purpose.

Item selection for the field test had its own problems. MSIC Experts have been assigned to this task (as part of their training) but as the number of items developed at the Workshop drastically increased, it became clear that they need more time to do this job. Since group work is a must for the item selection, the only way to do it is to organize a separate Workshop to synchronize and secure the Experts' working time. The Item Selection Workshop was thus newly introduced as Year 2 began. Its framework is as follows:

Item Selection for the Item Pools

This is done by the Item Selection Committee whose members are selected from the Workshop participants who belong to the Ministry of Education or NEAEA or MSIC.

Table 3.4.1 Members of the Item Selection Committee (as of July 2017)

Chairperson	Mr. Belayneh (MSIC)			
Mathematics	Mr. Daniel (MSIC)	Mr. Fikremariam (NEAEA)	Mr. Assefa (CDID)	Mr. Yibeltal (TELDD)
Biology	Mr. Yusuf (MSIC)	Mr. Minas (NEAEA)	Mr. Solomon (CDID)	Mr. Abebe (TELDD)
Chemistry	Mr. Gebre (MSIC)	Mr. Worku (NEAEA)	Mr. Nega (CDID)	Mr. Shewangizaw (TELDD)
Physics	Mr. Nega (MSIC)	Mr. Getaneh (NEAEA)	Mr. Yosef (CDID)	Mr. Dessie (MSIC)

Criteria to Select Items for the Item Pools

1) If the item has no serious defects, the item should be accepted for the Item Pool.
2) If the item has minor defects (such as misspelling, need for supplemental words), the item should be corrected by the item selector and should be accepted.
3) The item should be consistent with the intended competency for the relevant grade.

Item Selection for the Field Test

Thirteen MSIC Experts who are not the members of the Item Selection Committee select items for the field test.

Table 3.4.2 MSIC Experts to Select Items for the Field Test (as of January 2017)

Mathematics	Mr. Tesfu (MSIC)	Mr. Ermias (MSIC)	Mr. Bimerew (MSIC)	--
Biology	Ms. Etenesh (MSIC)	Mr. Mequanint (MSIC)	Ms. Tigist (MSIC)	Mr. Desalegn (MSIC)
Chemistry	Mr. Nesibu (MSIC)	Mr. Zelekew (MSIC)	Mr. Yidnekachew (MSIC)	--
Physics	Mr. Hailu (MSIC)	Mr. Dawit (MSIC)	Mr. Getachew (MSIC)	--

Criteria to Select Items for the Field Test

1) Items should be consistent with a given competency in the syllabus.
2) Items should be mathematically, scientifically and grammatically sound.
3) Items should have only one key answer.
4) Each Subject Group may set its own criteria in addition to the general criteria above

when necessary and/or appropriate.

For Item Pool selection, to ensure objectivity, the following procedure was employed: at least two assessors (judges) review the same item and make judgment. If their judgment differs, as the rule goes, the second assessor's judgment has priority over the first assessor's. They alternate their positions from batch to batch. By contrast, for Field Test item selection, each subject group selected items collectively.

3.4.2 Summary: Venue and Attendance

Throughout the LAMS project, a total of six Item Selection Workshops were held. Their venues and the number of attendants are summarized in Table 3.4.3.

Table 3.4.3 Venue and the Number of Attendants

Number	Dates	Venue	Attendants
1	Dec 14~16, 2015	Rift Valley Hotel, Adama	28
2	March 28~31, 2016	Rift Valley Hotel, Adama	21
3	July 13~16, 2016	Rift Valley Hotel, Adama	20
4	Nov 15~18, 2016	Ras Amba Hotel, Addis Ababa	13
5	April 10~12, 2017	Rift Valley Hotel, Adama	14
6	July 3~5, 2017	Rift Valley Hotel, Adama	22

3.4.3 Summary: Programs

Tables 3.4.4 to 3.4.9 show programs for the Item Selection Workshops.

Table 3.4.4 Program: First Item Selection Workshop

Time	2015					
	Dec 14 (Mon)		Dec 15 (Tue)		Dec 16 (Wed)	
8:30-10:00	***Opening*** - Opening remarks - Preparations for the selection (criteria, numbers, procedure) - Q and A		***Selection Committee*** - Selection 4	***Field Test Selection*** - Selection 4	***Selection Committee*** - Selection 8	***Field Test Selection*** - Selection 8
Tea Break						
10:30-12:00	***Selection Committee*** - Selection 1	***Field Test Selection*** - Selection 1	***Selection Committee*** - Selection 5	***Field Test Selection*** - Selection 5	***Selection Committee*** - Selection 9	***Field Test Selection*** - Selection 9
Lunch						
13:00-14:30	***Selection Committee*** - Selection 2	***Field Test Selection*** - Selection 2	***Selection Committee*** - Selection 6	***Field Test Selection*** - Selection 6	***Closing*** - Summary and review - Closing remarks	
Tea Break						
15:00-16:30	***Selection Committee*** - Selection 3	***Field Test Selection*** - Selection 3	***Selection Committee*** - Selection 7	***Field Test Selection*** - Selection 7		

Table 3.4.5 Program: Second Item Selection Workshop

Time	2016					
	Mar 28 (Mon)	Mar 29 (Tue)		Mar 30 (Wed)		Mar 31 (Thu)
8:30 - 10:00	***Opening***	***Selection Committee*** - Selection 4	***Field Test Selection*** - Selection 4	***Selection Committee*** - Selection 8	***Field Test Selection*** - Selection 8	***Field Test Selection*** - Selection 12

Tea Break							
10:30-12:00	***Selection Committee*** - Selection 1	***Field Test Selection*** - Selection 1	***Selection Committee*** - Selection 5	***Field Test Selection*** - Selection 5	***Selection Committee*** - Selection 9	***Field Test Selection*** - Selection 9	***Field Test Selection*** - Selection 13
Lunch							
13:00-14:30	***Selection Committee*** - Selection 2	***Field Test Selection*** - Selection 2	***Selection Committee*** - Selection 6	***Field Test Selection*** - Selection 6	***Closing*** - Summary and review - Closing remarks	***Field Test Selection*** - Selection 10	***Closing*** - Summary and review - Closing remarks
Tea Break							
15:00-16:30	***Selection Committee*** - Selection 3	***Field Test Selection*** - Selection 3	***Selection Committee*** - Selection 7	***Field Test Selection*** - Selection 7		***Field Test Selection*** - Selection 11	

Table 3.4.6 Program: Third Item Selection Workshop

Time	2016						
	July 13 (Wed)		**July 14 (Thu)**		**July 15 (Fri)**		**July 16 (Sat)**
8:30-10:00	***Opening***		***Selection Committee*** - Selection 3	***Field Test Selection*** - Selection 3	***Selection Committee*** - Selection 7	***Field Test Selection*** - Selection 7	***Field Test Selection*** - Selection 11
Tea Break							
10:30-12:00	***Special Lecture*** - A practical example of item analysis and test editing Hidetoki Ishii (LAMS)		***Selection Committee*** - Selection 4	***Field Test Selection*** - Selection 4	***Selection Committee*** - Selection 8	***Field Test Selection*** - Selection 8	***Field Test Selection*** - Selection 12
Lunch							
13:00-14:30	***Selection Committee*** - Selection 1	***Field Test Selection*** - Selection 1	***Selection Committee*** - Selection 5	***Field Test Selection*** - Selection 5	***Closing*** - Summary and review - Closing remarks	***Field Test Selection*** - Selection 9	***Closing*** - Summary and review - Closing remarks
Tea Break							
15:00-16:30	***Selection Committee*** - Selection 2	***Field Test Selection*** - Selection 2	***Selection Committee*** - Selection 6	***Field Test Selection*** - Selection 6		***Field Test Selection*** - Selection 10	

Table 3.4.7 Program: Fourth Item Selection Workshop

Time	2016						
	Nov 15 (Tue)		**Nov 16 (Wed)**		**Nov 17 (Thu)**		**Nov 18 (Fri)**
9:00-10:30	***Opening***		***Selection Committee*** - Selection 4	***Field Test Selection*** - Selection 4	***Selection Committee*** - Selection 8	***Field Test Selection*** - Selection 8	***Field Test Selection*** - Selection 12
Tea Break							
11:00-12:30	***Selection Committee*** - Selection 1	***Field Test Selection*** - Selection 1	***Selection Committee*** - Selection 5	***Field Test Selection*** - Selection 5	***Selection Committee*** - Selection 9	***Field Test Selection*** - Selection 9	***Closing*** - Summary and review - Closing remarks
Lunch							

13:30-15:00	***Selection Committee*** - Selection 2	***Field Test Selection*** - Selection 2	***Selection Committee*** - Selection 6	***Field Test Selection*** - Selection 6	***Closing*** - Summary and review - Closing remarks	***Field Test Selection*** - Selection 10	
Tea Break							
15:30-17:00	***Selection Committee*** - Selection 3	***Field Test Selection*** - Selection 3	***Selection Committee*** - Selection 7	***Field Test Selection*** - Selection 7		***Field Test Selection*** - Selection 11	

Table 3.4.8 Program: Fifth Item Selection Workshop

Time	2017		
	April 10 (Mon)	**April 11 (Tue)**	**April 12 (Wed)**
9:00-10:30	***Opening***	***Selection Committee*** - Selection 4	***Selection Committee*** - Selection 8
Tea Break			
11:00-12:30	***Selection Committee*** - Selection 1	***Selection Committee*** - Selection 5	***Closing*** - Review of the results - Closing remarks
Lunch			
13:30-15:00	***Selection Committee*** - Selection 2	***Selection Committee*** - Selection 6	
Tea Break			
15:30-17:00	***Selection Committee*** - Selection 3	***Selection Committee*** - Selection 7	

Table 3.4.9 Program: Sixth Item Selection Workshop

Time	2017		
	July 3 (Mon)	**July 4 (Tue)**	**July 5 (Wed)**
8:30-10:00	***Opening***	***Selection Committee*** - Selection 4	***Selection Committee*** - Selection 8
Tea Break			
10:30-12:00	***Selection Committee*** - Selection 1	***Selection Committee*** - Selection 5	***Closing*** - Summary and review - Closing remarks
Lunch			
13:00-14:30	***Selection Committee*** - Selection 2	***Selection Committee*** - Selection 6	
Tea Break			
15:00-16:30	***Selection Committee*** - Selection 3	***Selection Committee*** - Selection 7	

3.4.4 Summary: Selected Items

Table 3.4.10 summarizes the number of Grade-7 and -8 items selected for the Item Pools. Items are organized according to the Workshop in which they were developed.

Table 3.4.10 Items Selected for the Item Pools: Grades 7 and 8

Mathematics							
Items developed in	**Reviewed Items Total**	Items selected without modification	Items selected with modification	**Selected Items Total**	**Rejected items Total**	% of selection	% of rejection
Workshop 1	**131**	84	34	**118**	**13**	90.1	9.9
Workshop 2	**276**	215	43	**258**	**18**	93.5	6.5
Workshop 3	**360**	184	122	**306**	**54**	85.0	15.0
Workshop 4	**419**	265	137	**402**	**17**	95.9	4.1

Workshop 5	**508**	297	185	**482**	**26**	94.9	5.1
Workshop 6	**458**	288	152	**440**	**18**	96.1	3.9
Workshop 7	**301**	196	88	**284**	**17**	94.4	5.6
Workshop 8	**166**	112	44	**156**	**10**	94.0	6.0
Workshop 9	**0**	0	0	**0**	**0**	-	-
Workshop 10	**0**	0	0	**0**	**0**	-	-
Total	**2,619**	1,641	805	**2,446**	**173**	93.4	6.6

Biology							
Items developed in	**Reviewed Items Total**	Items selected without modification	Items selected with modification	**Selected Items Total**	**Rejected items Total**	% of selection	% of rejection
Workshop 1	**112**	66	22	**88**	**24**	78.6	21.4
Workshop 2	**198**	114	54	**168**	**30**	84.8	15.2
Workshop 3	**304**	113	181	**294**	**10**	96.7	3.3
Workshop 4	**458**	267	179	**446**	**12**	97.4	2.6
Workshop 5	**381**	260	50	**310**	**71**	81.4	18.6
Workshop 6	**381**	273	40	**313**	**68**	82.2	17.8
Workshop 7	**247**	52	134	**186**	**61**	75.3	24.7
Workshop 8	**146**	42	87	**129**	**17**	88.4	11.6
Workshop 9	**197**	68	101	**169**	**28**	85.8	14.2
Workshop 10	**0**	0	0	**0**	**0**	-	-
Total	**2,424**	1,255	848	**2,103**	**321**	86.8	13.2

Chemistry							
Items developed in	**Reviewed Items Total**	Items selected without modification	Items selected with modification	**Selected Items Total**	**Rejected items Total**	% of selection	% of rejection
Workshop 1	**54**	17	30	**47**	7	87.0	13.0
Workshop 2	**188**	91	89	**180**	8	95.7	4.3
Workshop 3	**322**	151	135	**286**	36	88.8	11.2
Workshop 4	**387**	164	175	**339**	48	87.6	12.4
Workshop 5	**358**	76	246	**322**	36	89.9	10.1
Workshop 6	**308**	88	181	**269**	39	87.3	12.7
Workshop 7	**168**	83	79	**162**	6	96.4	3.6
Workshop 8	**176**	68	95	**163**	**13**	92.6	7.4
Workshop 9	**223**	41	145	**186**	**37**	83.4	16.6
Workshop 10	**77**	18	56	**74**	**3**	96.1	3.9
Total	**2,261**	797	1,231	**2,028**	**233**	89.7	10.3

Physics							
Items developed in	**Reviewed Items Total**	Items selected without modification	Items selected with modification	**Selected Items Total**	**Rejected items Total**	% of selection	% of rejection
Workshop 1	**117**	95	4	**99**	**18**	84.6	15.4
Workshop 2	**190**	150	18	**168**	**22**	88.4	11.6
Workshop 3	**317**	286	19	**305**	**12**	96.2	3.8
Workshop 4	**347**	288	44	**332**	**15**	95.7	4.3
Workshop 5	**379**	217	142	**359**	**20**	94.7	5.3

Workshop 6	**342**	302	14	**316**	**26**	92.4	7.6
Workshop 7	**192**	41	125	**166**	**26**	86.5	13.5
Workshop 8	**117**	22	71	**93**	**24**	79.5	20.5
Workshop 9	**224**	57	149	**206**	**18**	92.0	8.0
Workshop 10	**22**	22	0	**22**	**0**	100.0	0.0
Total	**2,247**	1,480	586	**2,066**	**181**	91.9	8.1

All Subjects							
Items developed in	**Reviewed Items Total**	Items selected without modification	Items selected with modification	**Selected Items Total**	**Rejected items Total**	% of selection	% of rejection
Workshop 1	**414**	262	90	**352**	62	85.0	15.0
Workshop 2	**852**	570	204	**774**	78	90.8	9.2
Workshop 3	**1,303**	734	457	**1,191**	112	91.4	8.6
Workshop 4	**1,611**	984	535	**1,519**	92	94.3	5.7
Workshop 5	**1,626**	850	623	**1,473**	153	90.6	9.4
Workshop 6	**1,489**	951	387	**1,338**	151	89.9	10.1
Workshop 7	**908**	372	426	**798**	110	87.9	12.1
Workshop 8	**605**	244	297	**541**	**64**	89.4	10.6
Workshop 9	**644**	166	395	**561**	**83**	87.1	12.9
Workshop 10	**99**	40	56	**96**	**3**	97.0	3.0
Total	**9,551**	5,173	3,470	**8,643**	**908**	90.5	9.5

Table 3.4.11 summarizes the results of item selection by subject. Through the six Item Selection Workshops, they reviewed 9,551 items and finally selected 8,643 items, rejecting 908 items.[8]

Table 3.4.11 Summary: Question Items Selected for the Item Pools (Grades 7 and 8)

Working Group	Reviewed Total	Selected Total	Rejected Total
Mathematics	2,619	2,446	173
Biology	2,424	2,103	321
Chemistry	2,261	2,028	233
Physics	2,247	2,066	181
Assessment & Evaluation	--	--	--
Total	**9,551**	**8,643**	**908**

3.5 Item Pools

3.5.1 Framework of the Item Pools

Item pools for four subjects and two grades represent the principal output of LAMS. One of the main concepts of LAMS item pools is that it will be open to the public. In other words, anyone who is interested in the items should be able to access the item pools.

As agreed by stakeholders of LAMS, MSIC will be in charge of owning and managing the item pools since LAMS item pools cover only Mathematics and three Science subjects. Besides, it seems reasonable to separate the item pools from the item banks, which are managed by NEAEA and REBs with strict confidentiality.

One constraint with LAMS, however, is that "item writing by the participants" and "training

[8] The discrepancy between the total number developed at the Workshops (9,520) (see Table 3.1.17) and the total number reviewed at the Item Selection Workshops (9,551) is due mainly to the "homework" items submitted at later Workshops. Some of them were not properly counted in.

of them" went in parallel from the very beginning. With the concrete targets given, LAMS could not wait for the item writers to become skilled item writers. As a result, it is inevitable that the item pools should contain some "not so perfect" items. Therefore, it is expected that MSIC and other counterpart agencies will improve the item pools by continuously replacing sub-standard items with better ones.

Maintaining the Item Pools is also a very crucial task because any item pool will lose its value very quickly if it is not well maintained by continuously adding better items and enlarging its size. Therefore, it is recommended that the Item Pools be improved and enlarged on a regular basis. Given that MSIC will offer INSET training on educational assessment after LAMS, the following is suggested as a possible procedure. The training will invite the participating teachers to develop items on their own. Then MSIC will review them and select good items to add to the Item Pools. In this way, the regular maintenance could be realized.

3.5.2 Construction of the Item Pools

After seeking an appropriate software and a way of constructing the Item Pools, the JICA Expert Team decided to utilize Microsoft Office Excel and PDF since both of them are commonly installed into the majority of computers and a large number of people can use it to some extent. Therefore, those who maintain Item Pools can easily add, revise and delete items with Excel while items released to the public can be readily referred to by anyone through PDF files converted from Excel files. Besides, compared with specialized software, Excel and PDF are less burdensome in terms of maintenance cost, such as license fee. Manageability and sustainability are vital factors to make this kind of system active for a long time.

3.5.3 Publication of the Item Pools

Following two measures are currently considered as the distribution plan.

1) Item Pools will be uploaded on MoE's website in PDF files so that anyone can download them. It is expected that MoE will announce availability of Item Pools to the general public.

2) Item Pools will also be copied on DVDs and distributed to all Woredas. Woreda Educational Offices are expected to disseminate them to schools and teachers in their areas.

3.6 Workbooks

3.6.1 Framework of the Workbook Development

CDID is mainly responsible for developing subject-wise Workbooks for Grades 7 and 8, based on the good question items developed by the respective Working Groups [Output 4]. CDID, MSIC and the JICA Expert Team agreed in July 2015 that:

1) LAMS adopts the so-called "Medium" version of concept, which combines explanation and exercise on one sub-unit in a two-page spread;

2) LAMS will start developing the Workbooks simultaneously for Grade 7 and Grade 8; and

3) LAMS will involve Working Group members, particularly REB representatives, to develop the Workbooks as part of Workshop activity.

In the third Workshop, all participants agreed to work on the development of the Workbooks as part of their activity from the fourth Workshop on. The JICA Expert Team accordingly

lengthened the duration of the Workshop from five to six days to accommodate this additional task.

The table of contents of each subject and grade was thoroughly discussed and adopted in the fourth Workshop. As a principle, the Workbooks should cover all the units specified in the curriculum. However, to make them as slim as possible, the units were slightly reorganized as needed according to their importance and difficulty. Authors were then assigned to specific spreads.

The page format was subsequently discussed and adopted in the fifth Workshop. The format was necessitated to give the Workbooks a consistent look within a volume and across the subjects particularly when a number of authors work on the same volume simultaneously.

3.6.2 Table of Contents and Assignment

In the fourth Workshop, participants elaborated the table of contents for each subject and grade. Authors were then assigned among themselves. The results are summarized in Appendix 8.

3.6.3 Verification of the Workbooks

As the Workbooks near the completion, it was necessary to conduct a trial of them with students and teachers to verify their appropriateness and usefulness on the one hand and, on the other, to gain hints on how to improve them. A verification survey was thus designed and implemented in mid-May, 2017. Sample Workbooks (two sub-units each), a questionnaire for students and a questionnaire for teachers were prepared for the survey.

Addis Ababa Education Bureau kindly selected and appointed several target primary schools for this survey. From among them, LAMS finally selected five primary schools. Students were first asked to work on the sample Workbook and then fill in the questionnaire. At the same time, math and science teachers in charge of the target classes were asked to do the same exercises for themselves. The whole survey was done within 45 minutes. From 85 to 100 students per subject and grade took part in the survey. A total of 16 teachers (2 per subject and grade) also cooperated.

Responses to the questionnaires were overwhelmingly positive among the students and teachers irrespective of the subject and grade. (For details see the *Endline Survey Report*.) To the question, “Does this Workbook help you understand the textbook better?” the rate of the students who answered either “Yes, it helps me very much” or “Yes, it helps me” ranged from 100% (Mathematics G8, Biology G8) to 89.2% (Physics G8). Similarly, to the question, “Do you want to use the Workbook if it is given to you?” 100% (Mathematics G8, Biology G7) to 91.5% (Physics G8) students responded either “Yes, I very much want to use it” or “Yes, I want to use it.”

Teachers also gave positive responses. Though the number of surveyed teachers is small (16 in total), they nonetheless show a relatively strong support to the Workbooks.

Though this survey was small, it has amply verified that the Workbooks developed by LAMS have good merits and are eagerly awaited by students and teachers alike. It is strongly recommended that MoE or REBs take initiative to print and distribute them throughout the country. There is no doubt that low performing students will particularly benefit from them.

3.7 INSET Module

3.7.1 Framework of the INSET Module Development

This INSET Module has been developed according to an agreement between MSIC and the JICA Expert Team for LAMS that Japanese experts will first draft the module and MSIC

experts will finalize it.

Mr. Belayneh Teferra, Head of MSIC, and the JICA Expert Team had discussion twice in July and October 2016. Mr. Belayneh expressed his expectation that this module should be simple and able to respond to practical needs of teachers. Accordingly, the INSET Module of Educational Assessment was designed to consist of four main parts: the first part on the concept of educational assessment as related with LAMS' achievement; the second part on question item development; the third part on item analysis; and the fourth part on a case study of teaching scientific knowledge and concept, featuring a new classroom assessment method.

To make the module more practical, the second part regarding item development has been expanded with more practical exercises than originally conceived, while the fourth part on classroom assessment has been made to focus more on providing feedbacks from item analysis that are useful for classroom assessment.

As such, this INSET Module has following features:

- The module contains 7 major activities. The trainer can select activities from them to organize sessions of various duration: from a half day (minimum) to two days (maximum) according to the purpose of training.
- More than 40 question items are critically reviewed with both poor and improved versions juxtaposed. The module will contribute to item writers for high-stakes examinations.
- The module gives sufficient explanations and exercises for identifying and improving students' misconception of scientific knowledge, the core of science education.
- Cycles of item analysis with subsequent planning of a lesson flow are presented, which encourages teachers to examine the responses from students in designing lessons.
- The module confines the process of item analysis to obtaining only p and D values so that teachers feel easy to approach item analysis.

3.7.2 Table of Contents

The table of contents of the module is shown in Table 3.7.1.

Table 3.7.1 Table of Contents of INSET Module

Contents
1. Concept and Types of Assessment
1.1 What is Assessment in This Module
1.2 Types of Assessment
1.3 Classroom Assessment
2. Item Development and Analysis for Summative Assessment
2.1 Types of Paper and Pencil Tests
2.2 What Is the Multiple-Choice Item
2.3 How to Develop Multiple-Choice Items
2.4 LAMS Guidelines for Item Development
3. Basics of Item Analysis (Multiple Choice Items)
3.1 Proportion of Correct Answers: p-value
3.2 Discrimination Power: D-value
3.3 Distractor Analysis
4. Classroom Assessment for Improving Lessons
4.1 Lessons to Learn Scientific Knowledge
4.2 Lessons to Learn Scientific Reasoning

3.8 PRESET Module

3.8.1 Framework of the PRESET Module Development

The existing PRESET module on assessment, prepared by Mekelle University in June 2014, was not widely accepted among CTEs: some used it with modification; others used their own module; and still others did not even receive the module.

Against this backdrop, TELDD preferred revising the existing module to drafting a new one. TELDD, then, took the lead to consolidate the development procedure, and succeeded in gaining financial support from UNICEF for its idea: to organize intensive workshops inviting CTE lecturers so that the module is to be widely accepted among CTEs. To help TELDD realize this plan, JICA Experts for LAMS, among others, provided initial thoughts on the existing modules and co-designed a workshop program.

3.8.2 Development and Verification

Dates and venue. The Workshop for Module Revision was held for five and half days from February 1 to 6, 2016. The venue was the Adama German Hotel.

Participants. A total of 10 participants attended the Workshop. Table 3.8.1 shows the participants' number by CTE. Two TELDD Experts hosted this Workshop.

Table 3.8.1 The Number of Participants of the Module Revision Workshop

Name of CTE	Region/City	Number
Kotebe	Addis Ababa	1
Debre Birhan	Amhara	2
Nekemt	Oromia	1
Sebete	Oromia	1
Mettu	Oromia	1
Hawassa	SNNPR	1
Bonga	SNNPR	1
Hosana	SNNPR	1
Abbiy Addi	Tigray	1
Total		*10*

Module Revision. The workshop was very successful because the participants were dedicated, hard-working professionals. With a thorough appraisal of the submitted draft, TELDD Experts acknowledged that it met their expectation as it took practical experiences in CTE classrooms well into consideration.

Validation. TELDD validated this revised module along with seven other PRESET modules in June 2016, again inviting CTE lectures throughout the country to critically review the modules.

3.9 Inception Survey

3.9.1 Framework of the Inception Survey

The Work Plan (First Year) specifies two objectives for conducting inception survey, or baseline survey, of this project: (1) to analyze the level of consistency between the Minimum Learning Competency (MLC) and question items of various national examinations and textbooks in mathematics and science subjects, and (2) to learn the current practices and situation of primary education, particularly in terms of assessment of students' learning achievement. In line with these objectives above, the LAMS project conducted the inception survey and compiled the *Inception Survey Report* that comprises two parts corresponding to the two objectives above (consistency analysis and school observation survey). Table 3.9.1 shows the outline of the inception survey.

Table 3.9.1 Outline of the Inception Survey

	Consistency Analysis	School Observation Survey
Objective	To analyze the consistency among the following fundamental documents used in Ethiopia: ・ Between syllabus and PSLCE ・ Between syllabus and EGSECE ・ Between syllabus and textbooks	To know the current situation of primary education in terms of the following aspects: ・ Present conditions of principals, teachers and students; ・ Actual teaching-learning processes; ・ Assessment and evaluation activities; ・ Teachers' and students' perception of examinations; and ・ Students' achievement in sample tests (mock achievement test)
Method	Document collection Relevant documents were collected from CDID, NEAEA, REBs and MSIC Target grades and subjects for analysis G7/ G8: 4 subjects G9/ G10: 4 subjects	Sampling 32 schools in Addis Ababa, Amhara, Benishangul-Gumuz and SNNPR Data Questionnaire: ・ 70 principals ・ 173 teachers (Math and Science subjects) ・ 1,367 students Mock achievement test: ・ 1,330 students (multiple choice) ・ 105 students (open-ended)
Duration	From October 2014 to July 2015	From October 2014 to July 2015
Implementing Agency	JICA Experts	4 REBs (Addis Ababa, Amhara, Benishangul-Gumuz and SNNPR), MSIC and JICA Experts

The JICA Expert Team submitted the *Inception Survey Report* in July 2015. However, due to severely limited time to analyze the rich data collected, the report could only conduct analysis at a preliminary level. Therefore the JICA Expert Team conducted a supplementary, in-depth analysis utilizing statistically sophisticated methods. The supplementary report (*Inception Survey Report: Additional Analysis*) was submitted to JICA in June 2016.

3.9.2 Main Findings

Consistency analysis

- With PSLCE, regional as well as subject variations in consistency with syllabi are significant.
- EGSECE boasts high consistency rates for all the four subjects.
- Textbooks contain a fairly large portion of exercise items that are inconsistent with the syllabi (except Biology).
- A common drawback with PSLCE prepared by regions is that items are not scrutinized sufficiently. This may explain for a number of deficiencies observed in PSLCE, which is prepared and administered by respective regions.
- Technical exchanges among regional experts (item writers) would be highly beneficial to improve and equalize their item writing skills. LAMS Workshops provide one such forum.
- National initiative is necessary to review and revise the minimum competencies, the syllabi and the textbooks to make them all mutually consistent.

School observation survey

<Principal>
- The principal's major concern with school management is the students' academic achievement.
- All the principals encourage the teachers to use supplemental materials including special drills for PSLCE.

<Teacher>
- The teachers teach 17.7 lesson periods per week, spend 40 minutes to prepare for each lesson on average.
- In lesson, almost all the teachers use supplemental materials; they use question items which are picked up from the textbooks or which they develop by themselves.

<Student>
- One out of eight students (12%) does not go to school more than once a week.
- One out of four students (25%) has repeated the grade once.
- The students show their high interest in and positive attitudes for Math and Science learning. Approximately 80% of the students look forward to their Math and Science lessons and like difficult questions given in Math and Science lessons.

<Student-Student>

- The student whose mother attained higher academic qualification tends to talk about school at home more frequently. This indicates the influence of mother's academic qualification on her support to student at home.
- The number of meals has correlation with the time for learning at home. The student who is frequently absent from school has less time for learning at home. The results might show the relationship between income and student's learning time at home.

<Teacher-teacher>

- The teachers with high academic qualification show more confidence in teaching.
- Practice of making lesson plans has correlation with teacher's confidence in teaching and their usage of teaching methods.
- Practice of reflecting lessons has little correlation with teacher's confidence in teaching.

<Student-teacher>

- In the school where the students are frequently absent from classes, the teachers tend to show less confidence in teaching, and less usage of teaching methods.
- In the schools where the teachers make lesson plans, the teachers tend to give students opportunity to express their ideas.

Mock achievement test

- Mock achievement tests for the four subjects were developed consistently following the syllabi and textbooks. The results show that percentage of correct answers is pretty low for all the subjects (30.0% for Mathematics, 24.4% for Biology, 28.3% for Chemistry and 28.9% for Physics). These low achievements confirm the results of

PSLCE and suggest that a large portion of students randomly chose an option for the question items.

- The average Math-Science combined score of the male students is greater than that of female students.
- In the same class, the younger students are, the higher scores they obtain and *vice versa*. Interestingly, the average score decreases as the age increases, but it stops decreasing at age 17 then falls again at age 18 and above.

Comparison of Inception Survey with PISA

The LAMS Inception Survey intentionally made use of some same questionnaire items used in PISA (Programme for International Student Assessment) 2012, which was administrated in 65 countries and regions in the world. The objective of this is to compare Ethiopia with other countries, particularly African countries. While three countries from Africa, namely Algeria, Tunisia and Mauritius, participated in the program, questionnaire data were available only for Tunisia. In the analysis, data from Tunisia were utilized and compared. Main findings were as follows:

- The rate of grade repetition "once and more" of Ethiopia was the third highest in the world (29.3%). It follows the values in Tunisia (29.9%) and Macao-China (29.4%). In general the rates in African countries and South American countries were high.
- The rate of Ethiopian students who like mathematics was the highest in the world (55.1%), more than fivefold of the world averages (10.8%). Also teachers in Ethiopia gave students more opportunities to express their ideas in lesson; the rate was 58.1%, fifth highest in the world. However, there was a common tendency that the countries with low scores in Mathematics show very positive attitude towards the question above on Mathematics learning.

3.10 Endline Survey

3.10.1 Framework of the Endline Survey

The Endline Survey was conducted to follow up the Inception Survey. Its objectives, however, are different from the previous survey's. The Endline Survey is primarily meant to evaluate the impact of LAMS on various aspects. Therefore, the Endline Survey consisted of following seven studies to evaluate the impact from four viewpoints:

Viewpoint 1: Quality of test items

Study 1 Quantitative Analysis: Compare "difficulty" and "discrimination power" of conventional test items and LAMS test items. Show LAMS items have generally higher index values.

Study 2 Quantitative Analysis: Compare "difficulty" and "discrimination power" of test items developed in the second Workshop and in the fifth Workshop. Show that items from the fifth Workshop have higher quality.

Study 3 Qualitative Analysis: Compare test items developed in the second Workshop and in the seventh Workshop from various aspects. Criteria for the comparison will be: whether guidelines for developing multiple-choice items are observed; whether the stem is clear and appropriate; whether distractors are effective; etc. Indicate that the items from the later Workshop have higher quality. [PDM indicator]

Study 4 Quantitative Analysis: See how the values of two main indicators, difficulty and discrimination index, changed over the seven Workshops. [PDM indicator]

Viewpoint 2: Consistency between the syllabus and PSLCE/EGSECE

Study 5 The Inception Survey analyzed PSLCE items of Addis Ababa, Amhara, Benishangul-Gumuz and Dire Dawa (2012 edition) for consistency with the syllabus. The PSLCE items (2016 edition) of the same four regions will be analyzed again. The same analysis will be conducted with EGSECE, too.

Viewpoint 3: Capacity of the Working Group members

Study 6 A questionnaire survey will be administered to Working Group members asking such questions as: "Do you think your ability to write question items has improved through LAMS?" "If yes, how much?" and so on. This is asking for subjective judgment but will be a viable method to evaluate improvement in their item writing skills.

Viewpoint 4: Views of the Working Group members on curriculum consistency

Study 7 Another questionnaire survey will ask the Working Group members about how their views on the consistency of curriculum (syllabus), minimum learning competencies and textbooks have changed over the LAMS project period. If their views have changed positively over the period, it will be interpreted as one form of influence LAMS had on their recognition of curriculum consistency. [PDM indicator]

The results of these seven studies were analyzed and compiled in the *Endline Survey Report* submitted in June 2017, Year 3.

3.10.2 Component Studies and Their Implementation

The seven component studies are summarized in Table 3.10.1.

Table 3.10.1 Seven Component Studies of Endline Survey

Study No.	Viewpoint	Title	Activity	Implementation	Person in Charge
1	Viewpoint 1: 1) Quantitative Analysis	Differences in Test Item Quality: Comparison of LAMS Items and Conventional Items	Compare "difficulty" and "discrimination power" of conventional test items and LAMS test items. Show LAMS items have generally higher index values.	- Done in Feb~April 2016 - Paper finalized in Sept 2016	Bimerew (MSIC)
2	Viewpoint 1: 1) Quantitative Analysis	Differences in Test Item Quality: Comparison of WS2 Items and WS5 Items	Compare test items developed in the second Workshop and in the fifth Workshop in terms of "difficulty" and "discrimination power." Indicate that the items from the fifth Workshop have higher quality.	- Done in March~June 2016 - Paper finalized in Sept 2016	Etenesh (MSIC)
3	Viewpoint 1: 2) Qualitative Analysis	Differences in Test Item Quality: Comparison of WS2 Items and WS7 Items *[PDM indicator]*	Compare test items developed in the second Workshop and in the seventh Workshop. Each item is evaluated in terms of stem score, options score and innovation score. Indicate that the items from the seventh Workshop have higher scores.	- Analysis of the WS2 items done in Nov 2015 - Analysis of the WS7 items done in Dec 2016~ Jan	Toyomane Abdulaziz (Addis Ababa University)

				2017	
4	Viewpoint 1: 1) Quantitative Analysis	Difficulty and Discrimination Index of All Field-Tested LAMS Items *[PDM indicator]*	Trace the change in "difficulty" and "discrimination index" of the field-tested items over the seven Workshops	- Done in June 2017	Toyomane
5	Viewpoint 2	Consistency between the Syllabus and PSLCE/ EGSECE	The Inception Survey analyzed PSLCE items of Addis Ababa, Amhara, Benishangul-Gumuz and Dire Dawa (2012 edition) for consistency with the syllabus. The PSLCE items (2016 edition) of the same four regions are analyzed again. The same analysis is done with EGSECE.	- 2012 editions analyzed as part of Inception Survey - 2016 editions analyzed in Dec 2016~ March 2017	Wada Tanaka Miyakawa Oguchi
6	Viewpoint 3	Impact of LAMS Project Training on Test Development Skills of Trainees and Change in Their Perceived Self-Efficacy	A questionnaire survey is administered to Working Group members asking their perception of efficacy of LAMS Workshops.	- Survey conducted at WS5 in March 2016 - Paper finalized in Sept 2016	Etenesh (MSIC)
7	Viewpoint 4	Perceptional Change of the Working Group Members about the Curriculum Consistency *[PDM indicator]*	A questionnaire survey asks the Working Group members about how their views on the curriculum consistency have changed over the LAMS project period.	- First survey done in Nov 2015 at WS4 - Second survey done in Jan 2017 at WS8 - Analyzed in Feb~April 2017	Toyomane

3.10.3 Independent Research by MSIC Experts

As shown in Table 3.10.1 above, three studies were done by Mr. Bimerew and Ms. Etenesh of MSIC as their independent research. The results have been compiled as two research papers:

Bimerew, K.T. & Ishii, H. (2016). *Quality Difference between LAMS and Conventional Mathematics Question Items in Item Difficulty and Discrimination Power on Grade Seven Students in Bahir Dar City, Ethiopia*.

Etenesh, M. & Ishii, H. (2016). *The Impact of LAMS Project Training on Test Development Skills of Trainees and Change in Their Perceived Self-Efficacy.*

These two papers were read at the 14th annual conference of the Japan Association for Research on Testing (JART) held on September 8 and 9, 2016, in Tokyo, Japan.

Ms. Etenesh further presented her paper at the 14th Regional Conference for Mathematics, Science and Technology Education in Africa [COMSTEDA 14] and Annual SMASE-AFRICA Delegates Meeting held on November 22~24, 2016, in Nairobi, Kenya.

LAMS supported their research and presentations technically and financially as part of capacity development and as a means to publicize LAMS internationally.

3.10.4 Main Findings

The six studies out of seven analyzed the impact of LAMS from various perspectives and reached more or less the same conclusion: LAMS has had a significant positive impact on the capacity and views of the participants. Even though the two indicators out of four specified in the PDM narrowly failed to achieve their targets, their level of attainment is nonetheless respectable. It can be safely concluded that LAMS has succeeded in bringing about the intended change.

Regarding Study 5 about the consistency between the syllabus and PSLCE/EGSECE, no significant improvement was found. The general quality of the items remains more or less at the same level. This is not surprising, however, because LAMS did not directly target the quality of items of these national exams. The survey results showed that the indirect intervention, which LAMS could do at best, did not bring about significant change within the two years.

3.11 Special Training for MSIC Experts

3.11.1 Program

It was assumed that the LAMS project as a whole would provide an opportunity for MSIC Experts to get trained on educational assessment in general and item writing in particular. However, the JICA Expert Team has come to understand that participating in the Workshops alone would not be enough for them to become leading experts in this field in Ethiopia. Realizing this limitation, the JICA Expert Team and MSIC agreed in April 2015 to conduct "Special Training" for the MSIC Experts intermittently between the Workshops.

This "Special Training" aims to raise the capacity of MSIC Experts to become National Trainers on item writing. For this purpose, three specific areas are identified as the main contents of the training:

1) How to write good items [*item writing skills*]
2) How to distinguish good items from poor items [*item selection skills*]
3) How to do item analysis [*item analysis skills*]

Table 3.11.1 summarizes activities of this "Special Training."

Table 3.11.1 Special Training for MSIC Experts

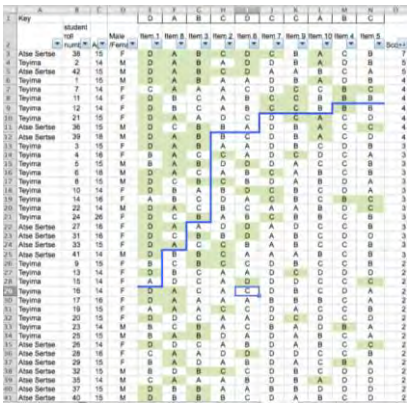
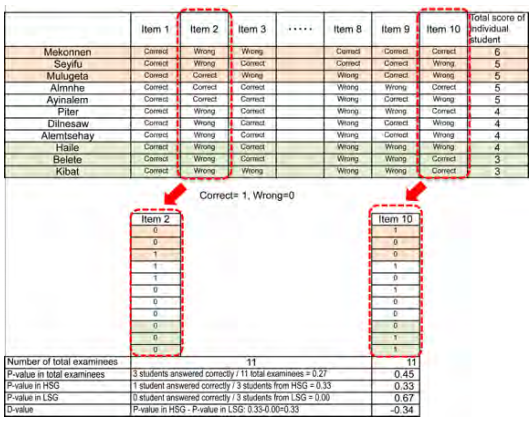
Month	Date	Training Activity	JICA Experts in Main Charge
April 2015	14~17	Item Selection for the 2nd Field Test	Miyakawa Tanaka
July 2015	14	Special Lecture on Item Analysis (Student-Problem Table)	Tsukui
August 2015	5~21	Item Selection for the 3rd Field Test	Miyakawa
December 2015	14~16	Item Selection for the 4th Field Test (1st Item Selection Workshop)	Toyomane/Tanaka/Miyakawa
March 2016	7~12	5th Workshop	Toyomane/Wada/Tanaka/Miyakawa/Tsukui/Murase
March 2016	28~31	Item Selection for 5th Field Test (2nd Item Selection Workshop)	Wada/Tanaka/Miyakawa
May 2016	3	Special Lecture on Item Analysis (using Excel and Field Test results)	Desalegn
June 2016	27~ July 2	6th Workshop	Toyomane/Wada/Tanaka/Miyakawa/Tsukui
July 2016	12~16	Item Selection for the 6th Field Test (3rd Item Selection Workshop)	Toyomane/Wada/Tanaka/Miyakawa
July 2016	13	Special Lecture on a Practical Example of Item Analysis	Ishii

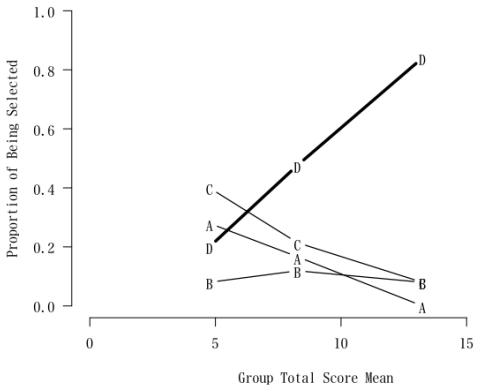
		and Test Editing	
October 2016	31~ Nov 5	7th Workshop	Toyomane/Wada/Tanaka/Miyakawa/Tsukui
November 2016	15~19	Item Selection for the 7th Field Test (4th Item Selection Workshop)	Toyomane/Wada/Tanaka/Miyakawa
January 2017	23~28	8th Workshop	Toyomane/Wada/Tanaka/Miyakawa/Oguchi
April 2017	10~12	Item Selection for the Item Pools (5th Item Selection Workshop)	Toyomane/Wada/Tanaka/Miyakawa
April 2017	24~28	9th Workshop	Toyomane/Wada/Tanaka/Miyakawa/Tsukui
July 2017	3~5	Item Selection for the Item Pools (6th Item Selection Workshop)	Toyomane/Tanaka/Miyakawa
July 2017	10~15	10th Workshop	Toyomane/Tanaka/Miyakawa
Aug 2017	22	Special Lecture (Training of Trainers) on INSET Module on Educational Assessment	Tsukui

In the fifth, sixth, seventh and eighth Workshops, LAMS gave the MSIC Experts chances to lead some sessions. This is another way of "special training" to give them practical experiences as trainers on item development.

3.11.2 Contents of Special Lectures

The four special lectures were delivered on the following contents.

Item Analysis (Student-Problem Table)	To learn how to make the two matrices of students score that represent Student-Curve and Problem-Curve. By analyzing the two curves, each single student's understanding of the knowledge and appropriateness of each item can be revealed. 
Item Analysis (using Excel and field test results)	To learn how to compute p-value (proportion of correct answers) and D-value (discrimination power of the item) using Excel. 

A Practical Example of Item Analysis and Test Editing	To learn the basics of the Classic Test Theory with following topics. • Practical procedure of developing a test • Item analysis, Distractor analysis • Test editing • Related topics (Internal consistency, Coefficient alpha, Item discrimination, Validity, Reliability)  The main point is to learn how to measure student's knowledge and thought by interpreting the distributions of data such as the trace line that demonstrates discrimination power of the items (Figure above).
TOT Training of INSET Module on Educational Assessment	To verify and learn how to implement the training session of the developed INSET Module on Educational Assessment.

3.12 Counterpart Training in Japan

3.12.1 Framework of the Counterpart Training

The course was designed with following five objectives:

(1) To understand that textbooks, learning materials and national examinations are prepared consistently with the national curriculum;

(2) To understand how question items for the National Learning Assessment and TIMSS are developed and how the test results are reflected in the national education policy;

(3) To understand how classroom assessment is done in Japanese schools;

(4) To understand the theory and basic methods of educational evaluation and measurement; and

(5) To observe pre-service teacher training in Japan.

Since organizations of participants varied year to year, the course content of respective years was adjusted so as to meet their organizational expertise.

3.12.2 Summary: Programs

Under the given condition of two-week course duration, a total of 10 sessions were basically available for the program. Considering the objectives and participants' needs, each year's course curriculum was fine-tuned as the tables below. According to the results of questionnaires collected at the end of the course, participants gave a high-level assessment to their accomplishment of the above five objectives and satisfaction of their needs.

Table 3.12.1 Course Curriculum for Training in Japan (First Year)

Date	Day	Activity/Lecture Title	Lecturer	Affiliation
18 Apr	Sat	Departure from Addis Ababa		
19 Apr	Sun	Arrival in Tokyo		
20 Apr	Mon	Briefing Session of the Training Course	JICA officials	
		Program Orientation	Mr. Atsushi Tsukui	Researcher/ International Development Center of Japan
21 Apr	Tue	National School Curriculum and	Mr. Masatsugu	Director/ Azabu Institute of

		Education System of Japan	Murase	Education
		Error Analysis: Assessing Student's Scientific Cognition	Mr.Masatsugu Murase	
22 Apr	Wed	National Learning Assessment of Japan	Dr. Kenji Matsubara	Senior Researcher/ National Institute of Educational Policy Research
		TIMSS: How to Measure the Student's Competency	Dr. Toshio Sawada	Researcher/ Institute of Mathematics Education, Tokyo University of Science
23 Apr	Thu	Development of Educational Workbooks for Students	Mr. Toshiyuki Shimura	Gakken Education Publishing
			Ms. Miki Hashizume	
24 Apr	Fri	Utilization of National Learning Assessment for School Management	Mr. Ikuo Someya	Head/ Board of Education of Ushiku City
		Classroom Assessment at a Junior Secondary School (school visit)	Mr. Masaomi Toyoshima	Supervisor/ Board of Education of Ushiku City
25/26Apr				
27 Apr	Mon	Characteristics of Question Items in Japanese Educational Contexts	Dr. Norimichi Toyomane	Chief Researcher/ International Development Center of Japan
		Wrap Up 1st Week	Mr. Atsushi Tsukui	Researcher/ International Development Center of Japan
28 Apr	Tue	National School Curriculum and Textbook Development	Mr. Norio Matsubara	Kyoiku Shuppan Inc.
		Development of Educational Materials: Universal Design and Intellectual Property	Mr. Toshiaki Yoshida Mr. Yasuhiro Terashima	
29 Apr	Wed	(National Holiday)		
30 Apr	Thu	Test and Item Analysis	Dr. Kentaro Kato	Senior Researcher/ Benesse Educational Research Development Institute
1 May	Fri	Reporting, Evaluation, Certification Ceremony Departure from Tokyo	JICA officials	
2 May	Sat	Arrival in Addis Ababa		

Table 3.12.2 Course Curriculum for Training in Japan (Second Year)

Date	Day	Activity/Lecture Title	Lecturer	Affiliation
10 May	Tue	Departure from Addis Ababa		
11 May	Wed	Arrival in Tokyo		
12 May	Thu	Briefing Session about the Training Course	JICA officials	
		Program Orientation	Mr. Atsushi Tsukui	Researcher/ International Development Center of Japan
13 May	Fri	National School Curriculum and Education System of Japan	Mr. Masatsugu Murase	Director/ Azabu Institute of Education
		Error Analysis: How to Utilize Test Results		
14/15 May				
16 May	Mon	National Learning Assessment of Japan	Dr. Kenichi Goto	Senior Researcher/ National Institute of Educational Policy Research
		TIMSS: How to Measure the Student's Competency	Dr. Toshio Sawada	Researcher/ Institute of Mathematics Education, Tokyo University of Science
17 May	Tue	Classroom Assessment at Junior High School (school visit)	Mr. Ikuo Someya	Head/ Board of Education of Ushiku City
		Effective Use of the Results of NLA (Junior High School)	Ms. Keiko Tsukamoto	Supervisor/ Board of Education of Ushiku City
18 May	Wed	Educational Assessment in Teachers Education	Prof Yasuyuki Iwata	Tokyo Gakugei University
		Classroom Assessment at Primary School (school visit)	Mr. Yoshihiro Sekita/ Mr. Kentaro Ono	Koganei Primary School
19 May	Thu	National School Curriculum and Textbook Development	Mr. Daisuke Hosokawa	Kyoiku Shuppan Inc.

		Development of Educational Materials: Universal Design	Mr. Yasuhiro Terashima	
		Development of Educational Materials: Intellectual Property	Mr. Toshiaki Yoshida	
		Digital Textbook	Mr. Yukihiro Kanoshima	
20 May	Fri	Wrap Up 1st Week/ Discussion with JICA officer	Mr. Atsushi Tsukui	Researcher/ International Development Center of Japan
		Discussion Meeting with Japanese Experts on Educational Assessment	Mr. Masaaki Sato	Free Consultant (Former Principal of Junior High School)
			Ms. Miki Hashizume Mr. Toshiyuki Shimura	Gakken Plus
		Courtesy Call to JICA Headquarters		
21/22 May				
23 May	Mon	Development of Educational Workbooks for Students	Mr. Toshiyuki Shimura Ms. Miki Hashizume	Gakken Plus
24 May	Tue	Reporting, Evaluation of the Training Course Closing Ceremony	JICA officials	
		Departure from Tokyo		
25 May	Wed	Arrival in Addis Ababa		

Table 3.12.3 Course Curriculum for Training in Japan (Third Year)

Date	Day	Activity/Lecture Title	Lecturer	Affiliation
13, 14 May	Sat/ Sun	Departure from Addis Ababa Arrival at Narita		
15 May	Mon	Briefing Session about the Training Course	JICA Officials	
		Program Orientation	Dr. Norimichi Toyomane	Chief Researcher/ International Development Center of Japan
16 May	Tue	National School Curriculum and Education System in Japan	Mr. Masatsugu Murase	Director / Azabu Institute of Education
		Basics on Classroom Assessment	Mr. Masatsugu Murase	
17 May	Wed	Classroom Assessment at Junior Secondary School (school visit)	--	Ushiku Daiichi Junior High School
		Effective Use of the Results of NLA (Junior High School)	Mr. Hiroshi Iwata	Supervisor / Board of Education, Ushiku City
18 May	Thu	National Learning Assessment in Japan	Dr. Kenichi Goto	Professor / Toyo University
		TIMSS: How to Measure the Student's Competency	Dr. Toshio Sawada	Researcher / Institute of Mathematics Education, Tokyo University of Science
19 May	Fri	How to Develop Good Items for Achievement Tests	Mr. Tsuyoshi Okano	Former Supervisor, Gumma Prefecture
		Basics on Test Construction	Dr. Hidetoki Ishii	Professor / Nagoya University
		Courtesy Call to JICA Headquarters		
20, 21 May	Sat/ Sun			
22 May	Mon	Development of Educational Workbooks for Students	Mr. Toshiyuki Shimura	Gakken Plus
			Ms. Miki Hashizume	
23 May	Tue	National School Curriculum and Textbook Development	Mr. Daisuke Hosokawa	Kyoiku Shuppan Inc.
		Digital Textbook	Mr. Yukihiro Kanoshima	
		Development of Educational Materials: Intellectual Property	Mr. Toshiaki Yoshida	
		Development of Educational Materials: Universal Design	Mr. Yasuhiro Terashima	

24 May	Wed	Classroom Assessment at Primary School (school visit)		Hamanogo Primary School
		Classroom Assessment at Primary School (school visit)		
25 May	Thu	Item Analysis and Wrong Answer Analysis	Dr. Kentaro Kato	Senior researcher / Benesse Educational Research Development Institute
		Error Analysis: Assessing Student's Scientific Cognitions	Mr. Atsushi Tsukui	Researcher / International Development Center of Japan
26 May	Fri	Report and Evaluation of the Training Course		JICA officials
		Closing Ceremony		JICA officials
		Departure from Narita		
27 May	Sat	Arrival in Addis Ababa		

3.12.3 Summary: Participants

The numbers of participants were 10 in the First Year (Table 3.12.4), 17 in the Second Year (Table 3.12.5), and 11 in the Third Year (Table 3.12.6). Participants' name and their affiliation and other information are shown in the following tables.

Table 3.12.4 List of Participants of Training in Japan (First Year)

No.	Name	Sex	Affiliation	Position
1	Araya G/Egziabher	M	NEAEA	Director General
2	Tamiru Zerihun	M	NEAEA	Director
3	Arega Mamaru	M	NEAEA	Director
4	Abiy Kefyalew	M	NEAEA	Expert
5	Yosef Mehret	M	CDID	Expert
6	Yibeltal Solomon	M	TELDD	Expert
7	Abebe Garedew	M	TELDD	Expert
8	Belayneh Tefera	M	MSIC	Head
9	Yidnekachew Legesse	M	MSIC	Expert
10	Biruk Zenebe	M	JICA Ethiopia Office	Program Officer

Table 3.12.5 List of Participants of Training in Japan (Second Year)

No.	Name	Sex	Affiliation	Position
1	Dilamo Aotorei	M	Addis Ababa CAEB	Bureau Head
2	Mohammed Uoda	M	Afar REB	Bureau Head
3	Binalf Andualem	M	Amhara REB	Bureau Head
4	Taye Bullo	M	Benishangul-Gumuz REB	Bureau Head
5	Abdusemed Mohammed	M	Dire Dawa CAEB	Bureau Head
6	Tut Jock	M	Gambella REB	Bureau Head
7	Afendi Abdulwasi	M	Harari REB	Bureau Head
8	Letibelu Motuma	M	Oromia REB	Deputy Head
9	Million Mathewos	M	SNNPR REB	Bureau Head
10	Mowlid Hayir	M	Somali REB	Bureau Head
11	Gobezay W/Aregay	M	Tigray REB	Bureau Head
12	Desalegn Teshome	M	MSIC	Biology Expert
13	Hailu Genebo	M	MSIC	Physics Expert
14	Yusuf Aliye	M	MSIC	Biology Expert
15	Teklu Hagos	M	TELDD	Expert
16	Taye Mengistu	M	CDID	Expert
17	Eshetu Gelaye	M	EPRMD	Expert

Table 3.12.6 List of Participants of Training in Japan (Third Year)

No.	Name	Sex	Affiliation	Position
1	Berhanu Fikru Firesenbet	M	Addis Ababa City Education	SMASEE trainer

			Bureau	
2	Girma Kifle Atinaf	M	Afar Regional Education Bureau	Expert
3	Mulugeta Mesfin Gorfu	M	Amhara Regional Education Bureau	Expert
4	Adiss Daka Rorissa	M	Benishangul-Gumuz Regional Education Bureau	Expert
5	Gizachew Mitiku Abdi	M	Dire Dawa City Education Bureau	Expert
6	Puot Gatwech Kuon	M	Gambella Regional Education Bureau	Expert
7	Dilnesaw Getachew Haile	M	Harari Regional Education Bureau	Teacher
8	Dejene Girma Awelachew	M	Oromia Regional Education Bureau	Expert
9	Beteselassie Biru Gebregiorgis	M	SNNPR Regional Education Bureau	Expert
10	Mohammed Mohamoud	M	Somali Regional Education Bureau	Expert
11	Gebremeskel Gebregziabher Melesse	M	Tigray Regional Education Bureau	Expert

3.13 Dissemination Seminar

Dissemination Seminar was held on 25 August 2017 at Hilton Hotel of Addis Ababa. Its purpose was to introduce the LAMS project and its products to a wider audience. A total of 57 attendants participated, including six Heads of Regional Education Bureaus and four officers representing the World Bank, UNESCO and UNICEF. Table 3.13.1 shows its program.

Table 3.13.1 Program of Dissemination Seminar

Date: 25 August 2017
Venue: Conference Room, Hilton Hotel, Addis Ababa

Time	Activity/Presentation	Presenter	Affiliation
9:00-9:30	Registration		
9:30-9:40	Opening remarks	Mr. Ken Yamada	Chief Representative, JICA Ethiopia Office
9:40-9:55	Introduction to LAMS: Its background and significance	Mr. Belayneh Teferra	Head, Mathematics and Science Improvement Center
9:55-10:05	Output 1: Item Pools	Mr. Mitsuhiko Ishida	JICA Expert
10:05-10:15	Output 2: Workbooks	Mr. Shimboku Miyakawa	JICA Expert
10:15-10:25	Output 3: INSET Module on Assessment	Mr. Atsushi Tsukui	JICA Expert
10:25-10:35	Output 4: PRESET Module on Assessment	Mr. Shuhei Oguchi	JICA Expert
10:25-11:00	Tea Break		
11:00-11:15	Impact of LAMS	Mr. Norimichi Toyomane	JICA Expert
11:15-11:30	What I have learned and will do next	Ms. Etenesh Mekonnen	Expert, Mathematics and Science Improvement Center
11:30-11:45	Q and A		
11:45-11:55	Hand over of Item Pools and Workbooks to REBs		
11:55-12:00	Closing remarks	Mr. Elias Girma	Director, EMIS, Planning and Resource Mobilization Directorate

3.14 National Steering Committee and Technical Committee Meetings

3.14.1 National Steering Committee

MoE, in cooperation with JICA, convened the first National Steering Committee meeting on 16 October 2014 at State Minister's meeting room. It was chaired by Mr. Tayachew Ayalew, Advisor to the State Minister for General Education, in the absence of Mr. Fuad Ibrahim,

State Minister for General Education.

The meeting discussed following agenda: 1) to announce the official commencement of the Project; 2) to review and discuss the draft Work Plan (First Year); 3) to decide the roles and responsibilities of the respective counterpart agencies; and to plan immediate activities. Among the members, no representatives from REBs were present.[9]

After this first meeting, no National Steering Committee meeting was held for one and half years simply because it was very difficult to have Heads of National Regional State Education Bureaus gather for a half-day meeting. The second National Steering Committee meeting was finally held on 6 May 2016 at the Ministry of Education. It was chaired by Mr. Eshetu Asfaw, Director of EMIS, Planning and Resource Mobilization Directorate (EPRMD).

The meeting discussed following agenda: 1) to report the progress of Year 1; 2) to review the results of Inception Survey; 3) to explain the Work Plan of Year 2; 4) to explain the second counterpart training in Japan; and 5) to revise the Project Design Matrix (PDM) specifying indicators.

For the last agenda, in order to set a feasible target to be achieved, the participants agreed to discuss the matter further in the third Technical Committee meeting. Chairperson also proposed to revise the composition of the Committee as he considered it very difficult to have Heads of REBs gather for the meeting, and Chief Representative of JICA Ethiopia Office acknowledged this request.

The third meeting was held on 25 August 2017 at the conference room of Hilton Hotel, Addis Ababa. Mr. Belayneh Teferra, Head of MSIC, chaired the meeting. The meeting discussed following agenda: 1) to report the implementation of LAMS; 2) to review the outputs and impact of LAMS; 3) to approve the Action Plan to utilize the LAMS materials; 4) to approve the *Project Completion Report*; and 5) to conclude LAMS. After presentations by Dr. Norimichi Toyomane, Team Leader of JICA Expert Team, the meeting approved both the Action Plan and the *Project Completion Report*.

The signed Minutes of NSCs are attached as Appendix 11-13 to this report.

3.14.2 Technical Committee

The first Technical Committee meeting was held on 27 November 2014 at NEAEA's meeting room. It was chaired by Mr. Belayneh Teferra, Head of MSIC, MoE.

The meeting discussed following agenda: 1) to confirm responsibilities among agencies; 2) to officially assign the members of Working Groups; 3) to nominate a Coordinator for LAMS in NEAEA, CDID and TELDD; 4) to discuss the concept of Baseline Survey; 5) to share overall strategy for the Workshops; and 6) to inform schedule and contents of the Training in Japan.

The second Technical Committee meeting was held on 2 September 2015 at NEAEA's meeting room. Mr. Belayneh Teferra, Head of MSIC, MoE, chaired the meeting.

The meeting discussed following agenda: 1) to report the progress of the Project; 2) to review the results of Inception Survey; 3) to confirm how to manage the Item Pools; 4) to report the progress of the Workbooks, INSET module and PRESET module; 5) to set some indicators to evaluate LAMS's achievement; and 6) to plan main activities of Year 2.

The third Technical Committee meeting was held on 16 December 2016 at Director's office, Exam Preparation and Administration Directorate, NEAEA. It was chaired by Mr. Gebre Egziabher, Deputy Head of MSIC.

The meeting discussed following agenda: 1) to report the progress of the Project; and 2) to set

[9] All REBs were officially informed of this Project later at a meeting of the 24th National Education Conference on 2 November 2014.

specific indicators introduced in the revised Project Design Matrix (PDM). The proposed revision was approved by the participants of the meeting.

The signed Minutes are attached as Appendix 14-16 to this report.

4 ACTION PLAN

4.1 Action Plan to Utilize the LAMS Materials

As the Record of Discussion (R/D) specifies, "Action plans, clarifying the utilization of developed materials" should be prepared as Output 7. Following is the Action Plan as required by the R/D.

4.1.1 LAMS Materials

Materials developed by LAMS refer to the following four outputs:

1. Item Pools
2. Workbooks
3. INSET Module on Assessment
4. PRESET Module on Assessment

4.1.2 Basic Policy

As the basic policy underlying the Action Plan, following three points should be emphasized:

Policy 1: Capacity development is the primary output of LAMS though it is intangible. How to mobilize the developed capacity should be one important consideration in this Action Plan.

Policy 2: To ensure sustainability of the LAMS outputs, the existing systems like MSIC's INSET training should be fully mobilized and utilized.

Policy 3: Budget necessary for utilization/dissemination should come either from the Federal Ministry of Education or the Regional Education Bureaus once LAMS is finished.

4.2 Action Plan

4.2.1 Item Pools

1) During LAMS

1. [Website] Item Pools will be uploaded on the MoE's website.
2. [DVD] Item Pools will be stored in DVDs (together with Workbooks) and distributed to Woreda (1 copy per Woreda).
3. [Print] Item Pools will be printed and bound and distributed to REBs (2 copies per subject per grade per region).
4. [Orientation] A one-day orientation will be provided to MSIC Experts on how to utilize the Item Pools in schools; the Experts will then train the regional experts.
5. [Guidebook] A simple 2- or 3-page guidebook on how to utilize the Item Pools will be developed and given to MSIC Experts and concerned others.

2) After LAMS

1. [INSET training] MSIC conducts training sessions for Regional Experts/Trainers as part of the INSET training on how to utilize the Item Pools at school.

(October 2017 ~)

2. [Regional Experts] Regional Experts who participated in LAMS Workshop should be involved in the INSET training at the regional and woreda levels to cascade the training provided by MSIC on how to utilize the Item Pools at school.

(October 2017 ~)

3. [Pilot school] A few pilot schools will be selected and provided with printed Item Pools. MSIC Experts will give an orientation to the teachers. Teachers will use the Item Pools to prepare unit exams. MSIC at the same time produces the standardized term exams and distributes them to the pilot schools for their use.

(October 2017 ~ June 2018)

4.2.2 Workbooks

1) During LAMS

1. [Print] Workbooks will be printed and bound and distributed to REBs (a few copies per subject per grade).
2. [DVD] Workbooks will be stored in DVDs (together with Item Pools) and distributed to Woreda (1 copy per Woreda).
3. [Orientation] A one-day orientation will be provided to MSIC Experts on how to utilize the Workbooks in schools; the Experts will then train the regional experts.
4. [Guidebook] A simple 2- or 3-page guidebook on how to utilize the Workbooks will be developed and given to MSIC Experts and concerned others.

2) After LAMS

1. [INSET training] MSIC conducts training sessions for Regional Experts/Trainers as part of the INSET training on how to utilize the Workbooks at school.

(October 2017 ~)

2. [Regional Experts] Regional Experts who participated in LAMS Workshop should be involved in the INSET training at the regional and woreda levels to cascade the training provided by MSIC on how to utilize the Workbooks at school.

(October 2017 ~)

3. [Pilot school] A few pilot schools will be selected and provided with printed Workbooks. MSIC Experts will give an orientation to the teachers. Students will use the Workbooks either as homework and/or during supplementary lessons.

(October 2017 ~ June 2018)

4. [Regional Education Bureau] If convinced with the effectiveness of the Workbooks, REBs are free to print them and distribute them to the schools with their own budget. The Regional Experts who took part in the LAMS Workshop and drafted the pages of the Workbooks may convince REBs to utilize the Workbooks.

(October 2017 ~)

5. [GEQIP III] The World Bank may print and distribute the Math Workbooks as part of GEQIP III.

(September 2018)

4.2.3 INSET Module

1) After LAMS

1. [SMASEE module] INSET module on assessment will make a part of the SMASEE modules and be used in MSIC's regional training.

(October 2017 ~)

4.2.4 PRESET Module

1) After LAMS

1. [CTEs] The module is to be adopted by CTEs to teach students on assessment.

(October 2017 ~)

4.3 MoE's Commitment

As specified in the R/D, MSIC, CDID and TELDD are mainly responsible for the Action Plan. The three agencies have shown their commitment to the Action Plan as delineated above.

5 REVISION OF PDM

5.1 Necessity to Revise the Original PDM

The original PDM (Project Design Matrix) is attached as Appendix 1 to this report. The PDM is one of the basic official documents (as part of the Record of Discussion), which specifies the project's goals, purposes, outputs and "objectively verifiable indicators" to evaluate the level of achievement of the goals, purposes and outputs.

LAMS' original PDM, however, does not specify concrete indicators for some items. For instance, the objectively verifiable indicator for the Project Purpose is written as:

"Understandings on quality of curriculum policy under curriculum consistency in mathematics and science education are deepened among the stakeholders."

The questions are, first, how we can evaluate the level of "stakeholders' understandings" that are "deepened" as a result of the project and, second, what value we should achieve for the indicator. Similarly, the objectively verifiable indicators for Output 1 are:

"Improvement of M&E results of the trainings and WS in terms of the following contents:

(1) Participants' performance
(2) Satisfaction toward the contents of the trainings and WS by the participants."

The questions again are how we should measure "participants' performance" and "satisfaction" and what level of them we should attain to be judged successful.

Thus we need to revise the original PDM primarily to specify objectively verifiable indicators and their concrete targets and, secondarily, to correct errors and update the contents.

5.2 Proposed Revisions

The proposed revision consists of three main modifications.

5.2.1 Specification of the Objectively Verifiable Indicator for Project Purpose

Original Version

Project Purpose

Quality of curriculum strategy to improve students' learning achievement in mathematics and science education at target grades is enhanced under curriculum consistency.

Objectively Verifiable Indicators

1. Understandings on quality of curriculum policy under curriculum consistency in mathematics and science education are deepened among the stakeholders.
2. Materials developed by the Project have curriculum consistency.

Proposed Modification

Project Purpose [No change]

Quality of curriculum strategy to improve students' learning achievement in mathematics and science education at target grades is enhanced under curriculum consistency.

Objectively Verifiable Indicators

1. Materials developed by the Project have curriculum consistency.
2. Understandings on quality of curriculum policy under curriculum consistency in mathematics and science education are deepened among the stakeholders.

   Workshop participants' understanding about the importance of curriculum consistency in terms of the rate of participants who strongly agreed with its importance:

   In 2014 28.6%

   In 2017 50%

5.2.2 Combination of Output 1 and Output 3 and Specification of the Objectively Verifiable Indicators

It is proposed to combine Output 1 and Output 3 because, since the fourth Workshop, the four Subject Working Groups and the Assessment and Evaluation Working Group have been integrated at least for item development. Thus Output 3 is integrated into Output 1 and a common set of indicators is specified to both.

Original Version

Output 1: (Subject WGs' members)

Capacity of Subject WGs' members on mathematics and science education are enhanced.

Objectively Verifiable Indicators

1. Improvement of M&E results of the trainings and WS in terms of the following contents;

(1) Participants' performance
(2) Satisfaction toward the contents of the trainings and WS by the participants.

2. Relevance of the quality of question items of Item Pool is secured through validation process.

Output 3: (mainly NEAEA and REBs)

Capacity of the following human resources on development of Item Banks is enhanced.

- Item writers and experts for "NLA Item Bank on mathematics and science education for Grade 4, 8 and 10 (NEAEA)"

- Subject experts for "PSLCE Item Bank on Mathematics and Science for Grade 8 and Ethiopian General Secondary Education Certificate Examination (EGSECE) in Grade 10 (NEAEA) "

- Item writers for " PSLCE items for Grade 8 (REBs)"

Objectively Verifiable Indicators

1. Improvement of M&E results of the trainings and WS in terms of the following

contents;

(1) Participants' performance
(2) Satisfaction toward the contents of the trainings and WS by the participants.

2. Improvement of the results of M&E of WG's sessions related to Output 3.

Proposed Modification

Output 1:

Capacity of Subject WGs' members on mathematics and science education and the following human resources on development of Item Banks is enhanced.

- Item writers and experts for "NLA Item Bank on mathematics and science education for Grade 4, 8 and 10 (NEAEA)"

- Subject experts for "PSLCE Item Bank on Mathematics and Science for Grade 8 and Ethiopian General Secondary Education Certificate Examination (EGSECE) in Grade 10 (NEAEA) "

- Item writers for " PSLCE items for Grade 8 (REBs)"

Objectively Verifiable Indicators

1. Improvement of M&E results of the trainings and WS in terms of the following contents;

(1) Participants' performance

i) Among the field-tested items, the percentage of items satisfying the two conditions below increases:

Difficulty >= 0.25

Discrimination index >= 0.10

For items developed by the members of 5 WGs in WS2: 52.0%

For items developed by the members of 5 WGs in WS7: 70.0%

ii) Quality of field-tested items improves in terms of the average score of item quality evaluation:

For items developed by the members of 5 WGs in WS2: 3.35

For items developed by the members of 5 WGs in WS7: 4.00

(2) Satisfaction toward the contents of the trainings and WS by the participants

Satisfied 5 WG members in WS7 and WS8 80%

2. Relevance of the quality of question items of Item Pool is secured through validation

process.

3. Improvement of the results of M&E of WG's sessions related to Output 1.

5.2.3 Modification of the Objectively Verifiable Indicators for Output 2

Original Version

Output 2: (Subject WGs' and Assessment and Evaluation WGs' members)

Item pool in mathematics and science education for Grade 7 and 8, and Sample Item pool in mathematics and science education for Grade 4 and 10 are developed.

Objectively Verifiable Indicators

1. Improvement of M&E results of the trainings and WS in terms of the following contents;

(1) Participants' performance based on concrete question items developed by the participants.

(2) Satisfaction toward the contents of the trainings and WS by the participants.

2. "Item pool" is allocated in accessible way for all related stakeholders.

3. "Item Pool" is utilized by related stakeholders.

Proposed Modification

Output 2: (Subject WGs' and Assessment and Evaluation WGs' members) [No change]

Item pool in mathematics and science education for Grade 7 and 8, and Sample Item pool in mathematics and science education for Grade 4 and 10 are developed.

Objectively Verifiable Indicators

1. "Item pool" for Grades 7 and 8 is developed in the form of database.

2. "Item pool" is allocated in accessible way for all related stakeholders.

5.3 Finalized PDM Version 2

The proposed PDM was discussed at the third Technical Committee meeting on December 16, 2016. The revision was approved without any modification. The finalized PDM, version 2, is attached as Appendix 2.

6 ACHIEVEMENT OF PROJECT OBJECTIVES

6.1 Project Goals and Objectives

To reiterate the Project Goals and Objectives:

This Project's super goal is that "students' learning achievement at Grades 7 and 8 is improved." Its overall goal is that "pedagogical basic foundation is prepared mainly at Grades 7 and 8 to improve students' learning achievement." Its project purpose is that "quality of curriculum strategy to improve students' learning achievement in mathematics and science education at target grades is enhanced."

6.2 How to Evaluate the Achievement

To evaluate the project's achievement, there are two main ways: One way is to see if the project has accomplished the seven outputs as prescribed in the R/D; the other way is to check if the project has achieved the targets of four indicators newly specified in the revised PDM.

6.2.1 Seven Outputs (R/D)

Following are the seven outputs for the project to develop:

Output 1 Capacity of subject Working Groups' members
Output 2 Item pools for Grades 7 and 8, and sample item pools for Grades 4 and 10
Output 3 Capacity of the human resources on development of item banks
Output 4 Workbooks for Grades 7 and 8
Output 5 INSET Module on assessment
Output 6 PRESET Module on assessment
Output 7 Action Plan

6.2.2 Four Indicators (PDM)

Following are the four main "objectively verifiable indicators" introduced in the revised PDM:

Project Purpose's Objectively Verifiable Indicator

[Indicator 1]

Workshop participants' understanding about the importance of curriculum consistency in terms of the rate of participants who strongly agreed with its importance:

In 2014 28.6%
In 2017 50%

Output 1's Objectively Verifiable Indicators

1. Improvement of M&E results of the trainings and WS in terms of the following contents;

(1) Participants' performance

[Indicator 2]

i) Among the field-tested items, the percentage of items satisfying the two conditions below increases:

Difficulty >= 0.25
Discrimination index >= 0.10

For items developed by the members of 5 WGs in WS2: 52.0%
For items developed by the members of 5 WGs in WS7: 70.0%

[Indicator 3]

ii) Quality of field-tested items improves in terms of the average score of item quality evaluation:

For items developed by the members of 5 WGs in WS2: 3.35
For items developed by the members of 5 WGs in WS7: 4.00

[Indicator 4]

(2) Satisfaction toward the contents of the trainings and WS by the participants

Satisfied 5 WG members in WS7 and WS8 80%

6.3 Achievement by the Project

6.3.1 With Respect to Seven Outputs

1) Output 1: Capacity of Subject Working Groups' Members

Capacity of the Subject Working Group members has been significantly improved. See Section 6.3.2 below and Section 3.10 "Endline Survey."

2) Output 2: Item Pools and Sample Item Pools

Item Pools for Grades 7 and 8 have been constructed and made public. All subject Working Groups have accomplished the target number of items (1,000 each). See Section 3.4.4. Sample Item Pools for Grades 4 and 10 have also been constructed storing more than 200 items per subject per grade as their target. See Section 3.1.5 "Summary: Developed Items."

3) Output 3: Capacity of the Human Resources on Development of Item Banks

Capacity of the personnel who work on the Item Banks has also been enhanced along with fellow Working Group members. See Section 6.3.2 below and Section 3.10 "Endline Survey."

4) Output 4: Workbooks

Workbooks for Grades 7 and 8 have been developed by the Working Group members. See Section 3.6 "Workbooks."

5) Output 5: INSET Module on Assessment

INSET Module on Assessment has been jointly developed by MSIC and the JICA Expert Team for LAMS. See Section 3.7 "INSET Module."

6) Output 6: PRESET Module on Assessment

PRESET Module on Assessment has been revised and validated by TELDD. See Section 3.8 "PRESET Module."

7) Output 7: Action Plan

Action Plan to utilize the LAMS materials has been approved by the National Steering Committee. See Chapter 4 "Action Plan."

6.3.2 With Respect to Four Indicators

The four main objectively verifiable indicators introduced in the revised PDM are all evaluated in the endline survey. For details see the *Endline Survey Report* submitted in June 2017. Following are brief summaries of the results.

1) Indicator 1: Understanding about the Importance of Curriculum Consistency

The rate of the participants who strongly agree with the view that "the curriculum (syllabus),

textbooks and PSLCE should be mutually consistent" was:

2014 28.6%
2015 51.2%
2017 46.5%

It is clear that the participants of the LAMS Workshops have better understood the importance of curriculum consistency than before the project started. However, the PDM target of 50% of "Yes, I agree very much" in 2017 was not achieved. See Chapter 7 of the *Endline Survey Report*.

2) Indicator 2: The Rate of Items Satisfying the Two Conditions Simultaneously

The rate of the "good" items (which satisfy both difficulty >= 0.25 and discrimination index >= 0.10) was 52.2% at the second Workshop but reached 73.5% at the seventh Workshop. Thus, this particular PDM indicator achieved its target, verifying LAMS' impact on the quality of items developed by the Workshop participants. For details see Chapter 5 of the *Endline Survey Report*.

3) Indicator 3: Quality of Field-Tested Items

To judge an item's overall quality, LAMS employed a simple method. With each item, following scores are calculated:

Item Evaluation Score = Stem Score + Options Score + Innovation Score

where *Stem Score* evaluates stem's clarity, appropriateness, English, and so on; *Options Score* evaluates options' appropriateness, distractors' effectiveness, plausibility, clarity, logical order, English, and so on; and *Innovation Score* evaluates the item's presentation and innovativeness. These three scores take either 0, 1 or 2. Thus, the *Item Evaluation Score* can range from 0 (worst) to 6 (best).

All items developed at the second and the seventh Workshop and field-tested underwent this evaluation. The number was 270 and 480, respectively. The overall average of the Item Evaluation Score was:

Workshop 2 3.35
Workshop 7 3.86

Items developed at the seventh Workshop achieved 3.86 for the Item Evaluation Score (total score), a respectable improvement from 3.35 scored at the second Workshop. Though this value (3.86) did not attain the 4.0 target specified in the PDM, it nonetheless testifies the positive impact of LAMS on the item writing skills of the participants. See Chapter 4 of the *Endline Survey Report.*

4) Indicator 4: Satisfaction of the Workshop Participants

At the end of each Workshop, participants were asked to fill in a questionnaire. According to the results of the seventh and eighth Workshops, the rate of the participants who were satisfied with the Workshop was as follows:

"Very satisfied" and "Satisfied" with the Workshop

Workshop 7 89.2%
Workshop 8 94.2%
Average *92.1%*

"Very satisfied" and "Satisfied" with their own achievement

Workshop 7 87.9%

Workshop 8	97.8%
Average	*93.7%*

Thus the PDM target of 80% was achieved.

6.3.3 With Respect to Project Purpose and Overall Goal

With respect to the project purpose, LAMS at least seems improving "curriculum strategy" by gradually constructing a backward loop from assessment to textbooks and curriculum. Some participants who are responsible for the development of curriculums and textbooks seem to have realized that the current textbooks and curriculums need review and improvement. In view of the recent news that MoE is considering revising the curriculums, those LAMS participants may have a pivotal role in the national endeavor. LAMS can achieve its project purpose by supporting those officials to take lead in this important duty.

As for the overall goal and super goal, it is still premature to judge anything about their achievement. However, at least one thing can be cited: item development is just one small part of educational activity and its significance is very much limited at most. Viewed in the overall scope of education, LAMS is just one tiny endeavor aiming at the betterment of education in Ethiopia. Nonetheless, through the project over the past three years, it has become clear that Ethiopia should pay more serious attention to Grade 1 pupils and the lessons given to them. Assessment of Grade 7 and 8 students' achievement in mathematics and science unambiguously indicates that classroom lesson reform and improvement should start at lower grades, probably at the very start, Grade 1.[10] If LAMS can facilitate Ethiopian officials' fostering a consensus about the point above, it would be considered to be a firm step towards the goals of improving students' academic achievement.

6.4 Results of Evaluation Based on DAC Evaluation Criteria

Results of evaluation based on the DAC evaluation criteria are as follows. This evaluation was done jointly with the counterpart.

6.4.1 Relevance

Ethiopia is strenuously promoting the national plan that the country will achieve the status of a lower middle-income country by 2025.[11] The key to the success is industrial development and Ethiopia prioritizes providing human resources equipped with mathematical and scientific knowledge to the industrial sector. To this end, the current Education Sector Development Program V places emphasis on science and technology education from primary to tertiary education.

On the other hand, the Japanese government and JICA both regard "providing high-quality primary education" as one pillar policy on cooperation with Ethiopia. Furthermore, Japanese government's new policy on educational cooperation lists "cooperation to achieve inclusive and equitable quality education" and "cooperation to build the foundation for the social development through raising human resources capable of industrial and technology development" as priorities. JICA's position paper on educational development also agrees with these priorities. Thus this project is highly relevant not only to Ethiopia's development policy and plan but also to Japan's policy on international cooperation in the field of education.

Education in Ethiopia, however, is faced with many challenges. For students to attain the

[10] A comprehensive research report on the arithmetic capacity of Grade 1 to Grade 4 pupils, published by MSIC in August 2016, clearly supports this argument. See Mathematics and Science Education Improvement Center (MSIC). (2016). *Research on basic arithmetic (Grade 1-4)*. Addis Ababa: MSIC.

[11] National Planning Commission. (2015). *The second growth and transformation plan (GTP II) (2015/16~2019/20) (Draft)*. Addis Ababa. p.16.

expected level of learning effectively, it is necessary that the three components of the teaching/learning process, that is, "curriculum," "classroom teaching" and "learning assessment," should be consistent in their principles and contents. Many problems can be cited with respect to the respective three components but the biggest deficiency is that these three components lack consistency. This problem is typically seen in those test items from PSLCE that are not consistent with the official syllabus.

JICA already implemented SMASEE to improve classroom lessons. This project by contrast aimed to ensure curriculum consistency particularly focusing on the assessment aspect. As such this project tried to squarely tackle one of the fundamental shortcomings inherent in the Ethiopian educational systems but were rarely dealt with.

This project is therefore relevant to Ethiopia's national policy and plan both at its inception and its conclusion. It also meets the unmet needs in Ethiopia's educational policy.

Output 3 of the project is the capacity development of those human resources who work for the item bank development. At the beginning, NEAEA showed strong skepticism on this provision fearing that the items in the item bank might leak out. They even hinted that they would withdraw from the project but the JICA Expert Team emphasized that the project would not touch on the item bank and finally convinced NEAEA to stay in the project. Output 3 may be a reasonable one in view of the super goal of the project but this incidence strongly suggests that the preparatory discussion with the designated counterpart agencies was not sufficient.

The workbook development (Output 4) for which CDID was mainly responsible had to undergo a significant modification, involving all the participants in the task. Evaluation of this modification will be given under Effectiveness (Section 6.4.2) and Sustainability (Section 6.4.5) below.

By and large, relevancy of this project is judged high.

6.4.2 Effectiveness

The project purpose of this project is that "quality of curriculum strategy to improve students' learning achievement in mathematics and science education at target grades is enhanced." This statement is abstract and lacks concrete contents. The seven outputs specified for the project, however, give some hints about what this project is aimed at: 1) capacity development of the Workshop participants; 2) item pools; 3) capacity development of the item writers for the item banks; 4) workbooks; 5) INSET module on assessment; 6) PRESET module on assessment; and 7) action plan to utilize the materials.

With regard to Output 1, the Workshop participants, around 90 from 11 regions and federal agencies, learned the necessity of curriculum consistency in writing question items. At the same time, they developed skills to critically review the textbooks from the same perspective. The endline survey results indicate that they have strengthened their understanding about the importance of curriculum consistency.

Through the workbook development, they have also learned that curriculum (syllabus) should be the basis for the workbooks. Originally, CDID was designated as the agency responsible for this task but, in view of the very small number of experts at CDID, the project changed the plan and involved all the participants in this additional task. This arrangement worked and all the workbooks were completed in time.

Outputs 1 and 3 both deal with the capacity development. Impact with his respect was highly significant as the endline survey amply showed the improvement in the item quality from various perspectives. The participants also indicated a high level of satisfaction throughout the project duration.

It is estimated that the participants are disseminating the concept of "curriculum consistency" and its importance to their colleagues at their work place. Since the Assessment Department of Regional Education Bureau is basically small with limited staff, their dissemination efforts are expected effective. Thus the project purpose of "enhanced quality of curriculum strategy" may be achieved to some extent.

Outputs 2, 4, 5 and 6 are all completed as planned. They also support the project purpose of "enhanced quality of curriculum strategy" to be materialized.

In view of the all achievements above, this project can be said to have achieved its project purpose effectively.

6.4.3 Efficiency

The project completed all the outputs specified in the R/D. The input needed to achieve it, however, was slightly more than the initial estimate. The total man-months allocated for the project was 112.77 at the beginning but later increased to 119.01, a 5.5% (6.24 man-months) increase. The primary reason for this increase was that the huge amount of time Japanese experts needed to check all question items repeatedly and review and comment on the manuscripts of the workbooks prepared by the participants. If we aim to achieve both capacity development of the participants and high-quality outputs at the same time, it is obvious that we need ample time to pursue both. The original estimate of necessary man-months seems insufficient in view of this particular requirement.

This project has accomplished all the targets but, compared with the inputs it necessitated, its efficiency may be judged slightly low.

6.4.4 Impact

This Project's super goal is that "students' learning achievement at Grades 7 and 8 is improved." Its overall goal is that "pedagogical basic foundation is prepared mainly at Grades 7 and 8 to improve students' learning achievement." As stated under Effectiveness above, the some 90 participants who have acquired the knowledge of curriculum consistency and skills to write good items are expected to disseminate what they learned under the project to other colleagues in their office. Thus the project will gradually have impact on the students' learning achievement in respective regions.

One impact that was not anticipated is the better communications and relationships between directorates/agencies of the Ministry of Education and between the Ministry of Education and the 11 Regional Education Bureaus. They have even nurtured mutual trust between them and this will become an important asset for the Ethiopian government.

Another significant impact, though it is not regarded as any outcome, is the sense of trust of the Ethiopian side that the JICA Expert Team finally earned with their sincerity. It can be regarded as one positive impact of the project that the JICA Expert Team has successfully maintained the Ethiopian side's trust in Japan.

6.4.5 Sustainability

According to the R/D, MSIC will take responsibility of the item pools and the INSET module, CDID of the workbooks, and TELDD of the PRESET module.

The item pools are now uploaded on the Ministry of Education's website, just as planned from the beginning. However, in view of the limited internet availability in Ethiopia, it is doubtful that the item pools will enjoy a large number of access. Similarly, the continuous extension and upgrading of the item pools may not be so easy since MSIC is not officially charged with this task. By contrast, the INSET module on assessment may be fully utilized in the INSET program implemented by MSIC.

The original plan was that the workbooks would be printed with funds from GEQIP II. The difference in the timelines of the World Bank and the project prohibited this idea from being materialized. As a result, there is no concrete plan at present on how to print the workbooks. Nonetheless, the Director of CDID appreciates the quality of the workbooks and might take some action to utilize the output. Similarly, the World Bank is also interested in the workbooks (mathematics) and may disseminate them as a component of GEQIP III.

The PRESET module on assessment was already distributed to CTEs throughout the country by TELDD.

In terms of the utilization of the project outputs, there has been some progress as seen above. However, overall level of utilization should remain low and some concern is inevitable about the sustainability of the project.

6.5 Suggestions to Achieve the Project Goals

This Project's super goal is that "students' learning achievement at Grades 7 and 8 is improved." Its overall goal is that "pedagogical basic foundation is prepared mainly at Grades 7 and 8 to improve students' learning achievement." A few suggestions to achieve these goals are as follows.

The central part of the "pedagogical basic foundation" should be the curriculum (or syllabus as called in Ethiopia) and textbooks. It is very respectable that Ethiopia developed them by herself but the current curricula and textbooks have some deficiencies. It is strongly suggested that the curricula and textbooks for all grades and all subjects should be thoroughly reviewed and revised. The point of the revision should be "refinement." Too many competencies are being taught to make students' academic load unnecessarily heavier. The contents of the textbooks are generally too difficult, ignoring the ordinary students' capability or level of development. They need refinement to become student-friendly and easy to understand.

To improve students' learning achievement, the key lies in the teaching/learning at the early grades of primary education. Once students fail to understand the basic concepts taught at these early stages, they will hardly recover the failure at later stages. It is recommended to review the teaching contents of all subjects and teaching methods for grades 1 to 4 students and make the students understand the basic contents better. Otherwise, it will be almost impossible to improve students' learning achievement at higher grades.

In Ethiopia, "elitism" is still very common in education but this should be totally changed to a democratic view that all students have an equal right to understand better and to perform better. This perceptional shift would be a prerequisite for better quality education and, furthermore, for nation building as envisaged in the national plan.

7 LESSONS GAINED FROM THE PROJECT

7.1 Issues and How to Deal with Them

7.1.1 From Summative to Formative Assessment

PSLCE is a typical form of summative assessment. Summative assessments are used to evaluate student learning, skill acquisition, and academic achievement at the conclusion of a defined instructional period—typically at the end of a project, unit, course, semester, program, or school year. By contrast, formative assessments are to collect detailed information that can be used to improve instruction and student learning while it's happening. In other words, formative assessments are said to be for learning while summative assessments are of learning.[12]

According to LAMS Inception Survey results,[13] Ethiopian teachers rather frequently give question items to students in lessons (almost every class: 10%, a few times a week: 45%, a few times a month: 42%, a few times a semester: 3%).[14] However, as the Report states:

> "It appears most of the teachers recognize the quiz/test items as tools for a summative assessment of students rather than for a formative assessment that confirms student's understanding in any occasion during a lesson. . ." (p. 49)

To most Ethiopian teachers, formative assessment remains a novel practice they are not so familiar with. The fact that the INSET Modules developed by SMASEE respectively emphasize the importance of formative assessment can be seen as an indication of teachers' general unfamiliarity with the concept. To cite the passages:

> "What kinds of assessment methods can you use to determine the extent to which students have met the objective of the lesson?. . .The focus must be on assessments used not only to determine grades, but also on some informal assessments that might or might not be graded but that provide valuable information about whether students are 'getting it.'"[15]
>
> "It is a common experience that when students are given final tests or exams, what they get or learnt is not equal to what they are expected to get or to have learned. This in turn tells us that students' level of learning should be always checked and continuously monitored. This fact makes the classroom assessment a vital and integrated part of teaching and learning. The information that the teacher gets by doing the classroom assessment is used both by the teacher and the students as well to improve teaching and learning."[16]
>
> ". . . current classroom assessment for learning in most chemistry lessons does (sic) NOT oriented to and implemented to:
>
> - Activate student's prior knowledge;
> - Help students explore and discover scientific concepts;
> - Lead to deeper understanding;
> - Control student behavior;
> - Manage the speed and direction of the lesson;

[12] Summative assessment and formative assessment (August 8, 2015). In S. Abbott (Ed.), The glossary of education reform. Retrieved from http://edglossary.org/summative-assessment/ and http://edglossary.org/formative-assessment/

[13] International Development Center of Japan Inc. and KRI International Corp. 2015. *LAMS Inception Survey Report.*

[14] *Ibid*, p. 49. Table 8.16.

[15] National Mathematics and Science Improvement Center. 2014. SMASEE INSET module book 2: Active learning in mathematics (Grade 7 and 8). (Addis Ababa: National Mathematics and Science Improvement Center). p.77.

[16] National Mathematics and Science Improvement Center. 2014. SMASEE INSET module book 3: Active learning in biology (Grade 7 and 8). (Addis Ababa: National Mathematics and Science Improvement Center). p.56.

- Create the bridge between activities;
- Increase student participation."[17]

". . . classroom assessment for learning is the process of checking students' learning as they learn in classroom. That means checking what students are learning, how well they are learning and how effectively the teacher is teaching. Classroom assessment for learning includes recording, studying and applying the result of the assessment obtained to improve students' learning and make the teaching better."[18]

Question items written for summative assessments (e.g., PSLCE) may not be appropriate for formative assessments. Not all items included in the textbooks are suitable, either. For the use of formative assessments, appropriate question items should be developed and stored in the LAMS item pools. By accessing to the item pools, teachers should gain some concrete idea about what types of question items are appropriate for formative assessments and, eventually, become able to write similar items for themselves.

7.1.2 MSIC's Role after LAMS

MSIC's mandate is to improve mathematics and science education in general and, in particular, to build the nation-wide system of in-service training (INSET) and conduct training of trainers (ToT) for the system. As such, it has no direct responsibility for item development particularly at national or regional level. Nonetheless, it has been nominated as National Coordinator of LAMS and its Experts have been heavily involved in training on item writing and item analysis as trainees.

A question that naturally arises is: What will MSIC do after LAMS ends in 2017?

Considering that 1) LAMS trained only a tiny fraction of educationists of Ethiopia on item development, 2) vast majority of teachers do not have proper knowledge or skills of educational assessment, 3) as a result, formative (or continuous) assessment of students is almost absent from the classrooms, and 4) this fact may be one main reason for the low academic achievement of Ethiopian students, we might think that *MSIC should take the lead in training teachers on formative (continuous) assessment duplicating what they have learned under LAMS.*

This strategy seems promising since it snugly fits in MSIC's mandate while tackling one of the most fundamental problems of Ethiopia's education system. For this strategy to be feasible, two preconditions should be met:

1) MSIC Experts are well qualified to be national trainers on educational assessment; and

2) Practical modules on educational assessment are ready for MSIC to use.

Qualifications of MSIC Experts as national trainers

Until the fourth Workshop, MSIC Experts were purely *trainees* under LAMS because they lacked knowledge on how to write good question items. However, this experience alone is not sufficient for them to become national trainers on item development. They also need to practice as *trainers* in the LAMS Workshops. With this goal in mind, LAMS deliberately made them play facilitator's role in some sessions starting from the fifth Workshop.

At the same time, LAMS has conducted "special training" for MSIC Experts to improve their skills of item development and item analysis (see Section 3.11).

[17] National Mathematics and Science Improvement Center. 2014. SMASEE INSET module Book 4: Active learning in chemistry (Grade 7 and 8). (Addis Ababa: National Mathematics and Science Improvement Center). p.55.

[18] National Mathematics and Science Improvement Center. 2014. SMASEE INSET module Book 5: Active learning in physics (Grade 7 and 8). (Addis Ababa: National Mathematics and Science Improvement Center). p.99.

Practical modules on educational assessment

As national trainers on educational assessment, MSIC Experts need a module to be used in their training. This module is exactly the INSET module developed by MSIC as output 4 of LAMS. It is practically oriented focusing on formative assessment in classroom and item writing; and it should be an additional part of the existing INSET modules developed under SMASEE.

Thus the two preconditions have been gradually and strategically cleared to qualify MSIC Experts as national trainers on educational assessment.

7.1.3 Management and Maintenance of the Item Pools

As agreed by stakeholders of LAMS, MSIC will own and manage the Item Pools developed by LAMS. Maintaining the Item Pools is a very crucial task because any item pool will lose its value very quickly if it is not well maintained by continuously adding better items and enlarging its size. Currently, however, MSIC is not yet officially mandated to do this job, particularly item development, as routine. The maintenance of the Item Pools is hence a very important issue LAMS should consider. As far as MSIC is not officially and explicitly assigned to item development, it seems difficult to maintain the Item Pools and, further, improve them.

However, there is one way to circumvent it. Suppose MSIC can conduct INSET training on educational assessment. The training will invite the participating teachers to develop items on their own. Then MSIC will review them and select good items to add to the Item Pools. This way, the Item Pools can be improved and enlarged on a regular basis. The idea above that MSIC will give INSET training on educational assessment after LAMS is thus a feasible solution to the difficult question of Item Pool maintenance as well.

7.1.4 Students' Low Achievement

Through activities under LAMS, one fact has been revealed time and again: students' academic achievement is generally low. It was out of the scope of LAMS to directly tackle this problem but nonetheless this fact has led us to think of how to improve this worrisome situation. Some proposals are described later in Section 7.3.2 focusing on Mathematics education particularly at lower grades. We have focused on Mathematics because it is the subject at the basis of all science subjects and, eventually, technology and industry. If Ethiopia aspires to push industrial development further to achieve the status of middle-income country by 2025, mathematics education needs to be thoroughly reformed to educate young generations more efficiently with this subject.

7.2 Lessons

7.2.1 Workbook Development as a Creative Assignment

According to the R/D, CDID is mainly responsible for developing subject-wise Workbooks for Grades 7 and 8 [Output 4]. However, LAMS has modified this framework and arranged things so that all Workshop participants jointly developed the Workbooks. This modification was a result of CDID's specific request in consideration of its severe capacity constraint given only one expert per subject.

At the beginning, it was worried that Workshop participants might refuse this extra assignment saying that it is not part of their official responsibility. It turned out that the worry was baseless. Participants showed very keen interest in developing the Workbooks. According to the questionnaire survey results, they almost unanimously welcomed this new assignment as an interesting and creative task they have never experienced before. They took this as an intellectual challenge to them.

We can learn one lesson from this outcome: people can take an extra work as a challenge, not a burden, if the work is meaningful and requires creativity.

7.2.2 Item Selection as Effective Training

Under LAMS, most participants at the central level are additionally assigned to item selection either for the Item Pools or for the field test. This particular assignment is meant to be part of their training on item writing skills. To select good items is equivalent to distinguish good items from poor items and to point out what are inadequate with the poor items. By selecting hundreds of items, they go through the process of critically checking them and articulating the reasons for revision or rejection. This intensive process is particularly effective to improve their capacity to "appreciate" and write good question items.

Item selection should therefore be an important and integral part of training to improve item writing skills. Particularly after we introduced the Item Selection Workshop in December 2015, the capacity of those who are assigned to this task seems to show steady enhancement. They have proved this in the later Workshops.

7.2.3 Effectiveness of the Counterpart Training

Since various organizations work for LAMS, the training program was so designed as to cover various topics and issues to meet their organizational concerns. The four objectives of the training indicate this particular intention:

1) To understand that textbooks, learning materials and national examinations are prepared consistently with the national curriculum;
2) To understand how question items for the National Learning Assessment and TIMSS are developed and how the test results are reflected in the national education policy;
3) To understand how classroom assessment is done in Japanese schools; and
4) To understand the theory and basic methods of educational evaluation and measurement.

According to the questionnaire answers collected at the end of the course, all participants favorably judged that they had accomplished the four objectives and expressed a high satisfaction of their needs. Moreover, participants made some noteworthy comments on how they would apply the knowledge gained in Japan to their professional work in Ethiopia. Among them:

- To analyze National Examinations results thematically for the purpose of informing the policy makers (so that the policy makers can revise curriculum and develop examinations referring to it);
- To ensure the curriculum alignment with other components of the education system;
- To participate in the international assessments, PISA or SACMEQ;
- To limit the number of items in test to minimum as much as possible;
- To publicize assessment results as early as possible and as much to all stakeholders as possible;
- To pay due attention to higher order thinking skills while test item writing;
- To enrich the existing classroom assessment manual for Ethiopian primary and secondary school teachers so that it contains Japanese-style group learning as well as teacher's day-to-day classroom management; and
- To refer to the Japanese practice where commitment and dedication of the education

experts are high at all levels of the education system, especially the contribution of the private companies.

There was another positive impact of the training on the future project management. Among these first-group participants were many members of the National Steering Committee and Technical Committee of the Project. They shared the same knowledge and ideas through this training course. Shared visions and knowledge would facilitate easier collaboration among the counterpart organizations. Some of their knowledge and experiences obtained in Japan have been further disseminated to all Working Group members in the subsequent Workshops.

7.3 Proposals

7.3.1 Reorganization of the INSET Curriculum

The INSET curriculum developed by SMASEE and detailed in the five-book modules contains one session on classroom assessment for respective subjects. This session emphasizes the importance of formative assessment and explains possible methods and techniques for teachers to use in the classroom. However, it does not touch on how to write question items appropriate for formative assessment, possibly due to time constraint.

According to LAMS inception survey results, 79% of surveyed teachers write question items for themselves to give their students in the class. However, as pointed out in Section 7.1.1 above, most items may not be suitable for formative assessment. Ethiopian teachers should be trained on how to write question items appropriate for every-day classroom assessment. The current INSET curriculum should be reorganized to accommodate these needs, by expanding the classroom assessment session to include this specific subject. The INSET module developed under LAMS as Output 5 can be used directly for this purpose.

It is strongly recommended and proposed to reorganize the INSET curriculum to deal with classroom assessment (formative assessment) more explicitly. At the same time, it is necessary as well to train the Experts (National Trainers) at MSIC to be capable of giving practical training on this topic. With this specific need in mind, LAMS has tried to capacitate them through facilitation roles in the Workshops, item selection for the field test and special training on item analysis.

7.3.2 Reform of the Mathematics Curriculum, Textbooks and Classroom Lessons for Low Graders

Throughout LAMS, we have been surprised and worried by the low achievement of many Grade 7 and Grade 8 students. We were first shocked by the results of a mock achievement test we conducted as part of the inception survey in early 2015. The students' academic performance was far lower than we expected. The subsequent field tests again and again revealed that many students did not master even the very basic knowledge they should have learned at lower grades. This failure was particularly severe with Mathematics.

We can easily understand that such students' poor performances at Grade 7 or Grade 8 did not begin recently. Their low achievements are the accumulated results of continuous failure to understand what they were taught at lower grades, very possibly at Grade 1.

This inference was verified by a research report published by MSIC in August 2016.[19] The research surveyed the arithmetical ability of Grade 1 to Grade 4 students throughout Ethiopia. As Table 7.3.1 indicates, their generally low rates of correct answer should be taken as alarming.

[19] Mathematics and Science Education Improvement Center. (2016). *Research on basic arithmetic (grade 1 – 4)*. Addis Ababa: MSIC.

Table 7.3.1 Rate of Correct Answers by Grade 1 to Grade 4 (%)

	Grade 1	Grade 2	Grade 3	Grade 4
2 + 3	84	90	94	96
13 + 5	58	73	81	87
50 + 40	44	66	80	88
8 - 4	52	68	77	86
9 - 7	46	59	69	81
70 - 30	37	54	66	76
2 x 3	37	51	64	76
2 x 8	27	43	59	71
4 ÷ 2	45	60	73	79
18 ÷ 2	26	32	45	55

Source: MSIC (2016), pp.18-20.

If a student did not completely master these simple operations at Grade 1, it should be almost impossible for the student to understand higher level of mathematical concepts and operations in later years. Grade 7 and 8 students' poor performances should be remedied starting from Grade 1 contents.

Why do so many Grade 1 pupils fail to do such basic calculations? There should be many factors contributing to this phenomenon both on the school's side and on the pupil's side. If we focus on the school's side, three main factors may be cited:

1 The curriculum is inappropriate.
2 The textbook is inappropriate.
3 Teachers' teaching is inappropriate.

A few examples of each shortcoming will follow.

The curriculum is inappropriate. The most critical shortcoming of the current syllabus for Grade 1 is the lack of explanation about the decimal system. Pupils are not taught what 2 and 7 means in the number, 27. Instead, the syllabus classifies the whole numbers into three categories: from 0 up to 9, from 0 up to 20, and from 0 up to 100. Within respective categories, pupils are asked to add or subtract numbers basically by counting, without referring to the logic and structure of the decimal system.[20] This way of introducing addition and subtraction is totally inappropriate.

The current syllabus has other deficiencies in view of mathematics education. It tries to teach Grade 1 pupils multiplication and division of whole numbers by 2. This partial treatment of multiplication and division does not seem beneficial to pupils at all. Pupils should be taught the logic of multiplication (or division) all at once. There is no mathematical meaning in treating multiplication by 2 separately from multiplication by 3 or 4 or 5. The syllabus also tries to introduce basic fractions (halves and quarters). This is another example of partial treatment of topics, which does not seem effective. Since the syllabus is highly voluminous having 12 units in total, its contents should be sifted out to make it lean and appropriate for Grade 1 pupils. It should be better to give Grade 1 pupils more time to repeatedly exercise the basic operations of addition and subtraction than to partially introduce advanced concepts like multiplication, division or fractions.

The textbook is inappropriate. If the syllabus has such deficiencies, the textbook cannot escape from them. The lack of clear explanation of the decimal system is reflected in the textbook. This may be the reason why some students even in higher grades still count tallies

[20] The concept of the decimal system is first introduced (though very vaguely) at Grade 3 when pupils learn to "represent a 3-digit number as the sum of a multiple of 100 and a multiple of 10 and a 1-digit number" and "represent a 3-digit number using a place value table." (Mathematics Syllabus Grade 3, Unit 1: The whole numbers up to 10,000 and their order). When pupils learn how to add or subtract two numbers with carrying or borrowing at Grade 2, there is no explanation about the meaning of 1 to carry to or borrow from the second digit. (Mathematics Syllabus Grade 2, Unit 1: Addition and subtraction up to 100).

in solving (or trying to solve) problems like 18+35 or 72÷12.

Teachers' teaching is inappropriate. Another factor contributing to pupils' low performance should be teachers' way of teaching. It is very common in Ethiopian classrooms that teacher simply copies the contents of the textbook on the blackboard. It is also common that teachers almost neglect slow learners. If a pupil stumbles over some topic like subtraction with borrowing, teacher rarely takes care of the pupil by giving additional explanation or repeating the topic from the beginning for the whole class. Such pupils will be eventually left over even at Grade 1.

For Ethiopia to improve its mathematics education, substantial reform is necessary beginning with Grade 1. The syllabi need to be thoroughly revised from Grade 1 to Grade 8. The textbooks should be rewritten accordingly. Teachers should be given additional training or orientation not only about how to better teach but also about how to take care of all pupils in the class. No such reform will be easy or can be done overnight. Nonetheless, improvement is absolutely necessary starting from low grades, particularly Grade 1.

APPENDIX

APPENDIX 1 PROJECT DESIGN MATRIX (Original)

Project Title: Project for Capacity Development for Improving Learning Achievement in Mathematics and Science Education in Ethiopia

Duration: 3 years: tentatively from August 2014 to August 2017**.**

Target Group: (Direct beneficiary group) NEAEA, MSIC, CDID, TELDD, TELLRD and REBs.

(Indirect beneficiary group)Teachers in primary and secondary education, CTE instructors, Students

Target subjects and grades: Mathematics and Science in primary and lower secondary education. (1st Cycle)

Target Area: Nationwide

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Super Goal Students' learning achievement at Grade 7 and 8[i] is improved.	1. Improvement of the results of Primary School Leaving Certificate Examination (PSLCE) in mathematics and science. 2. Improvement of the results of National Learning Assessment (NLA).	1. Result of PSCLE by REBs and NEAEA 2. Result of NLA by NEAEA	
Overall Goal Pedagogical basic foundation is prepared mainly at Grade 7 and 8 to improve students' learning achievement.	1. "Workbook" developed by the Project are distributed to schools. 2. "Assessment and Evaluation session module on mathematics and science education" is utilized at CTE and Inset.	1. MoE and REBs reports. 2. Interview with related directorates and REBs.	1. Quality of question items of PSLCE in mathematics and science, and NLA is improved based on the outputs of the project.
Project Purpose Quality of curriculum strategy to improve students' learning achievement in mathematics and science education at target grades is enhanced under curriculum consistency.	3. Understandings on quality of curriculum policy under curriculum consistency in mathematics and science education are deepened among the stakeholders. 4. Materials developed by the Project have curriculum consistency.	1. Project reports 2. Project reports	1. The Ethiopian Government fund is utilized for the outputs of the project, such as printing and distribution of the materials developed by the project and preset and inset. 2. Mathematics and Science textbooks are distributed nationwide.
Output 1:(Subject WGs' members) Capacity of Subject WGs' members on mathematics and science education are enhanced	1. Improvement of M&E results of the trainings and WS in terms of the following contents[ii]; (1) Participants' performance (2) Satisfaction toward the contents of the trainings and WS by the participants. 2. Relevance of the quality of question items of Item Pool is secured through validation process.	1. Project reports 2. Project reports	1. Collaborative activities among stakeholders are maintained.

Output 2 :(Subject WGs' and Assessment and Evaluation WGs' members) Item pool in mathematics and science education for Grade 7 and 8, and Sample Item pool in mathematics and science education for Grade 4 and 10 are developed.	1. Improvement of M&E results of the trainings and WS in terms of the following contents; (1) Participants' performance based on concrete question items developed by the participants. (2) Satisfaction toward the contents of the trainings and WS by the participants. 2. "Item pool" is allocated in accessible way for all related stakeholders. 3. "Item Pool" is utilized by related stakeholders	1. Project reports 2. Project reports 3. Project reports	
Output 3:(mainly NEAEA and REBs) Capacity of the following human resources on development of Item Banks is enhanced. - Item writers and experts for "NLA Item Bank on mathematics and science education for Grade 4, 8 and 10 (NEAEA)" - Subject experts for "PSLCE Item Bank on Mathematics and Science for Grade 8 and Ethiopian General Secondary Education Certificate Examination (EGSECE) in Grade 10 (NEAEA) " -Item writers for " PSLCE items for Grade 8 (REBs)"	1. Improvement of M&E results of the trainings and WS in terms of the following contents; (1)Participants' performance (2)Satisfaction toward the contents of the trainings and WS by the participants. 2. Improvement of the results of M&E of WG's sessions related to Output 3.	1. Project reports 2. Project reports	
Output 4:(mainly CDID) "Workbooks on mathematics and science for Grade 7 and 8" are developed.	1. Relevance of the quality of the product is secured through validation process. 2. Endorsement by MoE.	1. Project report 2. MoE	
Output 5:(mainly MSIC) "Assessment session module on mathematics and science education for Grade 7 and 8" based on "Item Pool for Grade 7 and 8", as one of the CPD modules, is elaborated.	1. Relevance of the quality of the product is secured through validation process. 2. Endorsement by MoE.	1. Project report 2. MoE	
Output 6:(mainly TELDD) "Assessment session module on mathematics and science education for Grade 7 and 8" based on "Item Pool for Grade 7 and 8", as one of the CTE modules, is elaborated.	1. Relevance of the quality of the product is secured through validation. 2. Endorsement by MoE.	1. Project report 2. MoE	
Output 7:(mainly CDID , MSIC and TELDD) Action plans, clarifying the utilization of developed materials, are prepared.	1. Approval by MoE.	1. MoE	
Activities	**Inputs**		1. Members of the WGs are not

1-1. Plan WG's trainings and WS. 1-2. Coordinate WG's trainings and WS. 1-3. Conduct Subject WG's trainings and WS. 1-4. Monitor and evaluate the results of the Subject WG's trainings and WS. 2-1. Trainings on development of question items for Item Pool. 2-2. Consolidate the procedure of development of Item Pool. 2-3. Draft question items for Grade 8. 2-4. Validate on reliance and relevance of drafted question items for Grade 8. 2-5. Finalize question items for Grade 8. 2-6. Draft question items for Grade 7. 2-7. Validate on relevance of drafted question items for Grade 7. 2-8. Finalize question items for Grade 7. 2-9. Draft sample question items for Grade 10. 2-10. Validate on reliance and relevance of drafted sample question items for Grade 10. 2-11. Finalize sample question items for Grade 10. 2-12. Draft sample question items for Grade 4. 2-13. Validate on reliance and relevance of drafted sample question items for Grade 4. 2-14. Finalize sample question items for Grade 4. 3-1. Plan Assessment and Evaluation WG's trainings and WSs. 3-2. Coordinate Assessment and Evaluation WG's trainings and WSs. 3-3. Conduct Assessment and Evaluation WG's trainings and WSs. 3-4. Monitor and evaluate Assessment and Evaluation WG's trainings and WSs. 3-5. (To be determined) Activities for improving quality of mathematics and science Item bank. 4-1. Establish editing concept of Workbook. 4-2. Consolidate development procedure. 4-3. Draft Workbook for Grade 8. 4-4. Validate drafted Workbook for Grade 8 at classroom level. 4-5. Finalize Workbook for Grade 8. 4-6. Draft Workbook for Grade 7. 4-7. Validate drafted Workbook for Grade 7 at classroom level. 4-8. Finalize Workbook for Grade 7. 5-1. Establish editing concept of the modules. 5-2. Consolidate development procedure. 5-3. Draft module for Grade 8, based on the Item Pool for Grade 8. 5-4. Validate drafted module for Grade 8. 5-5. Finalize the module for Grade 8.	Inputs by the Japanese Side • Experts from Japan -Chief adviser -Mathematics education -Science education (Chemistry, Biology and Physics) -Educational Assessment/Test development -Project coordinator/Public Relation • Expert Activity cost • Activity costs related to Workshop in WG • Necessary Equipment for the project activities • Necessary cost for Trainings in Japan and third countries Inputs by the Ethiopian Side • Counterparts (C/P) -Project Manager (State Minister) -Project Coordinator -Related officers in NEAEA -Related officers in Curriculum -Related officers in TELDD -Related officers in TELLRD -Related officers in MSIC -Related officers in REBs • Assignment of specialists (subject expert, item developers/writes), and Assessment and Evaluation specialists/ experts as WG members at Federal and REBs level. • Assignment of appropriate number of primary and secondary schools for validation of Item Pool and other related materials. • Necessary cost for implementation of all related activities which each directorate and REB plan and implement, such as teacher trainings, printing and distribution of materials etc. • Translation cost of final products of the Project from English to local language.	changed. 2. Members of the WGs continue participating the respective trainings and WSs. **Pre-Conditions** 1. The current Curriculum

5-6. Draft module for Grade 7, based on the Item Pool for Grade 7. 5-7. Validate drafted module for Grade 7. 5-8. Finalize the module for Grade 7. 6-1. Establish editing concept of the modules. 6-2. Consolidate development procedure. 6-3. Draft module for Grade 8, based on the Item Pool for Grade 8. 6-4. Validate drafted module for Grade 8. 6-5. Finalize the module for Grade 8. 6-6. Draft module for Grade 7, based on the Item Pool for Grade 7. 6-7. Validate drafted module for Grade 7. 6-8. Finalize the module for Grade 7. 7-1. Define scaling up strategy of how to utilize materials developed by the project. 7-2. Develop action plan for scaling up. 7-3. Obtain approval of the action plan.	• Project office with its running cost. • Necessary cost to conduct National Steering Committee and Technical Committee.	(Active learning and Competency based approach) is maintained. 2. Appropriate members are assigned to Subject and Assessment and Evaluation WGs.

[i] "Grade 7 and 8" are set as target grades of the initial stage of the strategy under curriculum consistency to be focused on in the Project. It is expected that other grades will be set as target grades after completion of the Project by the Ethiopian side.

[ii] Appropriate indicators will be determined in feasible way, after commencement of the project.

APPENDIX 2 PROJECT DESIGN MATRIX (Revised)

Project Title: Project for Capacity Development for Improving Learning Achievement in Mathematics and Science Education in Ethiopia
Duration: 3 years: from October 2014 to September 2017
Target Group: (Direct beneficiary group) NEAEA, MSIC, CDID, TELDD, and REBs
(Indirect beneficiary group)Teachers in primary and secondary education, CTE instructors, Students
Target subjects and grades: Mathematics and Science in primary and lower secondary education (1st Cycle)
Target Area: Nationwide

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Super Goal Students' learning achievement at Grade 7 and 8[i] is improved.	3. Improvement of the results of Primary School Leaving Certificate Examination (PSLCE) in mathematics and science. 4. Improvement of the results of National Learning Assessment (NLA).	3. Result of PSLCE by REBs and NEAEA 4. Result of NLA by NEAEA	
Overall Goal Pedagogical basic foundation is prepared mainly at Grade 7 and 8 to improve students' learning achievement.	3. "Workbook" developed by the Project are distributed to schools. 4. "Assessment and Evaluation session module on mathematics and science education" is utilized at CTE and Inset.	3. MoE and REBs reports 4. Interview with related directorates and REBs	2. Quality of question items of PSLCE in mathematics and science, and NLA is improved based on the outputs of the project.
Project Purpose Quality of curriculum strategy to improve students' learning achievement in mathematics and science education at target grades is enhanced under curriculum consistency.	5. Materials developed by the Project have curriculum consistency. 6. Understandings on quality of curriculum policy under curriculum consistency in mathematics and science education are deepened among the stakeholders. **Workshop participants' understanding about the importance of curriculum consistency in terms of the rate of participants who strongly agreed with its importance:** **In 2014 28.6%** **In 2017 50%**	3. Project reports and Workshop Questionnaires 4. Project reports	3. The Ethiopian Government fund is utilized for the outputs of the project, such as printing and distribution of the materials developed by the project and preset and inset. 4. Mathematics and Science textbooks are distributed nationwide.
Output 1: Capacity of Subject WGs' members on mathematics and science education and the following human resources on development of Item Banks is enhanced. - Item writers and experts for "NLA Item Bank on mathematics and science education for Grade 4, 8 and 10 (NEAEA)" - Subject experts for "PSLCE Item Bank on Mathematics and Science for	2. Improvement of M&E results of the trainings and WS in terms of the following contents[ii]; (3) Participants' performance **i) Among the field-tested items, the percentage of items satisfying the two conditions below increases:** **Difficulty >= 0.25**	3. Project reports and Workshop Questionnaires 4. Project reports 5. Project reports and Workshop Questionnaires	2. Collaborative activities among stakeholders are maintained.

Grade 8 and Ethiopian General Secondary Education Certificate Examination (EGSECE) in Grade 10 (NEAEA) ” -Item writers for “ PSLCE items for Grade 8 (REBs)”	**Discrimination index >= 0.10** **For items developed by the members of 5 WGs in WS2: 52.0%** **For items developed by the members of 5 WGs in WS7: 70.0% (see Appendix 1)** **ii) Quality of field-tested items improves in terms of the average score of item quality evaluation (see Appendix 2):** **For items developed by the members of 5 WGs in WS2: 3.35** **For items developed by the members of 5 WGs in WS7: 4.00** (4) Satisfaction toward the contents of the trainings and WS by the participants **Satisfied 5 WG members in WS7 and WS8 80%** 3. Relevance of the quality of question items of Item Pool is secured through validation process. 4. Improvement of the results of M&E of WG’s sessions related to Output 1.		
Output 2 :(Subject WGs’ and Assessment and Evaluation WG’s members) Item pool in mathematics and science education for Grade 7 and 8, and Sample Item pool in mathematics and science education for Grade 4 and 10 are developed.	1. “Item pool” for Grades 7 and 8 is developed in the form of database. 2. ”Item pool” is allocated in accessible way for all related stakeholders.	4. Project reports 5. Project reports	
Output 4:(mainly CDID) “Workbooks on mathematics and science for Grade 7 and 8” are developed.	1. Relevance of the quality of the product is secured through validation process. 2. Endorsement by MoE.	1. Project report 2. MoE	
Output 5:(mainly MSIC) “Assessment session module on mathematics and science education for Grade 7 and 8” based on “Item Pool for Grade 7 and 8”, as one of the CPD modules, is elaborated.	1. Relevance of the quality of the product is secured through validation process. 2. Endorsement by MoE.	1. Project report 2. MoE	
Output 6:(mainly TELDD) “Assessment session module on mathematics and science education for Grade 7 and 8” based on “Item Pool for Grade 7 and 8”, as one of the CTE modules, is elaborated.	1. Relevance of the quality of the product is secured through validation. 2. Endorsement by MoE.	1. Project report 2. MoE	

Output 7:(mainly CDID, MSIC and TELDD) Action plans, clarifying the utilization of developed materials, are prepared.	2. Approval by MoE.	1. MoE	
Activities	**Inputs**		3. Members of the WGs are not changed. 4. Members of the WGs continue participating the respective trainings and WSs.
1-1. Plan WG's trainings and WS. 1-2. Coordinate WG's trainings and WS. 1-3. Conduct Subject WG's trainings and WS. 1-4. Monitor and evaluate the results of the Subject WG's trainings and WS. 2-1. Trainings on development of question items for Item Pool. 2-2. Consolidate the procedure of development of Item Pool. 2-3. Draft question items for Grade 8. 2-4. Validate on reliance and relevance of drafted question items for Grade 8. 2-5. Finalize question items for Grade 8. 2-6. Draft question items for Grade 7. 2-7. Validate on relevance of drafted question items for Grade 7. 2-8. Finalize question items for Grade 7. 2-9. Draft sample question items for Grade 10. 2-10. Validate on reliance and relevance of drafted sample question items for Grade 10. 2-11. Finalize sample question items for Grade 10. 2-12. Draft sample question items for Grade 4. 2-13. Validate on reliance and relevance of drafted sample question items for Grade 4. 2-14. Finalize sample question items for Grade 4. 3-1. Plan Assessment and Evaluation WG's trainings and WSs. 3-2. Coordinate Assessment and Evaluation WG's trainings and WSs. 3-3. Conduct Assessment and Evaluation WG's trainings and WSs. 3-4. Monitor and evaluate Assessment and Evaluation WG's trainings and WSs. 3-5. (To be determined) Activities for improving quality of mathematics and science Item bank. 4-1. Establish editing concept of Workbook. 4-2. Consolidate development procedure. 4-3. Draft Workbook for Grade 8. 4-4. Validate drafted Workbook for Grade 8 at classroom level. 4-5. Finalize Workbook for Grade 8. 4-6. Draft Workbook for Grade 7. 4-7. Validate drafted Workbook for Grade 7 at classroom level. 4-8. Finalize Workbook for Grade 7.	Inputs by the Japanese Side • Experts from Japan -Chief adviser -Mathematics education -Science education (Chemistry, Biology and Physics) -Educational Assessment/Test development -Project coordinator/Public Relation • Expert Activity cost • Activity costs related to Workshop in WG • Necessary Equipment for the project activities • Necessary cost for Trainings in Japan and third countries Inputs by the Ethiopian Side • Counterparts (C/P) -Project Manager (State Minister) -Project Coordinator -Related officers in NEAEA -Related officers in CDID -Related officers in TELDD -Related officers in MSIC -Related officers in REBs • Assignment of specialists (subject expert, item developers/writes), and Assessment and Evaluation specialists/ experts as WG members at Federal and REBs level. • Assignment of appropriate number of primary and secondary schools for validation of Item Pool and other related materials. • Necessary cost for implementation of all related activities which each directorate and REB plan and implement, such as teacher trainings, printing and distribution of materials etc. • Translation cost of final products of the Project from English to local language. • Project office with its running cost. • Necessary cost to conduct National Steering Committee and Technical Committee.		

5-1. Establish editing concept of the modules. 5-2. Consolidate development procedure. 5-3. Draft module for Grade 8, based on the Item Pool for Grade 8. 5-4. Validate drafted module for Grade 8. 5-5. Finalize the module for Grade 8. 5-6. Draft module for Grade 7, based on the Item Pool for Grade 7. 5-7. Validate drafted module for Grade 7. 5-8. Finalize the module for Grade 7.		**Pre-Conditions** 3. The current Curriculum (Active learning and Competency based approach) is maintained. 4. Appropriate members are assigned to Subject and Assessment and Evaluation WGs.
6-1. Establish editing concept of the modules. 6-2. Consolidate development procedure. 6-3. Draft module for Grade 8, based on the Item Pool for Grade 8. 6-4. Validate drafted module for Grade 8. 6-5. Finalize the module for Grade 8. 6-6. Draft module for Grade 7, based on the Item Pool for Grade 7. 6-7. Validate drafted module for Grade 7. 6-8. Finalize the module for Grade 7.		
7-1. Define scaling up strategy of how to utilize materials developed by the project. 7-2. Develop action plan for scaling up. 7-3. Obtain approval of the action plan.		

[i] "Grade 7 and 8" are set as target grades of the initial stage of the strategy under curriculum consistency to be focused on in the Project. It is expected that other grades will be set as target grades after completion of the Project by the Ethiopian side.

[ii] Appropriate indicators will be determined in feasible way, after commencement of the project.

Appendix 1 to PDM version 2

The following diagrams show the distribution of "difficulty" and "discrimination index" of all field-tested items developed in Workshop 2 (239 items by the four Subject Working Groups and 30 by the Assessment and Evaluation Working Group).

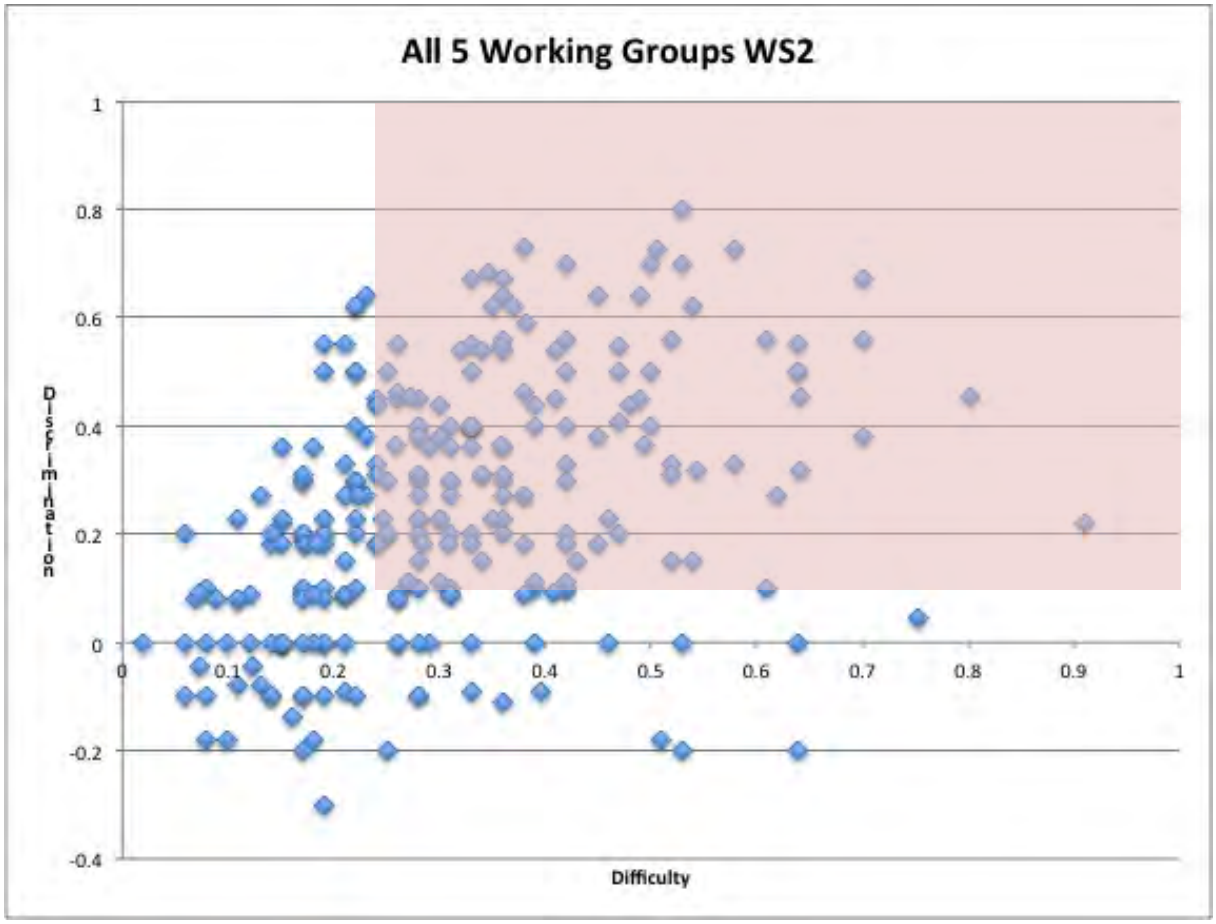
Those items whose difficulty and discrimination index exceeds 0.25 and 0.10, respectively, are considered "acceptable" items:

Difficulty ≧0.25
Discrimination index ≧0.10

Items with a difficulty rate over 0.25 are "acceptable" considering that they are four-option multiple-choice items. Items with a discrimination index over 0.10 are "acceptable" based on the empirical results of LAMS field tests conducted so far. Literature generally recommends that discrimination index should be over 0.20 for an item to be considered "good" but the field test results indicate that even seemingly high-quality items fail to cross this threshold. (It is suspected that Ethiopian students' generally low competencies account for this.) Taking this fact into consideration, we set 0.10 as our minimum level of discrimination index for an item to clear to be thought of as "acceptable."

The shaded area of the diagram below indicates those items. The rate of such "acceptable" items is:

0.52 for the **Five Working Groups** (140/269)



Appendix 2 to PDM version 2

Item Quality Evaluation is intended to evaluate Workshop participants' performance in terms of their item quality using the following method.

For each item, calculate:

Item Evaluation Score = Stem Score + Options Score + Innovation Score

Where

Stem Score = 0, 1, 2

Options Score = 0, 1, 2

Innovation Score = 0, 1, 2

Stem Score evaluates stem's clarity, appropriateness, English, and so on.

Options Score evaluates options' appropriateness, distractors' effectiveness, plausibility, clarity, logical order, English, and so on.

Innovation Score evaluates the item's presentation and innovativeness.

Thus, the Item Evaluation Score can vary from 0 to 6.

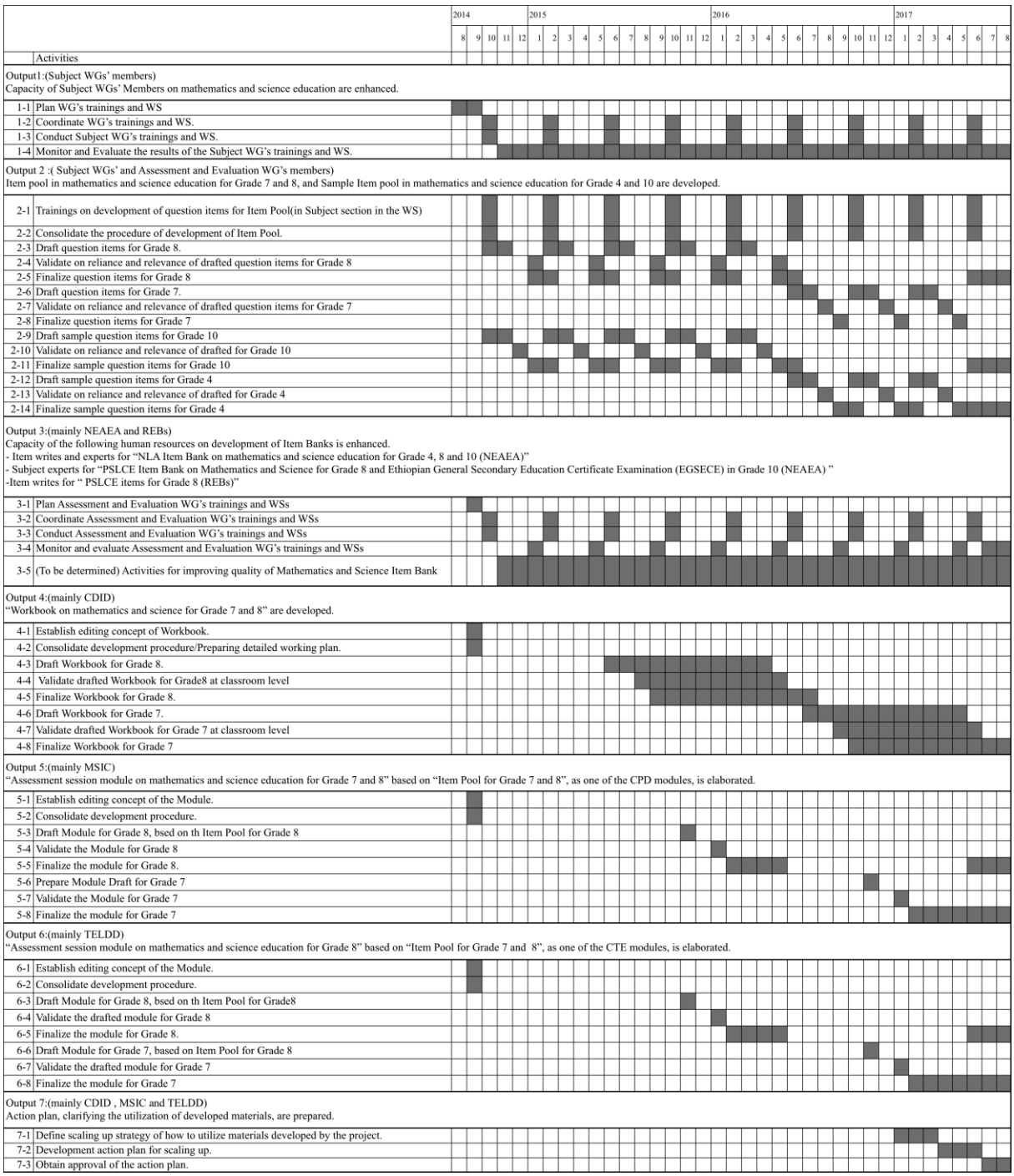
As the subjects, only those items (original version) selected for Field Test will be evaluated. For the items developed in Workshop 2, the average Item Evaluation Score was:

3.35 for the **four Subject Working Groups** (240 items)

3.37 for the **Assessment and Evaluation Working Group** (30 items)

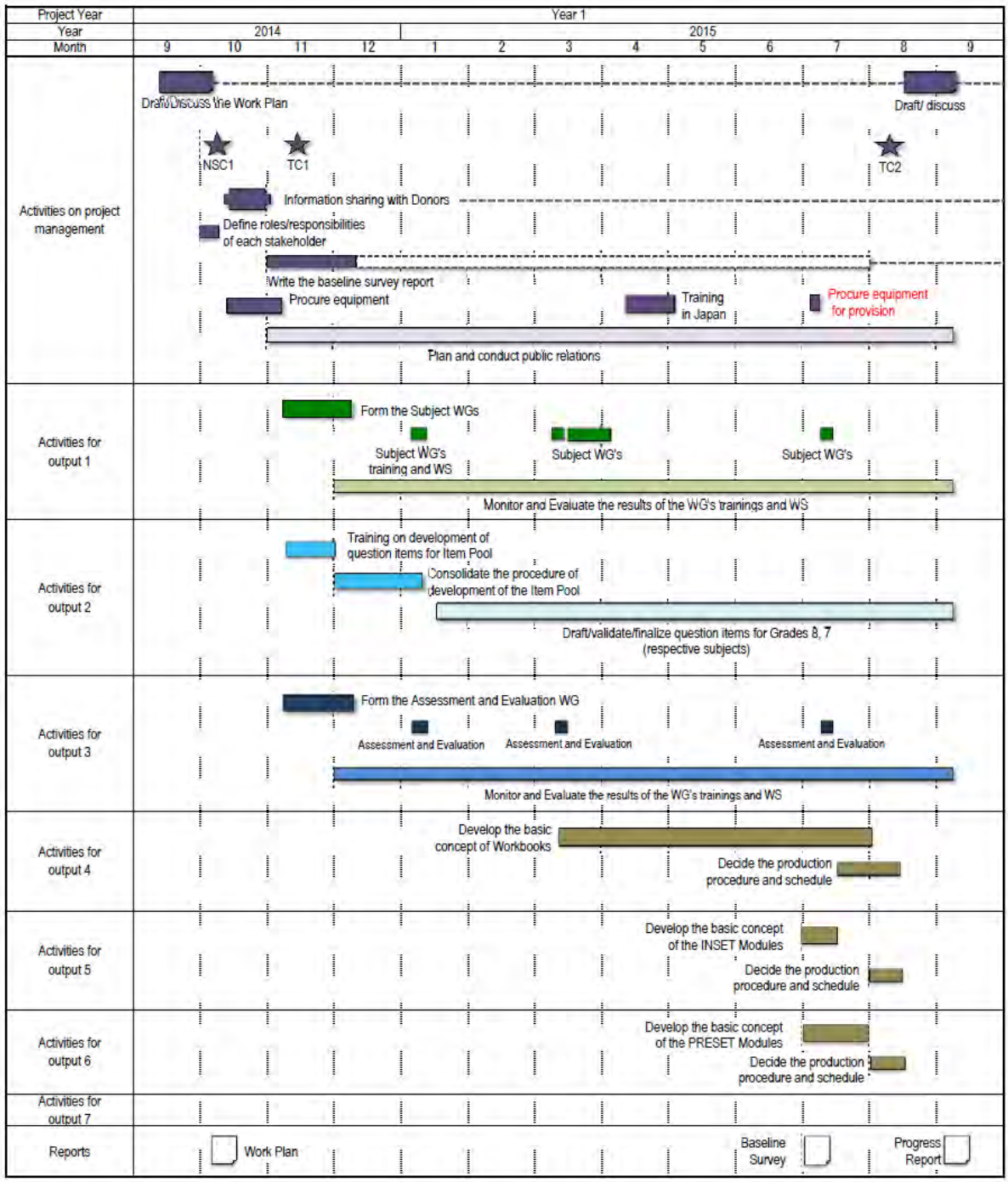
3.35 for the **five Working Groups** combined (270 items)

APPENDIX 3 PLAN OF OPERATION

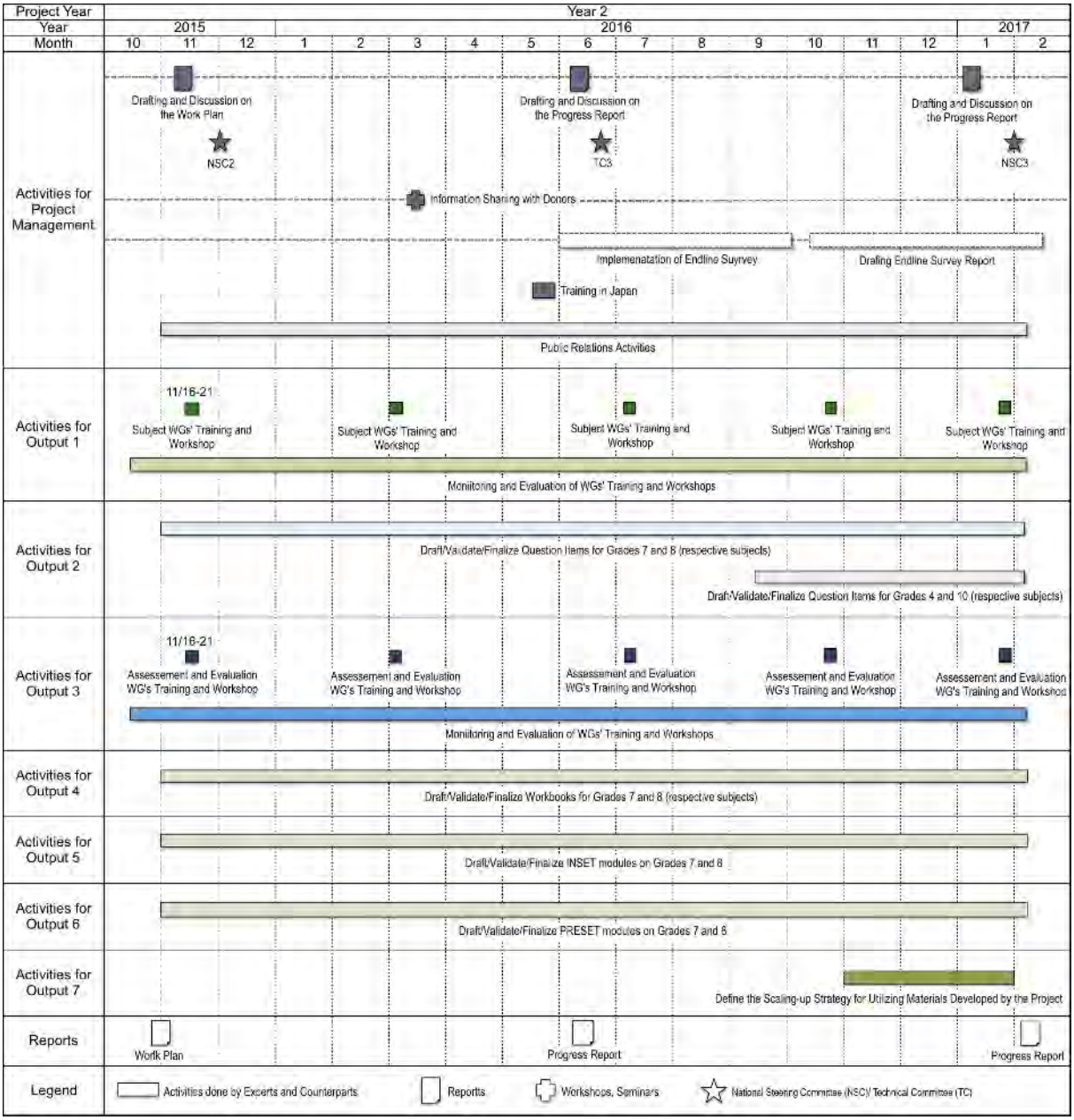


APPENDIX 4 WORK FLOW (Year 1~3)

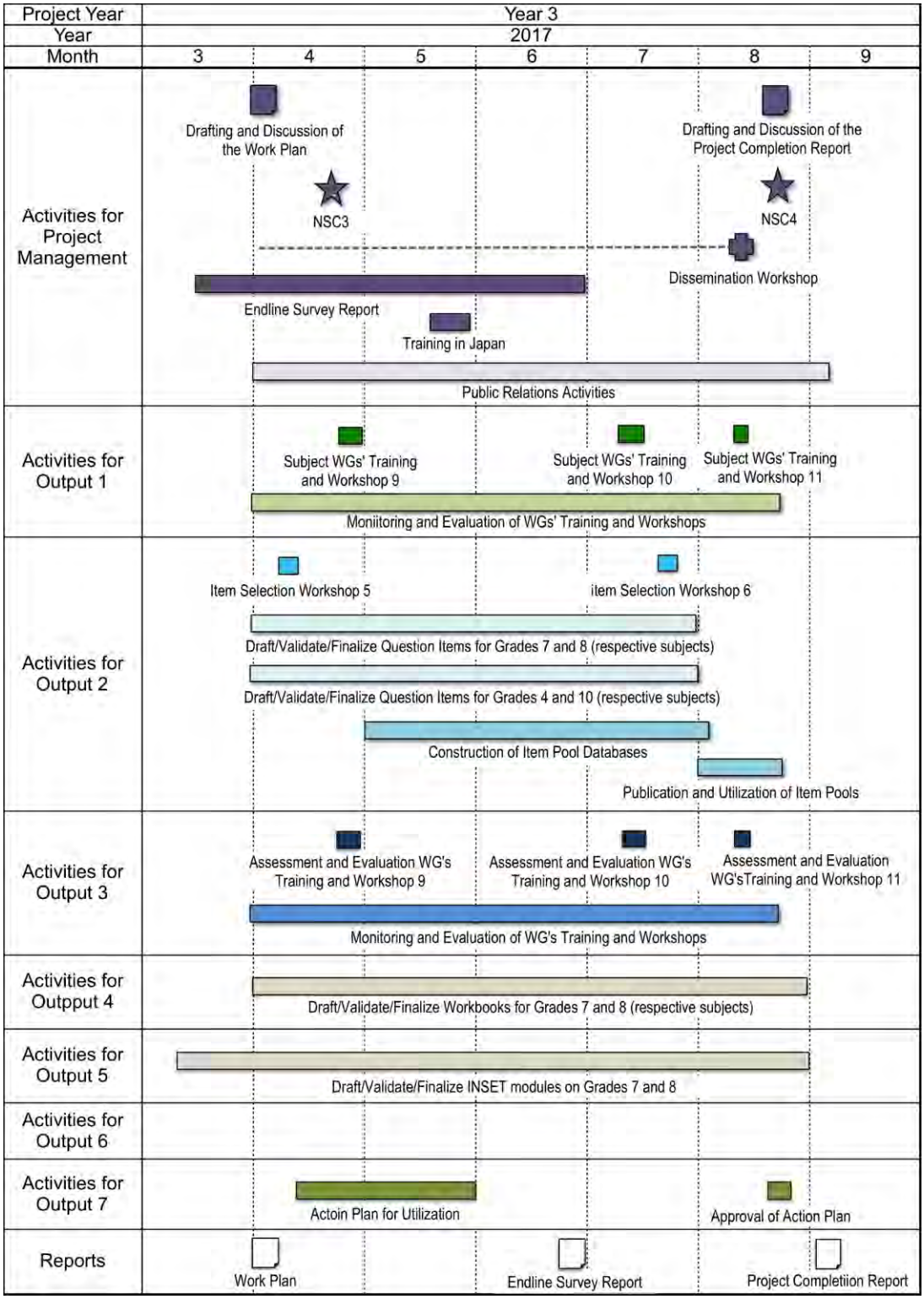
WORK FLOW (Year 1)



WORK FLOW (Year 2)

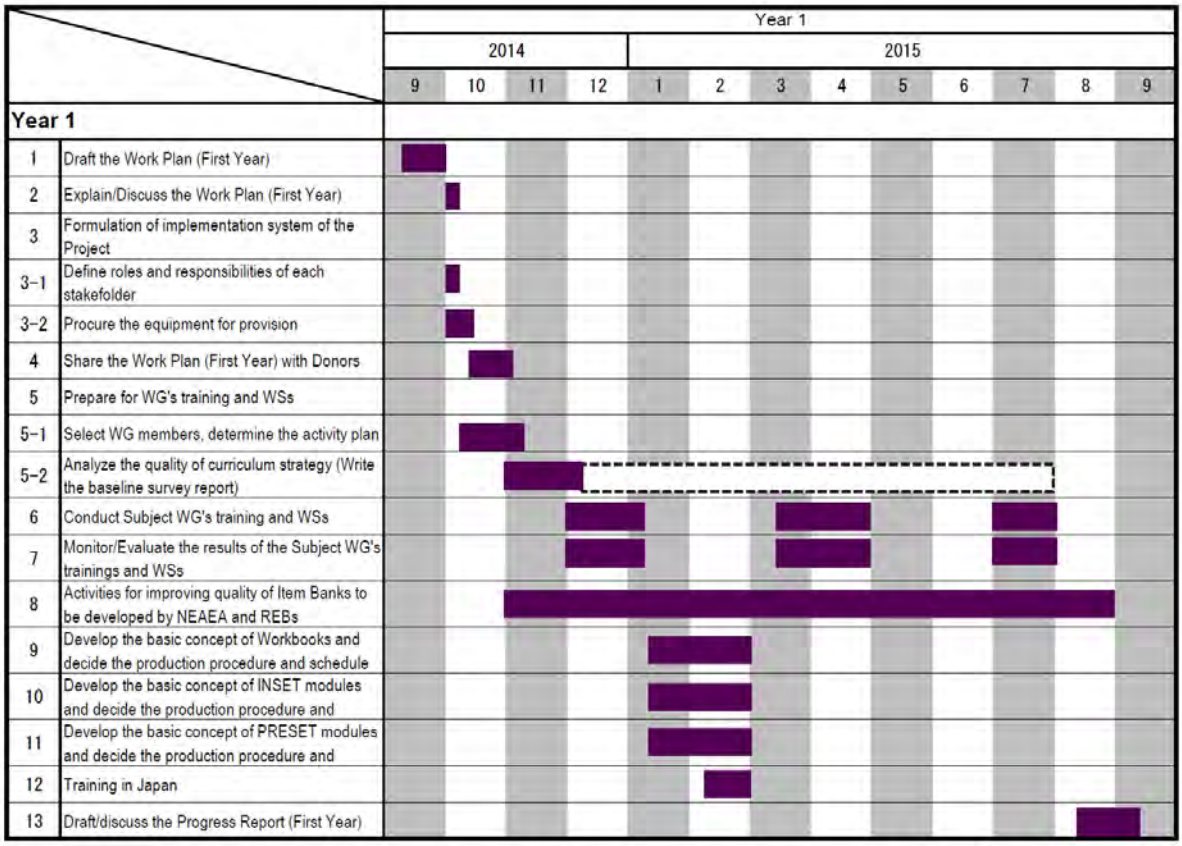


WORK FLOW (Year 3)

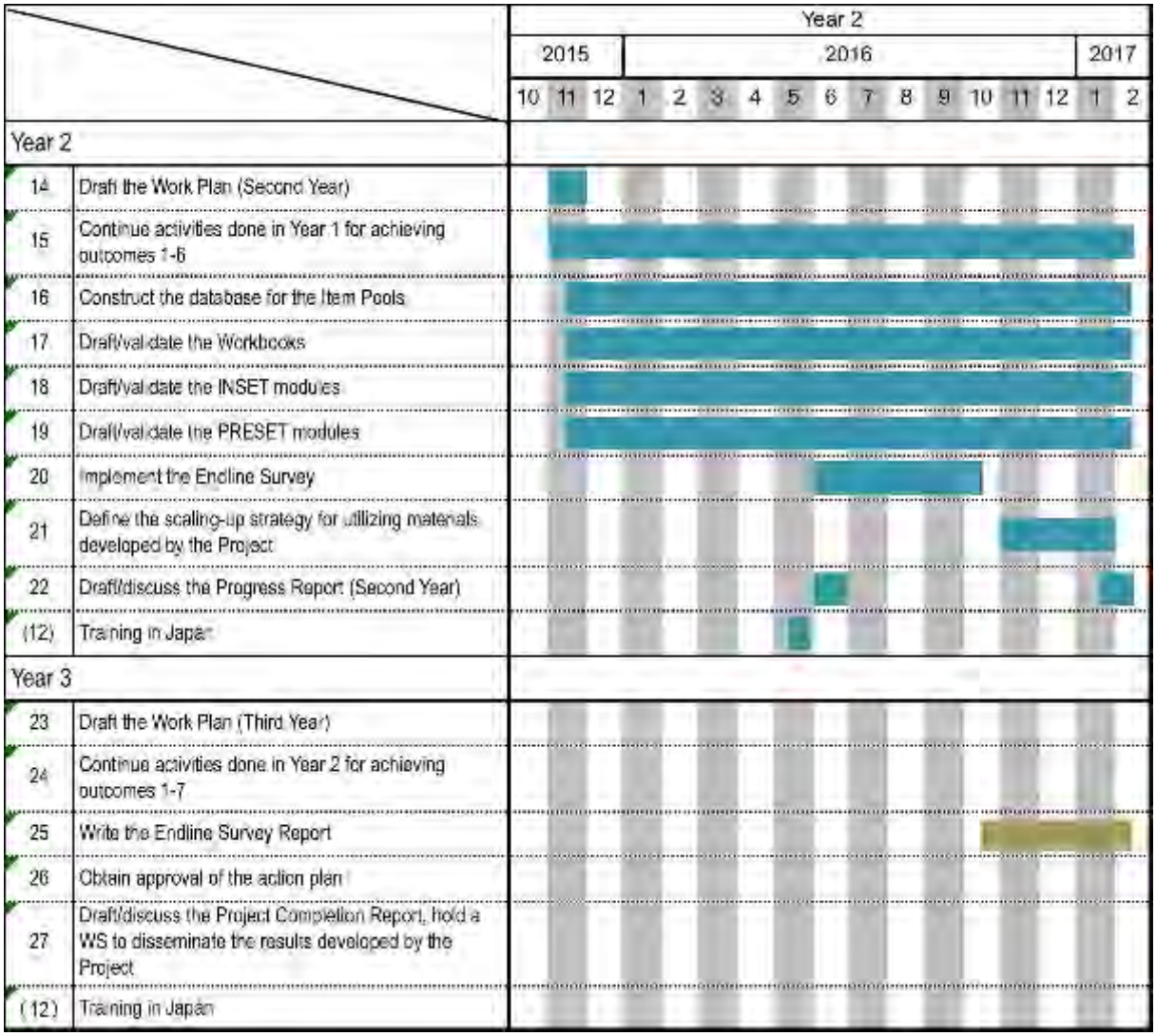


APPENDIX 5 WORK PLAN (Year 1~3)

WORK PLAN (Year 1)



WORK PLAN (Year 2)



WORK PLAN (Year 3)

		Year 3 (2017)						
		3	4	5	6	7	8	9
Year 3								
23	Draft the Work Plan (Third Year)		■					
24	Continue activities done in Year 2 for achieving outcomes 1 - 7		■	■	■	■	■	
25	Write the Endline Survey Report				■			
26	Obtain approval of the action plan		■	■			■	
27	Draft/discuss the Project Completion Report, hold a Workshop to diesseminate the results developed by the Project					■	■	
(12)	Training in Japan			■				

APPENDIX 6 ASSIGNMENT CHART (Year 1~3 Actual)

ASSIGNMENT CHART (Year 1 Actual)

Project for Capacity Development for Improving Learning Achievement in Mathematics and Science Education
LAMS

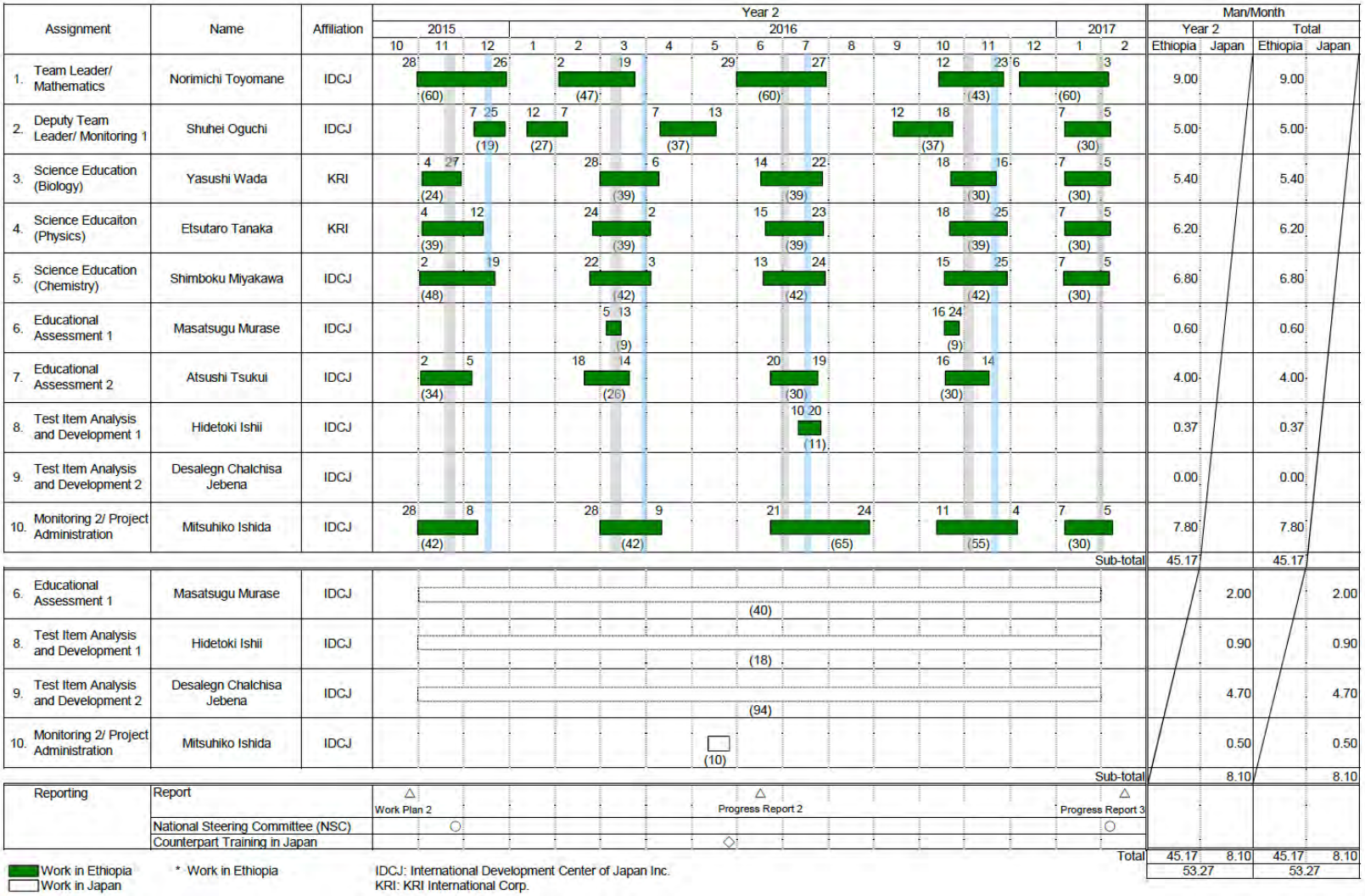
As of 15 August 2015

Assignment	Name	Affiliation	Year 1												Man/Month	
			2014				2015								Year 1 Total	
			9	10	11	12	1	2	3	4	5	6	7	8	9	Ethiopia	Japan
1. Team Leader/ Mathematics	Norimichi Toyomane	IDCJ		3 30 (28)		29	18 (21)	25	(52)	17		29	(76)		12	5.90	
2. Deputy Team Leader/ Monitoring 1	Shuhei Oguchi	IDCJ		22	(47)	7	10 (33)	11			5 17 (13)	31 14 (15)				3.60	
3. Science Education (Biology)	Yasushi Wada	KRI			10 (35)	14		2	(30)	31			28 (28)	25		3.10	
4. Science Education (Chemistry)	Shimboku Miyakawa	IDCJ			30 (39)	7	7		(81)	28			28 (60)	26		6.00	
5. Science Educaiton (Physics)	Etsutaro Tanaka	KRI								4 (43)	15					1.43	
5. Science Educaiton (Physics)	Kotaro Kijima	KRI											12 29 (18)			0.60	
6. Educational Assessment 1	Masatsugu Murase	IDCJ				31	8 (9)									0.30	
7. Educational Assessment 2	Atsushi Tsukui	IDCJ		3 (58)	29		9	26 (49)			30	14 (16) 29		12 (45)		5.60	
8. Test Item Analysis and Development 1	Hidetoki Ishii	IDCJ														0.00	
9. Test Item Analysis and Development 2	Desalegn Chalchisa Jebena	IDCJ								13 (21)	3 *					0.70	
10. Monitoring 2/ Project Administration	Mitsuhiko Ishida	IDCJ		3 (87)		28	2	18 (45)				28	(78)		13	7.00	
															Sub-total	34.23	
2. Deputy Team Leader/ Monitoring 1	Shuhei Oguchi	IDCJ									(4)						0.20
3. Science Education (Biology)	Yasushi Wada	KRI										(8)					0.40
6. Educational Assessment 1	Masatsugu Murase	IDCJ							(30)								1.50
7. Educational Assessment 2	Atsushi Tsukui	IDCJ									(8)						0.40
8. Test Item Analysis and Development 1	Hidetoki Ishii	IDCJ							(20)								1.00
9. Test Item Analysis and Development 2	Desalegn Chalchisa Jebena	IDCJ							(60)						**		3.00
10. Monitoring 2/ Project Administration	Mitsuhiko Ishida	IDCJ								(10)							0.50
															Sub-total		7.00
Reporting	Report		△ Work Plan 1										△ Inception Survey Report		△ Progress Report 1		
	National Steering Committee (NSC)			○											○		
	Counterpart Training in Japan									◇							
															Total	34.23	7.00
																41.23	

Work in Ethiopia
Work in Japan
* Work in Japan
** Work in Ethiopia
IDCJ: International Development Center of Japan Inc.
KRI: KRI International Corp.
Restricted Period due to the Elections

ASSIGNMENT CHART (Year 2 Actual)

Project for Capacity Development for Improving Learning Achievement in Mathematics and Science Education (LAMS)
Year 2



Assignment	Name	Affiliation	Man/Month Year 2 Ethiopia	Year 2 Japan	Total Ethiopia	Total Japan
1. Team Leader/ Mathematics	Norimichi Toyomane	IDCJ	9.00		9.00	
2. Deputy Team Leader/ Monitoring 1	Shuhei Oguchi	IDCJ	5.00		5.00	
3. Science Education (Biology)	Yasushi Wada	KRI	5.40		5.40	
4. Science Educaiton (Physics)	Etsutaro Tanaka	KRI	6.20		6.20	
5. Science Education (Chemistry)	Shimboku Miyakawa	IDCJ	6.80		6.80	
6. Educational Assessment 1	Masatsugu Murase	IDCJ	0.60		0.60	
7. Educational Assessment 2	Atsushi Tsukui	IDCJ	4.00		4.00	
8. Test Item Analysis and Development 1	Hidetoki Ishii	IDCJ	0.37		0.37	
9. Test Item Analysis and Development 2	Desalegn Chalchisa Jebena	IDCJ	0.00		0.00	
10. Monitoring 2/ Project Administration	Mitsuhiko Ishida	IDCJ	7.80		7.80	
		Sub-total	45.17		45.17	
6. Educational Assessment 1	Masatsugu Murase	IDCJ		2.00		2.00
8. Test Item Analysis and Development 1	Hidetoki Ishii	IDCJ		0.90		0.90
9. Test Item Analysis and Development 2	Desalegn Chalchisa Jebena	IDCJ		4.70		4.70
10. Monitoring 2/ Project Administration	Mitsuhiko Ishida	IDCJ		0.50		0.50
		Sub-total		8.10		8.10
Reporting	Report					
	Work Plan 2					
	Progress Report 2					
	Progress Report 3					
	National Steering Committee (NSC)					
	Counterpart Training in Japan					
		Total	45.17	8.10	45.17	8.10
			53.27		53.27	

Work in Ethiopia
Work in Japan

* Work in Ethiopia

IDCJ: International Development Center of Japan Inc.
KRI: KRI International Corp.

ASSIGNMENT CHART (Year 3 Actual)

Project for Capacity Development for Improving Learning Achievement in Mathematics and Science Education (LAMS)
Year 3

As of 24 September 2017

	Assignment	Name	Affiliation	Year 3 2017 Mar	April	May	June	July	Aug	Sept	Oct	Man/Month Year 3 Ethiopia	Year 3 Japan	Total Ethiopia	Total Japan
1.	Team Leader/ Mathematics	Norimichi Toyomane	IDCJ		(38)		(32)		(47)			3.90		3.90	
2.	Deputy Team Leader/ Monitoring 1	Shuhei Oguchi	IDCJ		(13)				(16)			0.97		0.97	
3.	Science Education (Biology)	Yasushi Wada	KRI		(35)			(7)	(27)			2.30		2.30	
4.	Science Educaiton (Physics)	Etsutaro Tanaka	KRI		(30)			(39)	(26)			3.17		3.17	
5.	Science Education (Chemistry)	Shimboku Miyakawa	IDCJ		(30)				(65)			3.17		3.17	
6.	Educational Assessment 1	Masatsugu Murase	IDCJ									0.00		0.00	
7.	Educational Assessment 2	Atsushi Tsukui	IDCJ		(25)			(30)	(20)			2.50		2.50	
8.	Test Item Analysis and Development 1	Hidetoki Ishii	IDCJ									0.00		0.00	
9.	Test Item Analysis and Development 2	Desalegn Chalchisa Jebena	IDCJ									0.00		0.00	
10.	Monitoring 2/ Project Administration	Mitsuhiko Ishida	IDCJ		(19)				(79)			3.27		3.27	
											Sub-total	19.28		19.28	
2.	Deputy Team Leader/ Monitoring 1	Shuhei Oguchi	IDCJ										0.00		0.00
3.	Science Education (Biology)	Yasushi Wada	KRI				(13)		(7)				1.00		1.00
4.	Science Educaiton (Physics)	Etsutaro Tanaka	KRI			(3)	(3)						0.30		0.30
5.	Science Education (Chemistry)	Shimboku Miyakawa	IDCJ			(3)	(3)						0.30		0.30
6.	Educational Assessment 1	Masatsugu Murase	IDCJ				(16)						0.80		0.80
8.	Test Item Analysis and Development 1	Hidetoki Ishii	IDCJ				(10)						0.50		0.50
9.	Test Item Analysis and Development 2	Desalegn Chalchisa Jebena	IDCJ				(40)						2.00		2.00
10.	Monitoring 2/ Project Administration	Mitsuhiko Ishida	IDCJ			(10)							0.50		0.50
											Sub-total		5.40		5.40
	Reporting	Report			△ Work Plan 3			△ Endline Survey	△ DFR		△ Completion Report				
		National Steering Committee (NSC)			○						○				
		Counterpart Training in Japan				◇									
											Total	19.28	5.40	19.28	5.40
												24.68		24.68	

Work in Ethiopia
Work in Japan
Workshop
Item Selection Workshop
Dissemination Workshop

IDCJ: International Development Center of Japan Inc.
KRC: Koei Research & Consulting Inc.

APPENDIX 7 MEMBERS OF THE WORKING GROUPS

Mathematics Working Group

SN	Name	Affiliation	Role	Attendance
1	Daniel Demissie Aga	MSIC		WS 2~7, 10
2	Tesfu Tezera Teyakie	MSIC		WS 1~10
3	Ermias Chufamo Beshir	MSIC		WS 1~6, 8~10
4	Bimerew Kerie Tesfaw	MSIC		WS 1~10
5	Yibeltal Solomon Mekbeb	TELDD		WS 3, 4, 6, 7
6	Assefa Teferi Ayle	CDID		WS 3~5, 7, 9, 10
7	Fikremariam Regassa Tefera	NEAEA	Chair	WS 1~3
8	Kifle Yilma	Addis Ababa Education Bureau		WS 1~3
9	Bilata Mekonnen Ayele	Afar REB		WS 1~6, 8, 9
10	Dagnaw Asmare Belalchew	Amhara REB		WS 1~4, 6
11	Asaye Akinaw	Benishangul-Gumuz REB		WS 1, 2
12	Sebsibe Getahun Abebe	Benishangul-Gumuz REB		WS 3~8, 10
13	Gizachew Mitiku Abdi	Dire Dawa Education Bureau	Secretary	WS 1~10
14	Etsey Gidey Mehari	Gambella REB		WS 1~6, 8, 9
15	Fantaye Aleme Shibeshi	Harari REB		WS 1~6, 8~10
16	Dejene Girma Awelachew	Oromia REB		WS 1~10
17	Beteselassie Biru Gebregiorgis	SNNPR REB		WS 1~10
18	Abdifetah Omer Hussein	Somali REB		WS 1, 2, 9, 10
19	Jibril Adem Mohammed	Somali REB		WS 6
20	Gebremedhin Gebru Tedla	Tigray REB		WS 1~6, 8~10
21	Mohammed Adem Mohammed	Afar (Teacher)		WS 4~6, 9, 10
22	Leta Gela Dinqu	Oromia (Teacher)		WS 4~10
23	Yohannes Wosene	SNNPR REB (Regional Trainer)		WS 5, 9, 10

Biology Working Group

SN	Name	Affiliation	Role	Attendance
1	Yusuf Aliye Said	MSIC		WS 4~6, 8~10
2	Ms. Etenesh Mekonnin Demena	MSIC	Chair	WS 1~8
3	Mequanint Addis Hailu	MSIC		WS 2~5, 7~10
4	Ms. Tigist Getahun Gebremichael	MSIC		WS 8
5	Desalegn Teshome Amare	MSIC		WS 1~6, 8~10
6	Abebe Garedew Amtate	TELDD		WS 1~4
7	Solomon Belayneh Abebe	CDID		WS 1~4, 6, 7
8	Minas Gebremeskel Weldesadik	NEAEA	Secretary	WS 1~3
9	Berhanu Fikru Firesenbet	Addis Ababa Education Bureau		WS 1~6, 9, 10
10	Getahun Asrat Tachbel	Afar REB		WS 1, 2, 4, 6, 9, 10
11	Hibste Kasse	Amhara REB		WS 1, 3, 4
12	Fentahun Alem Alamnie	Amhara REB		WS 6, 7
13	Adiss Daka Rorissa	Benishangul-Gumuz REB		WS 1~10
14	Arefat Musa Ali	Dire Dawa Education Bureau		WS 1~5, 7~10
15	James Gatbel	Gambella REB		WS 1~5
16	Gatdor Deng Duop	Gambella REB		WS 6, 8
17	Njib Jemal Michael	Harari REB		WS 1~6, 8~10
18	Alemu Legesse	Oromia REB		WS 1, 2
19	Mosisa Dejene Challa	Oromia REB		WS 1~10
20	Degu Zewdie Gizaw	SNNPR REB		WS 1~8, 10
21	Ahimed Omer Samale	Somali REB		WS 1~6, 8~10
22	Silas Araya Demwoz	Tigray REB		WS 1~5, 7, 8, 10
23	Daniel Nigatu Lema	Benishangul-Gumuz (Teacher)		WS 4~10
24	Philip Owar Ojulu	Gambella (Teacher)		WS 4~6
25	Workagegnehu Ashagire Gebremedhin	SNNPR REB		WS 5, 6, 9, 10

Chemistry Working Group

SN	Name	Affiliation	Role	Attendance
1	Gebregziabher Araya Hagos	MSIC	Chair	WS 1~10
2	Nesibu Mengistu	MSIC		WS 1~10
3	Zelekew Teshome	MSIC		WS 1, 2, 4~10
4	Yidnekachew Legese Mekonnen	MSIC		WS 1~6
5	Shewangzaw Shiferaaw	TELDD		WS 1, 3, 4
6	Nega Gichile	CDID		WS 1~7, 9
7	Worku G/Michael	NEAEA		WS 2~4, 10
8	Mekonnen Legesse	Addis Ababa Education Bureau		WS 1~6
9	Seifu Belete	Afar REB		WS 1~5, 9
10	Mulugeta Mesfin	Amhara REB		WS 2~5
11	Alfaruqe Abdulahi	Benishangul-Gumuz REB		WS 1, 2
12	Alemene Melaku	Benishangul-Gumuz REB		WS 3~10
13	Aynalem Aboye	Dire Dawa Education Bureau		WS 1~10
14	Peter John	Gambella REB		WS 1~6, 8~10
15	Dilnesaw Getachew	Harari REB High School Teacher		WS 1~10
16	Chernet Bekele	Oromia REB		WS 1, 2
17	Alemtsehay Duguma Gonfa	Oromia REB		WS 3~6
18	Melaku G/Michael	SNNPR REB		WS 1
19	Haile Hasana	SNNPR REB		WS 2
20	Anteneh Abebe Shiferaw	SNNPR REB		WS 7~10
21	Belete Sibhat	Somali REB		WS 1~10
22	Kibat H/Mikael	Tigray REB		WS 1~3, 10
23	Messele Terefe	Amhara Primary School Teacher		WS 4~6, 8, 9
24	Askalu G/egziabher Glmedihn	Tigray Primary School Head Teacher		WS 4, 5
25	Ashenafi Getachew Abebe	SNNPR REB Teacher		WS 4

Physics Working Group

SN	Name	Affiliation	Role	Attendance
1	Nega Deriba Worku	MSIC		WS 1~10
2	Hailu Genebo Hirboro	MSIC		WS 1~10
3	Dawit Belete Endeshaw	MSIC		WS 2~10
4	Getachew Debela Mamo	MSIC		WS 4, 5
5	Dessie Melese Wassie	MSIC		WS 4~6, 8~10
6	Yosef Mihret Mengistu	CDID		WS 1~7, 9, 10
7	Getaneh Tarekegn	NEAEA		WS 1, 2
8	Desta Mersha Odda	Addis Ababa Education Bureau	Secretary	WS 1~6, 9, 10
9	Girma Kifle Atnafu	Afar REB		WS 1~10
10	Melkie Kifle Nigussie	Amhara REB		WS 2~4
11	Tsegu Adere	Benishangul-Gumuz REB		WS 1~3
12	Chemeda Dufera Amejie	Benishangul-Gumuz REB		WS 4~10
13	Tolemariam Burka Raje	Dire Dawa Education Bureau		WS 1~10
14	Dereje Tefera Chekorso	Gambella REB		WS 1~6, 8
15	Nitsuhneh Tafesse	Harari REB		WS 1
16	Kemal Abdulbasit Ahmed	Harari REB		WS 1~6, 9, 10
17	Yusuf Mohammed Adem	Oromia REB	Chair	WS 1~6
18	Tesfaye Fantahun Ali	SNNPR REB		WS 1~3, 5~7, 9, 10
19	Mohammed Mohamoud Abdilahi	Somali REB		WS 1~6, 8~10
20	Gebremeskel Gebreegziabher Meles	Tigray REB		WS 1~10
21	Mulugeta Tafesse Debela	Dire Dawa (Teacher)		WS 4~10

22	Mukbil Salim Asif	Harari (Teacher)		WS 4~6, 8~10
23	Ismael Mohammed Duale	Somali (Teacher)		WS 4, 5, 8~10

Assessment and Evaluation Working Group

SN	Name	Affiliation	Role	Attendance
1	Belayneh Tefera Cherinet	MSIC		WS 1~10
2	Bekele Geleta	NEAEA		WS 1, 3, 7
3	Abiy Kefyalew Aboret	NEAEA	Chair	WS 1~3, 7
4	Ashenafi Tesfaye Bogale	NEAEA		WS 1, 3, 7, 10
5	Bekalu Yayeh	Addis Ababa Education Bureau		WS 1~3, 5
6	Mohammed Seid Hassen	Afar REB		WS 1~4, 6, 7, 10
7	Tesema Muluneh Fentie	Amhara REB	Secretary	WS 1, 2, 4, 7
8	Degu Bihonegn Tegegne	Benishangul-Gumuz REB		WS 1~5, 7, 10
9	Kasahun Mamo Abagero	Dire Dawa Education Bureau		WS 1~10
10	Puot Gatwech Kuon	Gambella REB		WS 1~9
11	Salahadin Abdurahman Mohammad	Harari REB		WS 2~5, 10
12	Habtamu Dugasa	Oromia REB		WS 3, 5
13	Temesgen Gezahegn Tefera	SNNPR REB		WS 1~4, 7, 9, 10
14	Ibrahim Abdulahi	Somali REB		WS 1
15	Ahmed Bashir Ahmed	Somali REB		WS 6
16	Seid Abdi Ismail	Somali REB		WS 8, 9
17	Atikilt Gebremedhin Tesfay	Tigray REB		WS 1~4, 10

APPENDIX 8 TABLE OF CONTENTS OF THE WORKBOOKS AND ASSIGNED AUTHORS

Grade 7 Mathematics

Unit	Title		Person in Charge
	How to Use This Workbook		
1	**Rational Numbers**		
	1.1	Rational Numbers, Number Line and Opposite of a Rational Number	Sebsibe
	1.2	Comparing and Ordering Rational Numbers (1)	Sebsibe
	1.3	Comparing and Ordering Rational Numbers (2)	Sebsibe
	1.4	Addition of Rational Numbers	Sebsibe
	1.5	Subtraction of Rational Numbers	Sebsibe
	1.6	Multiplication and Division of Rational Numbers	Gizachew
	1.7	Absolute Value (1) Definition	Gizachew
	1.8	Absolute Value (2) Absolute Value in Equations	Gizachew
	1.9	Relationship among W, Z and Q	Gizachew
	1.10	Unit Summary	Sebsibe
2	**Linear Equations and Inequalities**		
	2.1	Terms, Algebraic Expressions and Linear Equations	Bilata
	2.2	Rules of Transformation for Equations	Bilata
	2.3	Solving Linear Equations in One Variable (1)	Bilata
	2.4	Solving Linear Equations in One Variable (2)	Bilata
	2.5	Solving Linear Equations Involving Word Problems (1)	Bilata
	2.6	Solving Linear Equations Involving Word Problems (2)	Bilata
	2.7	Rules of Transformation for Inequalities	Fantaye
	2.8	Solving Linear Inequalities (1)	Fantaye
	2.9	Solving Linear Inequalities (2)	Fantaye
	2.10	Application of Linear Inequalities (1)	Fantaye
	2.11	Application of Linear Inequalities (2)	Fantaye
	2.12	Unit Summary	Bilata/ Fantaye
3	**Ratio, Proportion and Percentage**		
	3.1	Ratio	Yibeltal
	3.2	Proportion	Yibeltal
	3.3	Direct Proportionality	Yibeltal
	3.4	Inverse Proportionality	Yibeltal
	3.5	Percentage	Bimerew
	3.6	Calculating the Base and Rate	Leta
	3.7	Functional Relations among Base, Percent and Amount	Leta
	3.8	Application of Percentage (1) Percentage Increase and Decrease	Leta
	3.9	Application of Percentage (2) Percentage Increase and Decrease, Value Added Tax (VAT)	Sebsibe
	3.10	Application of Percentage (3) Profit and Loss	Sebsibe
	3.11	Application of Percentage (4) Simple Interest	Sebsibe
	3.12	Unit Summary	Gizachew
4	**Data Handling**		
	4.1	Collecting Data Using Tally Mark	Dejene
	4.2	Line Graphs	Dejene
	4.3	Pie Charts	Dejene
	4.4	The Mean	Dejene
	4.5	The Median	Dejene
	4.6	The Mode and Range of Data	Dejene
	4.7	Unit Summary	Dejene
5	**Geometric Figures and Measurement**		
	5.1	Quadrilateral	Gizachew

	5.2	Trapezium and Parallelogram	Gizachew
	5.3	Properties of Special Parallelograms	Gizachew
	5.4	Concave and Convex Polygons	Gizachew
	5.5	Circle	Gizachew
	5.6	Theorems of Triangles	Dagnaw
	5.7	The Sum of the Interior Angles of a Polygon	Dagnaw
	5.8	Area of a Triangle (1)	Dagnaw
	5.9	Area of a Triangle (2)	Dagnaw
	5.10	Area and Perimeter of Parallelogram and Trapezium	Dagnaw
	5.11	Circumference and Area of a Circle (1)	Ermias
	5.12	Circumference and Area of a Circle (2)	Ermias
	5.13	Surface Area of Prism and Cylinder	Ermias
	5.14	Volume of Prism and Cylinder	Ermias
	5.15	Unit Summary	Ermias

Grade 8 Mathematics

Unit	Title		Person in Charge
	How to Use This Workbook		
1	**Squares, Square Roots, Cubes and Cube Roots**		
	1.1	Squares and Square Roots (1)	Tesfu
	1.2	Squares and Square Roots (2)	Tesfu
	1.3	Using Square Root Table	Tesfu
	1.4	Operations of Square Roots (1) Addition and Subtraction	Tesfu
	1.5	Operations of Square Roots (2) Multiplication and Division	Tesfu
	1.6	Cubes and Cube Roots	Tesfu
	1.7	Unit Summary	Tesfu
2	**Further on Working with Variables**		
	2.1	Variables, Terms and Expressions (1)	Daniel
	2.2	Variables, Terms and Expressions (2)	Daniel
	2.3	Multiplication of Monomial by Binomial	Daniel
	2.4	Multiplication of Binomial by Binomial	Daniel
	2.5	Factorizing Out the Highest Common Factor: Monomial Factor	Yohannes
	2.6	Factorizing Out the Highest Common Factor: Binomial Factor	Yohannes
	2.7	Unit Summary	Daniel
3	**Linear Equations and Inequalities**		
	3.1	Solving Linear Equations Involving Brackets	Etsay
	3.2	Solving Linear Equations Involving Fractions (1)	Etsay
	3.3	Solving Linear Equations Involving Fractions (2)	Etsay
	3.4	Solving Word Problems Using Linear Equations (1)	Etsay
	3.5	Solving Word Problems Using Linear Equations (2)	Etsay
	3.6	Further on Linear Inequalities	Etsay
	3.7	Cartesian Coordinate Plane and Four Quadrants	Leta
	3.8	Coordinates and Straight Lines	Leta
	3.9	Linear Equation and Straight Line	Leta
	3.10	Graph of an Equation of the Form y = b	Leta
	3.11	Graph of an Equation of the Form x = a	Leta
	3.12	Graph of an Equation of the Form y = mx ($m \neq 0$) (1)	Leta
	3.13	Graph of an Equation of the Form y = mx ($m \neq 0$) (2)	Leta
	3.14	Unit Summary	Leta
4	**Similar Figures**		
	4.1	Similar Plane Figures	Assefa
	4.2	Similar Triangles	Assefa
	4.3	Tests for Similarity of Triangles (SSS, SAS and AA) (1)	Assefa
	4.4	Tests for Similarity of Triangles (SSS, SAS and AA) (2)	Assefa

	4.5	Perimeter and Area of Similar Triangles	Assefa
	4.6	Unit Summary	Assefa
5	**Circles**		
	5.1	Parts of a Circle (1) Arcs	Bimerew
	5.2	Parts of a Circle (2) Sector and Segment	Bimerew
	5.3	Positional Relations between a Circle and a Line	Bimerew
	5.4	Determination of the Center of a Circle by Construction	Bimerew
	5.5	Central Angle and Inscribed Angle	Bimerew
	5.6	Theorems on Angles in a Circle (1)	Beteselassie
	5.7	Theorems on Angles in a Circle (2)	Beteselassie
	5.8	Angles Formed by Two Intersecting Chords	Beteselassie
	5.9	Cyclic Quadrilaterals	Beteselassie
	5.10	Unit Summary	Bimerew/ Beteselassie
6	**Introduction to Probability**		
	6.1	The Concept of Probability	Mohammed
	6.2	Probability of Simple Events	Mohammed
	6.3	Unit Summary	Mohammed
7	**Geometry and Measurement**		
	7.1	Euclid's Theorem and Its Converse (1)	Gebremedhin
	7.2	Euclid's Theorem and Its Converse (2)	Gebremedhin
	7.3	Pythagoras' Theorem (1)	Gebremedhin
	7.4	Pythagoras' Theorem (2)	Gebremedhin
	7.5	Application of Pythagoras' Theorem	Gebremedhin
	7.6	The Trigonometric Ratios	Abiy
	7.7	The Values of Sine, Cosine and Tangent for 30°, 45° and 60° (1)	Abiy
	7.8	The Values of Sine, Cosine and Tangent for 30°, 45° and 60° (2)	Abiy
	7.9	Pyramid	Beteselassie
	7.10	Cone	Beteselassie
	7.11	Unit Summary	Beteselassie

Grade 7 Biology

Unit	Title		Person in Charge
	How to Use This Workbook		
1	Biology and Technology		
	1.1	What Is Biology?	Etenesh
	1.2	How Is Biology Utilized in Society?	Silas
	1.3	What are some of the technological innovation derived from Biology?	Bchonegn
2	Cell Biology		
	2.1	Do You Know Microscope?	Daniel
	2.2	How Do You Use Compound Microscope? (Procedure)	Etenesh
	2.3	What Is a Cell?	Tessema
	2.4	Let Us Observe Cells Using Microscope	Addisu
	2.5	Do cells differ in type, size and shape?	Tessema
3	Human Biology and Health		
	3.1	What Is Skelton?	Nejib
	3.2	What Compose the Skelton System? (Bones and Joints)	Arafat
	3.3	What Are Muscles?	Degu
	3.4	How Do You Keep the Muscle and Skelton Healthy?	Solomon
	3.5	What Are the Structure and Functions of Our Teeth?	Gatdoar
	3.6	How do we use dental formula?	Desaleng
4	Plants		
	4.1	How Do Flowering Plants and Non-Flowering Plants Differ?	Birhanu

	4.2	What Characteristics Do Flowering Plants Have?	Pwot
	4.3	What Are Characteristics of the Roots, Stems and Leaves?	Desalegn
	4.4	How Do Monocot and Dicot Differ?	Daka
	4.5	How Do a Plant Reproduce? (Asexual)	Bchonegn
	4.6	How Do a Plant Reproduce? (Sexual)	Asrat
	4.7	What are the structures and functions of seeds?	Daniel
5	Animals		
	5.1	How Diverse Are Animals?	Silas/Ahmad
	5.2	What Are Insects?	Ahmad Omer
	5.3	What Are Economically Important Insects?	Temesgen
	5.4	What Are Social Insects and Their Characteristics?	Workagegnheu
	5.5	How Do You Keep Bees? (Theory)	Degv
	5.6	How do you keep bees? (Practice)	Yusuf
6	Environment		
	6.1	What Is a Habitat?	Solomon/Daka
	6.2	What Is Population/Community?	Fentahun
NY	6.3	Let Us Observe Habitat in Our Surrounding	Kasahun
NY	6.4	What Is Food Chain/Food Web?	Tigist/Ahmed

Grade 8 Biology

Unit	Title		Name
	How to Use This Workbook		
1	Biology and Technology		
	1.1	What Are Contributions of Biology for Development?	Silas
			Etenesh
	1.2	What Are Technological Products Used in Biology?	Daka
2	Cell Biology		
	2.1	How Do You Observe Unicellular Organisms?	Mosisa
	2.2	What Are Characteristics of Single-Celled Organisms? (Amoeba, Paramecium and Euglena)	Kasahun
	2.3	What Are Characteristics of Single-Celled Organisms? (Bacteria and Yeast)	Mosisa
	2.4	How Are Multi-Cellular Organisms Structured? (Cell and Tissue)	Mequanint
	2.5	How Are Multi-Cellular Organisms Structured? (Organ and system)	Birhanu
3	Human Biology and Health		
	3.1	What are the Primary and Secondary sexual Characteristics in human beings?	Solomon
	3.2	What Are the Characteristics of Male and Female Reproductive Organs?	Degu
	3.3	How Are Menstrual Cycle and Fertilization Related?	Fentahun
	3.4	What Are reproductive health problems?	Degu Zewdie
	3.5	How Do We Control the Birth?	Mequanint
	3.6	How does our society deal with HIV/AIDS?	Yusuf
4	Plants		
	4.1	What Is the Process of Photosynthesis?	Philip
	4.2	Let Us Grow Trees from Seeds	Daniel/Pwot
5	Animals		
NY	5.1	What Kinds of Farm Animals Do You Know? What are the uses of them?	Daka
	5.2	What Is the difference between ruminant and human stomach?	Philip
	5.3	How Do You Take Care of Farm Animals?	Solomon
	5.4	How do you increase farm animals?	Solomon
	5.5	What are the symptoms and prevention methods of diseases of farm animals?	Peter
6	Environment		

	6.1	What Is Ecosystem?	Bekele
	6.2	What Kinds of Associations Are There among Living Things?	Daka
	6.3	What are different types of soil? How do we conserve the soil?	Fentahun
	6.4	How do we conserve the water?	Kasahun

Grade 7 Chemistry

Unit		Title	Person in Charge
	How to Use This Workbook		
1	Chemistry and Its Importance		
	1.1	Chemistry and Other Natural Sciences	G/Egziabher
	1.2	Chemistry in Production and Society	Nesibu
2	Substances		
	2.1	Properties of Substances	Zelekaw
	2.2	Grouping Substances - Elements	G/Egziabher
	2.3	Grouping Substances – Compounds	Anteneh
	2.4	Grouping Substances – Mixtures	Nega
	2.5	Grouping Substances –Identification of Elements, Compounds and Mixtures	Dilnesaw
	2.6	Changes around Us – Physical Changes and Chemical Changes	Hailu
	2.7	Separation of Mixtures- Magnetic Separation, Decantation and Filtration	Hailu
	2.8	Separation of Mixtures- Evaporation and distillation	Nega
	2.9	Unit Summary	
3	Language of Chemistry		
	3.1	Symbols of Elements	Alemneh
	3.2	Chemical formulas – Molecules of Elements	Aynalem
	3.3	Chemical formulas –*Binary Compounds*	Hailu
	3.4	Chemical formulas – Polyatomic ions and their compounds,	Askalu
	3.5	Qualitative and Quantitative Significance – Coefficient and Subscript	Messele
	3.6	Chemical Equations – Word and Chemical Equations	Gebre
	3.7	*Chemical Equations –Balancing chemical equations*	Zelekew
	3.8	*Unit Summary*	
4	Structure of Substances		
	4.1	Atomic Theory	Belete
	4.2	The Structure of the Atom – Subatomic Particles and Isotopes	Belete
	4.3	The Structure of the Atom – Electronic Configuration	Salahdine
	4.4	The Structure of the Atom – Valence Electrons and Ions	Ashenafi T
	4.5	Molecules of Elements and Compounds	Dilnesaw
	4.6	Unit Summary	
5	Periodic Classification of the Elements		
	5.1	Periodic Classification of the Elements	Belete
	5.2	Modern Periodic Table – Periods and Groups	Alemneh
	5.3	Modern Periodic Table –Some periodic properties	Worku
	5.4	Modern Periodic Table –Importance of periodic table	Nega
	5.5	Unit Summary	

Grade 8 Chemistry

	Title	Person in charge

	How to Use This Workbook		
1	Classification of Compounds		
	1.1	*Organic Compounds – Alkanes, Alkenes and Alkynes*	Messele
	1.2	*Organic Compounds – Importance*	Zelekaw
	1.3	Inorganic Compounds - Oxides	Nesibu
	1.4	Inorganic Compounds –Acids	Nega
	1.5	Inorganic Compounds –Bases	Anteneh
	1.6	Inorganic Compounds –Salts	Anteneh
	1.7	Unit Summary	
2	Some Important Metals		
	2.1	General properties of Metals	Alemneh
	2.2	Sodium, Potassium, Magnesium and Calcium	Aynalem
	2.3	Aluminium and Iron	Nasibu
	2.4	Copper, Silver, Gold, Platinum and Tantalum	Belete
	2.5	Alloys and their uses	Salahdine
	2.6	Unit Summary	
3	Some Important Non-metals		
	3.1	General properties of non-metals and Carbon	Belete
	3.2	Nitrogen and Phosphorous,	Ashenafi T
	3.3	Oxygen and Sulphur	Anteneh
	3.4	Uses of Common Compounds of Non-metals	Dilnesaw
	3.5	Unit Summary	
4	Environmental Chemistry		
	4.1	Air – Composition, Pollution, Global Warming and its effects	Hailu
	4.2	Water – Hardness and softness of Water	Aynalem
	4.3	Water – Pollution and Purification	Salahadin
	4.4	Soil – Components, acidic and alkaline Soil	Seif
	4.5	Plant nutrients and improvement of soil	Alemneh
	4.6	Fuels –Coal, Natural Gas and Crude Oil	Worku
	4.7	Unit Summary	
5	Calculations Based on Formulas		
	5.1	Atomic Mass, Molecular Mass and Formula Mass	Anteneh
	5.2	The Mole Concept	Nega
	5.3	Percentage Composition of Compounds	Nesibu
	5.4	Determination of Formulas	G/Egziabher
	5.5	Unit Summary	

Grade 7 Physics

Unit	Title		Person in Charge
	How to Use This Workbook		
1	Physics and Measurement		
	1.1	Definition of Physics	01 Nega
	1.2	Standardization and Measurement	02 Hailu
	1.3	Measuring Physical Quantity (1) Length	03 Dawit
	1.4	Measuring Physical Quantity (2) Mass	04 Getachew 01 Nega
	1.5	Measuring Physical Quantity (3) Time	05 Dessie
	1.6	Unit Summary	05 Dessie 12 Tolemariam
2	Motion		

	2.1	Definition of Motion	06 Yosef
	2.2	Motion along a Straight Line	06 Yosef
	2.3	Qualitative Exploration of Constant Velocity	08 Desta
	2.4	Qualitative Exploration of Accelerated Motion	09 Girma
	2.5	Unit Summary	20 Mukbil 08 Desta
3	Force and Newton's Laws of Motion		
	3.1	Force	11 Chemeda
	3.2	Measuring a Force	11 Chemeda
	3.3	Newton's First Law of Motion	12 Tolemariam
	3.4	Newton's Second Law of Motion	12 Tolemariam
	3.5	Weight	13 Dereje 08 Desta
	3.6	Newton's Third Law (Law of Action and Reaction)	15 Yusuf 14 Kemal
	3.7	Definition and Types of Frictional Force	16 Tesfaye
	3.8	Effects of Friction	17 Mohammed M.
	3.9	Unit Summary	21 Ismail 18 GebreMeskel
4	Work, Energy and Power		
	4.1	Work	18 GebreMeskel
	4.2	Definition of Energy	22 Mohammed S.
	4.3	Kinetic Energy and Potential Energy	18 GebreMeskel
	4.4	Transformation and Conservation of Energy	20 Mukbil
	4.5	Power	19 Mulugeta
	4.6	Unit Summary	19 Mulugeta 23 Atakilt
5	Simple Machines		
	5.1	Definition of Machines	21 Ismail
	5.2	Definition of Mechanical Advantage, Velocity Ratio and Efficiency	01 Nega
	5.3	Types of Simple Machines	02 Hailu
	5.4	Torque	03 Dawit
	5.5	Unit Summary	01 Nega 09 Girma
6	Temperature and Heat		
	6.1	Definition of Temperature and Measurement	01 Nega
	6.2	Temperature Scales	05 Dessie
	6.3	Conversion of Temperature Scales	06 Yosef
	6.4	Definition and Source of Heat	06 Yosef
	6.5	Effect of Heating	19 Mulugeta
	6.6	Unit Summary	06 Yosef 03 Dawit
7	Sound		
	7.1	Definition, Production and Transmission of Sound	09 Girma
	7.2	Speed of Sound in Different Media	11 Chemeda 18 GebreMeskel
	7.3	Reflection of Sound	11 Chemeda
	7.4	Unit Summary	17 Mohammed M. 18 GebreMeskel
8	Electricity and Magnetism		
	8.1	Magnets (1)	13 Dereje
	8.2	Magnets (2)	13 Dereje
	8.3	Magnetic Lines of Force and Uses of Magnets	20 Mukbil
	8.4	Electrostatics	15 Yusuf 14 Kemal
	8.5	Methods of Charging	16 Tesfaye
	8.6	Law of Electrostatics	17 Mohammed M.
	8.7	Electric Current and Potential Difference	18 GebreMeskel
	8.8	Primary and Secondary Cells	22 Mohammed S.
	8.9	Electric Circuit	18 GebreMeskel

			23 Atakilt
	8.10	Unit Summary	01 Nega 22 Mohammed S.

Grade 8 Physics

Unit	Title		Person in Charge
	How to Use This Workbook		
1	Physics and Measurement		
	1.1	Measuring Area	20 Mukbil
	1.2	Measuring Volume	19 Mulugeta
	1.3	Measuring Density	21 Ismail
	1.4	Dimensional Expression and Scientific Notation	01 Nega
	1.5	Unit Summary	09 Girma 11 Chemeda
2	Motion in One Dimension		
	2.1	Forces in Physics	02 Hailu
	2.2	Uniform Motion	03 Dawit
	2.3	Uniformly Accelerated Motion	14 Kemal
	2.4	Freely Falling Bodies	05 Dessie
	2.5	Representation of Uniform Motion using tables and graphs	06 Yosef
	2.6	Representation of Uniformly Accelerated Motion using tables and graphs (1)	06 Yosef
	2.7	Representation of Uniformly Accelerated Motion using tables and graphs (2)	12 Tolemariam
	2.8	Unit Summary	06 Yosef 08 Desta
3	Pressure		
	3.1	Definition and unit of pressure	09 Girma
	3.2	Atmospheric Pressure	20 Mukbil
	3.3	Measuring Air Pressure	11 Chemeda
	3.4	Liquid Pressure	12 Tolemariam
	3.5	Pascal’s Principle	13 Dereje 08 Desta
	3.6	Applications of Atmospheric Pressure	18 GebreMeskel
	3.7	Unit Summary	01 Nega 02 Hailu
4	Heat Energy		
	4.1	Transfer of Heat (1) Conduction	21 Ismail
	4.2	Transfer of Heat (2) Convection and Radiation	16 Tesfaye 06 Yosef
	4.3	Quantity of Heat	17 Mohammed M.
	4.4	Specific Heat Capacity	18 GebreMeskel
	4.5	Unit Summary	21 Ismail 18 GebreMeskel
5	Electricity and Magnetism		
	5.1	Modeling of Electric Current, a Circuit Loop and Voltage	05 Dessie
	5.2	Qualitative Modeling of an Electric Light Bulb	18 GebreMeskel
	5.3	Relationship of Volts, Current and Resistance	20 Mukbil
	5.4	Measuring Electric Current, Resistance and Voltage	19 Mulugeta
	5.5	Resistors in Series Circuit	21 Ismail
	5.6	Resistors in Parallel Circuit	01 Nega
	5.7	Energy and Power in an Electric Circuit	02 Hailu
	5.8	Magnetic Effect of a Current	03 Dawit
	5.9	Magnetic Field around a Solenoid	02 Hailu
	5.10	Electric Motor	14 Kemal
	5.11	Electromagnetic Induction	06 Yosef
	5.12	Generator	06 Yosef

	5.13	Transformers	21 Ismail
	5.14	Power Transmission and Conversion of Energy	09 Girma
	5.15	Unit Summary	17 Mohammed M. 23 Atakilt
6	Light		
	6.1	Definition Sources and Propagation of Light	11 Chemeda 18 GebreMeskel
	6.2	Law of Reflection	11 Chemeda
	6.3	Image Formation by a Plane Mirror	12 Tolemariam
	6.4	Images Formed by Concave Mirrors	12 Tolemariam
	6.5	Images Formed by Convex Mirrors	16 Tesfaye 02 Hailu
	6.6	Refraction of Light	17 Mohammed M.
	6.7	Formation of Images by a Convex Lens	16 Tesfaye 01 Nega
	6.8	Images Formed by a Concave Lens and Dispersion of Light	19 Mulugeta
	6.9	Unit Summary	22 Mohammed S.

APPENDIX 9 PARTICIPANTS OF COUNTERPART TRAINING

First Training (18 April ~ 2 May, 2015)

No.	Name	Affiliation	Position
1	Araya G/Egziabher	NEAEA	Director General
2	Tamiru Zerihun	NEAEA	Director
3	Arega Mamaru	NEAEA	Director
4	Abiy Kefyalew	NEAEA	Expert
5	Yosef Mehret	CDID	Expert
6	Yibeltal Solomon	TELDD	Expert
7	Abebe Garedew	TELDD	Expert
8	Belayneh Tefera	MSIC	Head
9	Yidnekachew Legesse	MSIC	Expert
10	Biruk Zenebe	JICA Ethiopia Office	Program Officer

Second Training (10 May ~ 25 May, 2016)

No.	Name	Affiliation	Position
1	Dilamo Aotorei	Addis Ababa CAEB	Bureau Head
2	Mohammed Uoda	Afar REB	Bureau Head
3	Binalf Andualem	Amhara REB	Bureau Head
4	Taye Bullo	Benishangul-Gumuz REB	Bureau Head
5	Abdusemed Mohammed	Dire Dawa CAEB	Bureau Head
6	Tut Jock	Gambella REB	Bureau Head
7	Afendi Abdulwasi	Harari REB	Bureau Head
8	Letibelu Motuma	Oromia REB	Deputy Head
9	Million Mathewos	SNNPR REB	Bureau Head
10	Mowlid Hayir	Somali REB	Bureau Head
11	Gobezay W/Aregay	Tigray REB	Bureau Head
12	Desalegn Teshome	MSIC	Biology Expert
13	Hailu Genebo	MSIC	Physics Expert
14	Yusuf Aliye	MSIC	Biology Expert
15	Teklu Hagos	TELDD	Expert
16	Taye Mengistu	CDID	Expert
17	Eshetu Gelaye	EPRMD	Expert

Third Training (13 May ~ 27 May, 2017)

No.	Name	Affiliation	Position
1	Berhanu Fikru Firesenbet	Addis Ababa City Education Bureau	SMASEE trainer
2	Girma Kifle Atinaf	Afar Regional Education Bureau	Expert
3	Mulugeta Mesfin Gorfu	Amhara Regional Education Bureau	Expert
4	Adiss Daka Rorissa	Benishangul-Gumuz Regional Education Bureau	Expert
5	Gizachew Mitiku Abdi	Dire Dawa City Education Bureau	Expert
6	Puot Gatwech Kuon	Gambella Regional Education Bureau	Expert
7	Dilnesaw Getachew Haile	Harari Regional Education Bureau	Teacher
8	Dejene Girma Awelachew	Oromia Regional Education Bureau	Expert
9	Beteselassie Biru Gebregiorgis	SNNPR Regional Education Bureau	Expert
10	Mohammed Mohamoud	Somali Regional Education Bureau	Expert
11	Gebremeskel Gebregziabher Melesse	Tigray Regional Education Bureau	Expert

APPENDIX 10 EQUIPMENT PROVIDED

No.	Item	Model	Delivery Date	Recipient	Location
1	Laptop Computer	Toshiba Satellite Pro C50	October 8, 2014	MoE (MSIC)	Project Office
2	Laptop Computer	Toshiba Satellite C50	November 10, 2014	MoE (MSIC)	Project Office
3	Laptop Computer	Toshiba Satellite C50	November 10, 2014	MoE (MSIC)	Project Office
4	Laptop Computer	Toshiba Satellite C55	July 20, 2015	Addis Ababa EB	Addis Ababa EB
5	Laptop Computer	Toshiba Satellite C55	July 20, 2015	Afar REB	Afar REB
6	Laptop Computer	Toshiba Satellite C55	July 20, 2015	Amhara REB	Amhara REB
7	Laptop Computer	Toshiba Satellite C55	July 20, 2015	Benishangul-Gumuz REB	Benishangul-Gumuz REB
8	Laptop Computer	Toshiba Satellite C55	July 20, 2015	Dire Dawa EB	Dire Dawa EB
9	Laptop Computer	Toshiba Satellite C55	July 20, 2015	Gambella REB	Gambella REB
10	Laptop Computer	Toshiba Satellite C55	July 20, 2015	Harari REB	Harari REB
11	Laptop Computer	Toshiba Satellite C55	July 20, 2015	Oromia REB	Oromia REB
12	Laptop Computer	Toshiba Satellite C55	July 20, 2015	SNNPR REB	SNNPR REB
13	Laptop Computer	Toshiba Satellite C55	July 20, 2015	Somali REB	Somali REB
14	Laptop Computer	Toshiba Satellite C55	July 20, 2015	Tigray REB	Tigray REB
15	FAX	Canon L150	November 10, 2014	MoE (MSIC)	MSIC
16	Printer	HP LaserJet P1102	January 8, 2015	MoE (MSIC)	Project Office
17	Scanner	EPSON DS-560	February 26, 2015	MoE (MSIC)	Project Office
18	Projector	SONY VPL-DX102	November 6, 2015	MoE (MSIC)	Project Office
19	Laptop Computer	HP HQ-TRE 71025	September 20, 2017	MoE (MSIC)	MSIC

APPENDIX 11 MINUTES OF DISCUSSION OF THE FIRST NSC MEETING (October 16, 2014)

Minutes of Discussion
of
The First National Steering Committee Meeting
on
The Project for Capacity Development for Improving Learning Achievement
in Mathematics and Science Education
(LAMS)

Agreed Upon Between

Ministry of Education
Federal Democratic Republic of Ethiopia

and

Expert Team
Japan International Cooperation Agency

Addis Ababa
16 October 2014

Mr. Tayachew Ayalew
Advisor to the State Minister
for General Education
Ministry of Education
Federal Democratic Republic of Ethiopia

Dr. Norimichi Toyomane
Team Leader
JICA Expert Team
for LAMS

The Ministry of Education (MoE), in cooperation with JICA, convened the first National Steering Committee meeting on the Project for Capacity Development for Improving Learning Achievement in Mathematics and Science Education on 16 October 2014 at State Minister's meeting room. It was chaired by Mr. Tayachew Ayalew, Advisor to the State Minister for General Education, in the absence of Mr. Fuad Ibrahim, State Minister for General Education.

The Ministry of Education invited following authorities to the meeting: EMIS, Planning and Resource Mobilization Directorate (EPRMD), MoE; Ministry of Finance and Economic Development (MoFED); National Regional State Education Bureaus (REBs); National Educational Assessment and Examinations Agency (NEAEA); Curriculum Development and Implementation Directorate (CDID), MoE; Teachers and Educational Leaders Development Directorate (TELDD), MoE; and Mathematics and Science Improvement Center (MSIC), MoE. The meeting was also attended by the Japan International Cooperation Agency (JICA) Ethiopia Office and the JICA Experts for the Project. A list of attendants is as below. The meeting discussed following agenda and reached the conclusions as recorded.

Date: 16 October 2014 (Thursday)
Time: 14:40 ~ 16:30
Venue: State Minister's meeting room, MoE

Attendants:

Mr. Tayachew Ayalew	Advisor to the State Minister for General Education, MoE (Chairperson)
Mr. Araya G/Egziabher	Director General, NEAEA
Mr. Daniel Abebe	Acting Director, CDID, MoE
Ms. Abebech Negash	Director, TELDD, MoE
Mr. Getachew Admasu	Senior Expert, EPRMD, MoE
Mr. Belayneh Teferra	Head, SMIC, MoE (Secretary)
Mr. Takusaburo Kimura	Senior Representative, JICA Ethiopia Office
Mr. Biruk Zenebe	Program Officer, JICA Ethiopia Office
Mr. Norimichi Toyomane	JICA Expert
Mr. Atsushi Tsukui	JICA Expert
Mr. Yosuke Sakurai	JICA Expert
Ms. Grumeshet Mergia	Project Secretary

1

Agenda:

1. To announce the official commencement of the Project
2. To review and discuss the draft Work Plan (First Year)
3. To decide the roles and responsibilities of the respective counterpart agencies
4. To plan immediate activities

Discussion:

Main points of the presentation and discussion are summarized as follows:

1. Referring to the Ethiopian government's principal policy to improve mathematics and science education, Chairperson expressed his expectation that this Project would overcome two challenges: lack of integration of curriculum and assessment and gaps in assessment skills. With this expectation in mind, he officially announced the commencement of the Project.

2. Pointing out that no representatives from REBs were present, TELDD asked if this meeting could decide on important issues. Chairperson replied that all REBs could be officially informed of this Project later at a meeting of the 24th National Education Conference scheduled from October 30 to November 1 this year. MSIC clarified that this way was what State Minister intended to do.

3. EPRMD asked what EPRMD's roles were in this Project. JICA Expert Team replied that, as specified in the R/D, Director of EPRMD would chair this National Steering Committee meeting and manage the overall implementation of the Project.

4. NEAEA declined to participate in the four Subject Working Groups, whose main task was to develop Item Pools. As the reason, NEAEA stressed the strict secrecy required for the development of Item Banks. NEAEA feared the possibility of leakage if its experts were engaged in the development of both Item Pools and Item Banks. MSIC, explaining the objective of this Project, urged NEAEA to join the development of Item Pools and share its experts' high-level expertise in question item development with other officials in charge of curriculum development, teacher development or lesson improvement. JICA Expert Team reiterated the same point. Since NEAEA did not agree on the inclusion of its personnel/experts in the four Subject Working Groups that develop Item Pools, Chairperson instructed MSIC and JICA Expert Team to continue discussion with NEAEA on this issue

and come up with a feasible solution that will be further discussed and agreed upon by the National Steering Committee chaired by State Minster.

5. CDID asked how they could collaborate with REBs to develop Workbooks and Item Pools. It also raised a question whether their work required for this Project should be regarded as part of their official duties. JICA Expert Team replied that CDID experts and REB experts would work together in the series of Workshops, which tentatively would be held in Addis Ababa. It also clarified that all work required for this Project should be deemed to be part of the official duties.

6. Regarding the place of Workshops, TELDD and other attendants strongly recommended JICA Expert Team to decide the venue of the Workshops according to REBs' needs and preferences. Chairperson instructed MSIC and JICA Expert Team to consult REBs on this issue.

7. Chairperson asked how the Project would improve question items. JICA Expert Team replied that writing good question items was an art and not easily amenable to technical transfer. It would nonetheless follow the table indicating the number of question items to be developed, corresponding to the MLC goals and three cognitive categories (knowing, applying and reasoning).

8. Chairperson asked why CDIC was to be involved in the development of Item Pools because its mandate did not look relevant to this task. JICA Expert Team answered that this was so arranged by the R/D. It was so arranged, JICA Expert Team inferred, in order to make curriculum and assessment consistent.

9. Chairperson pointed out that the linkage between primary and secondary education appeared weak in this Project. He stressed that it should be strengthened.

10. TELDD asked how the number of participants of the counterpart training in Japan was decided. JICA Expert Team explained that the number was set according to JICA's budget. TELDD then asked if the training would be technical. JICA Expert Team replied that it would be a kind of exposure trip.

11. Regarding the Task Force, the meeting unanimously decided to disband it while clarifying that Technical Committee would take up the same roles from now on.

12. As to the abbreviation of the Project, the meeting unanimously chose LAMS since it contains Learning, Achievement, Mathematics and Science, four essential components of the Project.

13. Chairperson, in summarizing the discussion, decided not to approve the table of responsibilities (as shown in slide 41 of JICA Expert Team's presentation) in this meeting. He instructed MSIC and JICA Expert Team to work on the selection of the participants of the first counterpart training in Japan. He also instructed the Ethiopian attendants to provide the materials requested by JICA Expert Team.

14. In his closing remarks, Senior Representative of JICA Ethiopia Office expressed his hope that this Project would produce good results to benefit Ethiopia.

15. Hoping that this Project would be fruitful, contribute to the improvement of mathematics and science education and help Ethiopian children learn, Chairperson finally concluded the meeting.

APPENDIX 12 MINUTES OF DISCUSSION OF THE SECOND NSC MEETING (May 6, 2016)

Minutes of Discussion
of
The Second National Steering Committee Meeting
on
The Project for Capacity Development for Improving Learning Achievement
in Mathematics and Science Education
(LAMS)

Agreed Upon Between

Ministry of Education
Federal Democratic Republic of Ethiopia

and

Japan International Cooperation Agency

Addis Ababa
06 May 2016

Mr. Kimiaki Jin
Chief Representative
Japan International Cooperation Agency
Ethiopia Office

Mr. Eshetu Asfaw
Director
EMIS, Planning and Resource
Mobilization Directorate (EPRMD)
Ministry of Education
Federal Democratic Republic of Ethiopia

The Ministry of Education (MoE), in cooperation with Japan International Cooperation Agency (JICA), convened the second National Steering Committee meeting on the Project for Capacity Development for Improving Learning Achievement in Mathematics and Science Education on 6 May 2016 at the Ministry of Education. The meeting was chaired by Mr. Eshetu Asfaw, Director of EMIS, Planning and Resource Mobilization Directorate (EPRMD).

The Ministry of Education invited the following authorities to the meeting: Ministry of Finance and Economic Development (MoFED); National Regional State Education Bureaus (REBs); National Educational Assessment and Examinations Agency (NEAEA); Curriculum Development and Implementation Directorate (CDID), MoE; Teachers and Educational Leaders Development Directorate (TELDD), MoE; and Mathematics and Science Improvement Center (MSIC), MoE. The meeting was also attended by JICA Ethiopia Office and Deputy Team Leader for the Project. A list of attendants is as below. The meeting discussed following agenda and reached the conclusions as recorded.

Date: 6 May 2016 (Friday)
Time: 15:00 ~ 17:00
Venue: EPRMD meeting room, MoE

Attendants:

Mr. Eshetu Asfaw	Director, EPRMD, MoE (Chairperson)
Mr. Tut Jock	Bureau Head, Gambela Regional State Education Bureau
Mr. Mowlid Hayir	Bureau Head, Somali Regional State Education Bureau
Mr. Belayneh Teferra	Head, MSIC, MoE (Secretary)
Mr. Gebregziabher Araya	Expert, MSIC, MoE
Mr. Nega Gichile	Expert, CDID, MoE
Mr. Kimiaki Jin	Chief Representative, JICA Ethiopia Office
Dr. Takeshi Miyazaki	Advisor to MSIC, MoE
Mr. Biruk Zenebe	Program Officer, JICA Ethiopia Office
Mr. Shuhei Oguchi	JICA Expert
Mr. Takele Alemu	Project Research Assistant
Mr. Anteneh Getachew	Project Research Assistant
Ms. Grumeshet Mergia	Project Secretary

Agenda:

1. To report the progress of Year One
2. To review the results of Inception Survey
3. To explain the work plan of Year Two
4. To explain the second counterpart training in Japan
5. To revise the Project Design Matrix specifying indicators

Note: *The meeting was delayed for an hour, expecting regional bureau heads to gather for the meeting. It turned out that nine regions were not able to attend due to their official duties.*

Discussion:

Main points of the presentations and discussion are summarized as follows:

1. Chairperson highly commended the progress of the Project while admitting that there still is a serious challenge on mathematics and science academic ability in the country. He expressed his sincere hope that the Project will follow the success of its predecessor, i.e., the project for Strengthening Mathematics and Science Education in Ethiopia (SMASEE).

2. Regarding the indicators proposed by the Project, Chairperson asked if there was any 'baseline' study made. JICA Expert Team responded that the result of mock tests conducted after the second workshop was employed as baseline.

3. Chairperson questioned the seriousness of students who took mock tests, and worried that the credibility of results might be lowered. In order for students to work "more seriously" on mock tests, he suggested to take the results into account for school records. Advisor to MSIC informed that neither PISA, TIMSS nor similar standardized tests for international comparison does use students' scores for school records. Chairperson reiterated that he was also concerned with the results of National Learning Assessment for the said reason.

4. Chairperson expressed his concerns over the quality of developed items. From his experience in attending and observing the physics working group during the fifth workshop, he found that even those items reviewed at workshops still contain some 'conceptual' errors. He suggested the Project to once again carefully review the procedure for item correction, and item selection for the Item Pool. The CDID Expert expressed his opinion that the current procedure leaves very little room for 'inappropriate items' to stay in the Item Pool as it encompasses peer review, mock tests, item selection committee, etc.

5. Regarding the indicators proposed by JICA Expert Team, Chairperson and other attendants felt that the target set to measure participants' performance, particularly "among the field-tested items, the percentage of items satisfying the two conditions below increases" was 'not ambitious' at all. In order to set a feasible target to be achieved, Chairperson suggested to discuss the matter further among NEAEA, CDID, TELDD and MSIC on a future occasion. JICA Expert Team proposed to hold a Technical Committee meeting for the purpose, and Chairperson agreed with the idea.

6. Chairperson proposed to revise the composition of the National Steering Committee as he considered it very difficult to have Heads of REBs gathered for the meeting. He promised to consult this matter with State Minister, and asked the JICA side to confirm the due procedure to do so. Chief Representative of JICA Ethiopia Office acknowledged this request.

7. In his closing remarks, Chief Representative of JICA Ethiopia Office expressed his hope that this Project would produce even better results to benefit Ethiopia.

8. Hoping that this Project would be fruitful, contribute to the improvement of mathematics and science education and help Ethiopian children learn, Chairperson finally concluded the meeting.

APPENDIX 13 MINUTES OF DISCUSSION OF THE THIRD NSC MEETING (August 25, 2017)

Minutes of Discussion
of
The Third National Steering Committee Meeting
on
The Project for Capacity Development for Improving Learning Achievement
in Mathematics and Science Education
(LAMS)

Agreed Upon Between

Ministry of Education
Federal Democratic Republic of Ethiopia

and

Expert Team
Japan International Cooperation Agency

Addis Ababa
25 August 2017

Mr. Belaynesh Tefera
Head
Mathematics and Science Improvement Center
Ministry of Education
Federal Democratic Republic of Ethiopia

Dr. Norimichi Toyomane
Team Leader
JICA Expert Team for LAMS

The Ministry of Education (MoE), in cooperation with Japan International Cooperation Agency (JICA), convened the third National Steering Committee meeting on the "Project for Capacity Development for Improving Learning Achievement in Mathematics and Science Education" on 25 August 2017 at the Hilton Hotel. The meeting was chaired by Mr. Belayneh Teferra, Head of Mathematics and Science Improvement Center (MSIC) in the absence of Mr. Elias Girma, Director of EMIS, Planning and Resource Mobilization Directorate (EPRMD).

The Ministry of Education invited the following institutions to the meeting: EMIS, Planning and Resource Mobilization Directorate (EPRMD), MoE: Ministry of Finance and Economic Cooperation (MoFEC); National Regional State Education Bureaus (REBs); National Educational Assessment and Examinations Agency (NEAEA); Curriculum Development and Implementation Directorate (CDID), MoE; Teachers and Educational Leaders Development Directorate (TELDD), MoE; and Mathematics and Science Improvement Center (MSIC), MoE. The meeting was also attended by JICA Ethiopia Office and the JICA Experts for the Project. A list of attendants is as below. The meeting discussed following agenda and reached the conclusions as recorded.

Date: 25 August 2017 (Friday)
Time: 14:00 ~ 15:30
Venue: Conference Room, Hilton Hotel

Attendants:

Mr. Belayneh Teferra	Head, MSIC, MoE (Chairperson)
Mr. Dara Mohammed	Representing Head, Afar Regional State Education Bureau
Mr. Alembrhan Duguma	Representing Head, Benishangul-Gumuz Regional State Education Bureau
Mr. Abdusemed Mohamed	Head, Dire Dawa City Administration Education Bureau
Mr. Peter John	Representing Head, Gambella Regional State Education Bureau
Mr. Sadat Mohammed	Vice Head, Harari Regional State Education Bureau
Mr. Mesele Kebede	Vice Head, Southern Nations, Nationalities, and Peoples' Regional State Education Bureau
Mr. Hiroyuki Tanaka	Senior Representative, JICA Ethiopia Office
Mr. Biruk Zenebe	Program Officer, JICA Ethiopia Office
Mr. Yasuto Kikuma	Representative, JICA Ethiopia Office
Dr. Takeshi Miyazaki	Advisor to MSIC, MoE

Dr. Norimichi Toyomane	JICA Expert
Mr. Shuhei Oguchi	JICA Expert
Mr. Yasushi Wada	JICA Expert
Dr. Etsutaro Tanaka	JICA Expert
Mr. Shimboku Miyakawa	JICA Expert
Mr. Atsushi Tsukui	JICA Expert
Mr. Mitsuhiko Ishida	JICA Expert
Mr. Takele Alemu	Project Research Assistant
Mr. Ephrem Girma	Project Research Assistant
Ms. Grumeshet Mergia	Project Secretary

Agenda:

1. To report the implementation of LAMS
2. To review the outputs and impact of LAMS
3. To approve the Action Plan to utilize the LAMS materials
4. To approve the *Project Completion Report*
5. To conclude LAMS

Discussion:

Main points of the presentations and discussion are summarized as follows:

1. Chairperson welcomed and thanked the participants for their attendance.

2. Team Leader of the JICA Expert Team presented the outline of the Draft Project Completion Report and the Action Plan.

3. Regarding the Action Plan, Southern Nations, Nationalities, and Peoples' Regional Education Bureau Vice Head pointed out that time frame should be clarified. JICA Expert Team responded that it would revise the Action Plan accordingly.

4. Southern Nations, Nationalities, and Peoples' Regional Education Bureau Vice Head emphasized that the LAMS workbooks should be printed using funds from GEQIP III.

5. Dire Dawa Education Bureau Head expressed his gratitude to the Japanese government for implementing the LAMS project. He acknowledged that Dire Dawa's

experts very much improved their capacity owing to LAMS but expressed his concern that their personnel turnover was already high.

6. Afar Education Bureau Representative insisted that all outputs of LAMS should be provided to all schools and students throughout the country. He strongly suggested that GEQIP funds should be utilized for this purpose.

7. Chairperson explained that according to the original plan, GEQIP II funds were to be utilized to print and distribute the LAMS workbooks but the plan did not materialize. He was looking forward to GEQIP III funds becoming available for us to carry it out.

8. Chairperson further explained that a new project called MUST was under preparation. This MUST project would deal with mathematics for Grade 1 to Grade 8, though he would like JICA to cover science as well. He expected that all stakeholders, including donors, would support this new project.

9. Regarding personnel turnover in regions, Chairperson pointed out that it would be a chance for the personnel to disseminate what he or she learned under LAMS to other personnel of the region. He strongly urged regional officials to strengthen the capacity of the regional government.

10. Regarding the utilization of the LAMS workbooks, Chairperson also urged the Regional Education Bureaus not to wait for the MoE but to begin translation of the workbooks into their local languages with their own initiatives.

11. JICA Program Officer pointed out that utilization of the LAMS outputs would require commitment on the side of project owners. Since JICA could no longer support LAMS, he requested the MoE, Regional Education Bureaus in particular, to sustain the project outcomes with their own efforts under the coordination by MSIC. He pointed out that one question with LAMS was how to deliver the outcomes down to the cluster/school levels because LAMS had dealt only with regions. He further pointed out that a deliberate plan would be necessary to overcome this difficulty. In regard to the printing of the workbooks, he strongly urged the MoE to declare that it was the ministry's priority and secure budget from GEQIP III because it should be the MoE, not the donors, to decide on how to spend the funds. Once the MoE decided so, he emphasized, no one would stop it.

12. In relation to the budget problem, Gambella Education Bureau Representative complained that the regional government was not interested in teacher training because of the

lack of budget. He doubted that if LAMS outputs were provided by the MoE, the regional government would further distribute them down to Woredas. Chairperson questioned why budget was not sufficient when 10% of the school grant was appropriated for teacher training but later acknowledged that Gambella was a special case. Gambella Education Bureau Representative further explained that they once tried to hold a workshop but failed because of the tangled responsibility between the departments of teacher development and curriculum. Chairperson admitted that such structural problems existed.

13. Concluding the discussion, the meeting approved the Action Plan, after revision as suggested, and the Draft Project Completion Report.

14. In his closing remarks, Senior Representative of JICA Ethiopia Office expressed his pleasure that LAMS had significant impact on the capacity of the workshop participants even though LAMS was the first of its kind for JICA to implement. He also announced that a new project was under preparation and that JICA would continue a close cooperation with the Ethiopian government. He urged the Ethiopian side to select and decide appropriate counterpart agencies for the coming project. Pointing out the uniqueness of JICA's cooperation as focusing on capacity development, he stressed that capacity development was not only with individuals but with organizations as well and expressed his hope that this new project would succeed in capacity development of the counterpart agencies and facilitate educational development of Ethiopia further.

15. Chairperson finally concluded the meeting appreciating JICA's effective cooperation and support throughout the LAMS project.

APPENDIX 14 MINUTES OF THE FIRST TECHNICAL COMMITTEE MEETING (November 26, 2014)

LAMS
Minutes of the 1st Technical Committee Meeting

Mr. Belayneh Teferra
Head
Mathematics and Science Improvement Center
Ministry of Education
Federal Democratic Republic of Ethiopia

大口修平
Mr. Shuhei Oguchi
Deputy Team Leader
JICA Expert Team for LAMS

Date: November 27, 2014
Time: 15:00 – 16:15
Venue: Meeting Room, National Educational Assessment and Examination Agency (NEAEA)
Participants: 13 participants

Mr. Belayneh Teferra	Head, MSIC, MoE (Chairperson)
Mr. Tamiru Zeryaun	Director, National Educational Assessment Directorate, NEAEA
Mr. Arega Ma naru	Director, National Examinations Directorate, NEAEA
Mr. Ejore Negeri	Expert (English), CDID
Ms. Yukiko Okugawa	Project Formulation Advisor (Education), JICA Ethiopia Office
Mr. Biruk Zenebe	Program Officer, JICA Ethiopia Office
Mr. Shuhei Oguchi	Deputy Team Leader, JICA Expert Team
Mr. Yasushi Wada	Member, JICA Expert Team
Mr. Atsushi Tsuka	Member, JICA Expert Team
Mr. Yosuke Sakurai	Member, JICA Expert Team
Mr. Takele Ademu	Senior Research Assistant
Mr. Anteneh Getachew	Research Assistant
Ms. Gnumeshet Mergia	Project Secretary

Agenda:

1) Confirm responsibilities among agencies;
2) Officially assign the members of Working Groups;
3) Nominate a Coordinator for LAMS in NEAEA, CDID and TELDD;
4) Discuss the concept of Baseline Survey;
5) Overall strategy for the Workshops; and
6) Schedule and contents of the Training in Japan.

Discussed Agenda and Actions to Be Taken

Discussed Agenda and Decisions	Actions to Be Taken
1) Confirming responsibilities among agencies	
Mr. Oguchi presented the table of responsibilities among MSIC, NEAEA, CDID, TELDD and REDs. 3 The attendants approved the table.	
2) Official assignment of Working Groups members	
Mr. Oguchi requested the official assignment of Working Group members. 2 Mr. Belayneh, Chairperson, informed that CDID and TELDD had already assigned experts by official letters. 3 Mr. Belayneh also confirmed that REBs were officially requested to assign their experts by letter through fax. 4 Mr. Tamiru concerned that National Educational Assessment Directorate does not have any subject experts to be assigned. He promised to discuss further with Mr. Araya, Director General of NEAEA.	NEAEA shall officially assign their experts after their internal discussion.
3) Nomination of a Coordinator for LAMS in NEAEA, CDID and TELDD	
Mr. Oguchi requested to nominate a Coordinator for the Project. 2 The attendants approved the idea.	A Coordinator shall be nominated by NEAEA, CDID and TELDD.
4) Discussion on the concept of Baseline Survey	
Mr. Oguchi presented the objectives, targets and schedule of LAMS baseline survey. Draft tools comprising questionnaires (both teacher and student), and Biology academic test (in four types), were distributed for the examination of attendants. 2 Many attendants questioned the size and distribution of samples, and validity of the academic test items. 3 Mr. Tamiru and Mr. Araya strongly suggested that the concept was to be revisited carefully before conducting pre-test.	JICA Expert Team shall visit MSIC, NEAEA, CDID and TELDD to collect comments.
5) Overall strategy for the Workshops	
Mr. Oguchi presented the objectives, strategies, and tentative schedule of the workshops as a whole. It was announced that the first workshop would be held from January 13 to 16 in 2015 in Adama, inviting all WG members together. 2 Attendants were invited to give their comments and ideas.	
6) Training in Japan	
Mr. Oguchi presented the schedule and contents of training in Japan. The first training is scheduled from April 18 to May 2 in 2015. Participants are to be selected by Ministry of Education based on the criteria.	MoE shall start the selection of candidates.

In his closing remarks, Mr. Belayneh, Chairperson, thanked all the attendants of the meeting. He stressed to revisit the concept of Baseline Survey. He, then, suggested that in the beginning of the project, the meeting should be held more frequently whenever necessity arises. Even better coordination among agencies was encouraged.

APPENDIX 15 MINUTES OF THE SECOND TECHNICAL COMMITTEE MEETING (September 2, 2015)

LAMS
Minutes of the 2nd Technical Committee Meeting

Mr. Belayneh Tefera
Head
Mathematics and Science Improvement Center
Ministry of Education
Federal Democratic Republic of Ethiopia

Dr. Norimichi Toyomane
Team Leader
JICA Expert Team for LAMS

Date: September 02, 2015
Time: 14:00~16:00
Venue: Meeting Room, National Educational Assessment and Examinations Agency (NEAEA)
Participants: 9 participants

Mr. Belayneh Tefera	Head, MSIC (Chairperson)
Mr. Tamiru Zerihun	Director, Educational Assessment Directorate, NEAEA
Mr. Arega Mamaru	Director, Exam Preparation and Administration Directorate, NEAEA
Mr. Daniel Abebe	Director, CDID
Mr. Biruk Zenebe	Program Officer, JICA Ethiopia Office
Dr. Norimichi Toyomane	Team Leader, JICA Expert Team
Mr. Mitsuhiko Ishida	Member, JICA Expert Team
Mr. Takele Alemu	Research Assistant
Mr. Anteneh Getachew	Research Assistant

Agenda:

1) Report the progress of the Project;
2) Review the results of Inception Survey;
3) Confirm how to manage the Item Pools;
4) Report the progress of the Workbooks, INSET module and PRESET module;
5) Set some indicators to evaluate LAMS' achievement; and
6) Plan main activities of Year 2.

Discussed Agenda and Actions to Be Taken

Discussed Agenda and Decisions	Actions to Be Taken
1) Progress of the Project	
1 Dr. Toyomane presented the progress of Year 1 as follows: - The first year of the project is near completion. In this one-year period, there were encouraging results on each component of the project objectives. - Three out of the 10 workshops intended in the project life time were conducted. - With a target of developing a total of 9600 items in all subjects, items have been developed and 26.7% of this goal has been materialized by the participants of the workshops. - There has also been a significant increase in the number of items developed in each workshop with promising progress to meet the goal at the end of the project.	
2) Review of the Inception Survey	
1 Dr. Toyomane presented the objectives, findings, and suggestions of the Inception Survey, as below: - The objectives are the following: to check consistency between syllabi and PSLCE, EGSECE and textbooks by consistency analysis; and to learn current practices and teaching-learning situations in the country through school surveys. - PSLCE samples from Addis Ababa, Amhara, Benishangul-Gumuz, and Dire Dawa and EGSECE samples as well as textbooks of Grades 7 and 8 in the four subjects were scrutinized for the consistency analysis. - 70 principals, 173 teachers of mathematics and science, and 1367 students from 32 primary schools in Addis Ababa, Amhara, Benishangul-Gumuz and SNNPR were involved in the survey. - In the results it was found out that PSLCE items in Mathematics and Chemistry show lower consistency with competencies while Biology items show relatively better consistency. Regional variations are also significant. By comparison, EGSECE items showed better rates of consistency. The exercise question items in the textbooks also showed considerable discrepancy with the competencies. - Recommendations: technical expertise exchange between different regional experts is necessary to reduce regional variations and a national initiative is required to make all such documents mutually consistent. - School observation survey results showed that students showed immense interest to learn Mathematics and Science subjects. However, they also scored low below 30% in the mock achievement tests given by LAMS. Principals also showed that student's achievements are their major concern. 2 Mr. Arega expressed his interest in the survey results and stressed the importance of supporting regions. 3 Mr. Tamiru asked how its consistency analysis was conducted to consult it for NEAEA's future activities. 4 Dr. Toyomane promised to confirm the means of analysis with the project members and will inform the participants of it. 5 Mr. Tamiru also asked why National Learning Assessment (NLA) was not included in the survey. 6 Dr. Toyomane answered that it was because NLA question papers were not available due to its confidentiality. 7 Mr. Daniel informed that CDID is expecting to work together with NEAEA to fill the gap between the curriculum and the exams with referring to the	Dr. Toyomane will confirm how consistency analysis was conducted with the project members. Dr. Toyomane will deliver the printed copies of the Inception Survey Report.

2

	are the tasks to be met ahead. 2 Mr. Daniel proposed that it is better to hold separate workshops for the workbooks instead of adding one day to each workshop for the Item Pools. He also asked Dr. Toyomane to make a work plan for the workbooks to clarify whether GEQIP funds can be applied to printing workbooks or not. State Minister, Mr. Fuad, also has a strong interest in this issue. 3 Dr. Toyomane answered that he is now consulting with JICA Headquarters whether it is possible to hold new workshops for the workbooks which will require more budgets and human resources. He promised to make the work plan and report it to Mr. Fuad as soon as he receives the answer from JICA.	
5)	**Setting indicators to evaluate LAMS' achievement**	
	1 Dr. Toyomane proposed five new indicators and surveys to evaluate the outputs 1 and 3 in the PDM. Five surveys proposed are as follows: - A quantitative analysis to see if quality of question items is improved (comparison between discrimination power of old and new items) - Qualitative analysis of items (comparing question items developed by the same participants in different workshops) - Analysis to see if consistency of PSLCE is improved - Study to see if capacity of participants is improved - Study to see change in the view of participants regarding curriculum, syllabi, and examinations 2 Attendants were invited to give their comments and ideas. 3 Mr. Tamiru questioned that these indicators may not be helpful to conclude that they are improved by LAMS as they could also be affected by other factors, and we do not have any control groups. 4 Mr. Belayneh basically agreed with the indicators, but questioned that it could be difficult to measure them since they look qualitative and subjective. He suggested considering more quantitative indicators. 5 Dr. Toyomane answered that he will review the indicators and surveys to make them more specific to LAMS and more quantitative. 6 Mr. Arega offered a comment that the revised PDM sounds reasonable.	Dr. Toyomane will reconsider the indicators and surveys to make them more appropriate.
6)	**Main activities of Year 2**	
	1 Dr. Toyomane presented the main activities supposed to be conducted in Year 2, which are - Workshops (4, 5, 6, 7, 8) - Item selection for item pool - Database building for item pool - Development of Workbook, INSET and PRESET modules - Second counterpart training in Japan - End-line Surveys - Public relations activities 2 Attendants were invited to give their comments and ideas. 3 Mr. Biruk asked why End-line Survey is included in Year 2 although LAMS will continue up to Year 3. 4 Dr. Toyomane answered that it should be conducted in Year 2 to write the End-line Survey Report which will be issued in Year 3.	

In his closing remarks, Mr. Belayneh, Chairperson, thanked all the attendants of the meeting. He encouraged them to have better coordination among agencies to make LAMS project proceed on the right track.

APPENDIX 16 MINUTES OF THE THIRD TECHNICAL COMMITTEE MEETING (December 16, 2016)

LAMS
Minutes of the 3rd Technical Committee Meeting

Mr. Gebre Egziabher Araya
Deputy Head
Mathematics and Science Improvement Center
Ministry of Education
Federal Democratic Republic of Ethiopia

Dr. Norimichi Toyomane
Team Leader
JICA Expert Team for LAMS

Date: December 16, 2016
Time: 9:00~11:45
Venue: Mr. Arega Mamaru's office, National Educational Assessment and Examinations Agency (NEAEA)
Participants: 11 participants

Mr. Gebre Egziabher Araya	Deputy Head, MSIC (Chairperson)
Mr. Arega Mamaru	Director, Exam Preparation and Administration Directorate, NEAEA
Mr. Tamiru Zeryhun	Director, Educational Assessment Directorate, NEAEA
Mr. Biruk Zenebe	Program Officer, JICA Ethiopia Office
Mr. Genya Nakamura	Program Officer, JICA Ethiopia Office
Dr. Takeshi Miyazaki	MoE Advisor, JICA
Dr. Norimichi Toyomane	Team Leader, JICA Expert Team
Dr. Desalegn Chalchisa	Member, JICA Expert Team
Mr. Takele Alemu	Research Assistant, LAMS
Mr. Anteneh Getachew	Research Assistant, LAMS
Ms. Grumeshet Mergia	Secretary, LAMS

Agenda:

1) Reporting the progress of the LAMS Project
2) Setting specific targets for the indicators introduced in the revised PDM

Discussed Agenda and Actions to Be Taken

Discussed Agenda and Decisions	Actions to Be Taken
1) Progress of the Project	
1 Dr. Toyomane presented the achievements and challenges of Year 2 as follows:	

Achievements - Four Workshops have been conducted so far in Year 2; - 85.2% of the targets of items to be developed in the Workshops have been completed; - Workbook development is also underway. A number of manuscripts have been produced and digitized; - Four Item Selection Workshops have been conducted and items developed in Workshops 1 to 6 were reviewed by experts; - Preparation of INSET module is in progress and PRESET module was prepared and validated with TELDD; - Second counterpart training was conducted in Japan and all 11 REB Heads participated. *Challenges* - The attendance of LAMS Workshop participants has reduced due to various factors. Consequently, the project is in danger of not meeting some of its target outputs. It may not be able to develop the target numbers of items for the item pools or complete all Workbook manuscripts. - Resolution: We will officially report this situation to the State Minister and ask him to issue a letter urging REBs and Directorates/Agency to ensure better participation of participants. 2 Mr. Tamiru commented that the higher-level officials, both regional and federal, need to be brought "on board" while arranging the Workshop. There should be no gap of communication. 3 Mr. Tamiru asked why LAMS is not working on the item banks. 4 Mr. Biruk answered that when LAMS started its implementation, Director General of NEAEA indicated that the item bank was strictly confidential and LAMS' outputs should be meant only for the item pools. 5 Mr. Arega asked what LAMS specifically does for the item bank writers sent by NEAEA. 6 Mr. Biruk answered that what LAMS does for the anonymously participating item bank item writers is capacity building. This is one of the project objectives and they are enhancing their capacity in developing good quality items. 7 Mr. Arega asked what happens to the items not selected in the item selection and how the selected items' validity is guaranteed. 8 Mr. Gebre Egziabher answered that during the review, the judges select best items from among the group of items dealing with the same competency. The judges also make corrections and modifications with items having minor defects. In this way, we make sure that each competency is covered and the items' quality is secured. 9 Mr. Arega proposed to store some of the items developed later for Grade 10 by LAMS in the NEAEA's item bank for EGSECE. This proposal was not accepted by the participants and Mr. Arega withdrew it.	
2) Revision of the PDM	
1 Dr. Toyomane presented proposals for main changes in the Project Design Matrix (PDM): *Combination of Output 1 and Output 3* - Since 4 Subject Working Groups (Output 1) and Assessment and Evaluation Working Group (Output 3) are no longer differentiated in item writing, the two Outputs should be combined under new Output 1. *Indicator to evaluate participants' understanding about the importance of curriculum consistency (Project Purpose)* - The rate of participants who strongly agree with its importance:	

2

	In 2014 28.6% In 2017 50% *Indicators to evaluate "participants' performance" (Output 1)* - Participants' performance should be evaluated in two ways: 1) The percentage of items satisfying the two conditions below increases: Difficulty >= 0.25 Discrimination Index >= 0.10 For Workshop 2 52.0% For Workshop 7 70.0% 2) Average score of item quality evaluation increases: For Workshop 2 3.35 For Workshop 7 4.00 *Indicator to evaluate "participants' satisfaction" (Output 1)* - Participants' satisfaction should be: In Workshops 7 and 8 80%	
2	Mr. Arega asked why 0.25 and 0.10 are chosen as the benchmarks. Dr. Toyomane explained that difficulty of 0.25 is the minimum level for the multiple-choice items to clear and 0.10 is set for discrimination index based on the results of the early field tests.	
3	Mr. Tamiru questioned whether difficulty of 0.25 was acceptable. Dr. Toyomane explained that these benchmarks were set to evaluate LAMS achievements and not to conduct scientific research.	
4	Mr. Tamiru suggested to lower the "70.0%" target to an achievable and realistic percentage since that target might be a bit too stretched in view of the recent performances.	
5	Mr. Biruk argued that we should keep the "70.0%" target as it is even though it would require much more effort by LAMS and stakeholders.	
6	Mr. Gebre Egziabher agreed with this argument.	
7	Dr. Miyazaki asked who would conduct the item quality evaluation. Dr. Toyomane answered that LAMS Advisor would.	
8	All the proposals presented by Dr. Toyomane were accepted by the meeting.	

Mr. Gebre Egziabher, Chairperson, closed the meeting urging the members to try to increase the participants from the regions since it is the responsibility of the Technical Committee to sustain the project outcome after LAMS finishes.

APPENDIX 17 MONITORING SHEETS (Version 1, January 2015)

PM Form 3-1 Monitoring Sheet Summary

TO: CR of JICA Ethiopia Office

PROJECT MONITORING SHEET

Project Title: The Project for Capacity Development for Improving Learning Achievement in Mathematics and Science Education (1st Year)

Version of the Sheet: Ver. 1 (**Term:** October 2014 – October 2015)

Name: Norimichi Toyomane

Title: Team Leader/Mathematics

Submission Date: January 30, 2015

I. Summary

1 Progress

1-1 Progress of Inputs

- Experts from Japan are assigned and dispatched as planned.
- First Training in Japan is planned from 18 April to 2 May 2015. Ten candidates for the training are to be selected by the Ethiopian side.
- The Ethiopian side assigned experts as WG members at both Federal and REBs level.

1-2 Progress of Activities

- 1st National Steering Committee meeting was held on October 16, 2014 at State Minister's meeting room.
- 1st Technical Committee meeting was held on November 27, 2014 at NEAEA.
- 1st Workshop was held on January 13-16 in Adama by inviting all WG members. 79 attended.
- Materials for LAMS data collection, consisting of questionnaires and achievement tests, were prepared by mid-December 2014. A pre-test of the test items was conducted for validation on December 24, 2014. Data collection is to be conducted in total 30 primary schools of Addis Ababa, Amhara, SNNPR and Benishangul-Gumuz.

1-3 Achievement of Output

Output 2: Item pool in mathematics and science education for Grade 7 is partially developed in the first workshop in January 2015.

1-4 Achievement of the Project Purpose

N/A

1-5 Changes of Risks and Actions for Mitigation

N/A

1-6 Progress of Actions undertaken by JICA

All inputs and actions have been undertaken by JICA according to the plan.

1-7 Progress of Actions undertaken by Gov. of Ethiopia

National Learning Assessment by NEAEA is planned in 2014/2015. NEAEA confirmed that it would conduct the study from April to May 2015. Tools have been developed, verified and printed.

1-8 Progress of Environmental and Social Considerations (if applicable)

N/A

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

N/A

1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

All Regions are currently engaged in conducting in-service training programs for primary school teachers under GEQIP, and experts are to serve as trainers in this training. Hence, MSIC experts need to be consulted well in advance on the Workshop schedule of LAMS to ensure their participation.

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

No delay or problem has been recorded.

2-2 Cause

N/A

2-3 Action to be taken

N/A

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of Ethiopia, etc.)

N/A

3 Modification of the Project Implementation Plan

3-1 PO

No modification has been made on the PO.

3-2 Other modifications on detailed implementation plan

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team

deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

No modification has been made on the detailed implementation plan.

4 Preparation of Gov. of Ethiopia toward after completion of the Project

No preparation has been started yet.

II. Project Monitoring Sheet I & II *as Attached*

Project Monitoring Sheet I （Revision of Project Design Matrix）

Project Title: Project for Capacity Development for Improving Learning Achievement in Mathematics and Science Education (LAMS)
Version: 1
Implementing Agency: Fedearl Ministry of Education
Dated: January 30, 2015
Target Group: Officials of the Federal Ministry of Education, Officials of Regional Education Bureaus (11)
Period of Project: October 2014~October 2017
Project Site: Whole country **Model Site**: None

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Super Goal Students' learning achievement at Grade 7 and 8* is improved.	1 Improvement of the results of Primary School Leaving Certificate Examination (PSLCE) in mathematics and science 2 Improvement of the results of National Learning Assessment (NLA)	1 Result of PSCLE by REBs and NEAEA 2 Result of NLA by NEAEA			
Overall Goal Pedagogical basic foundation is prepared mainly at Grade 7 and 8 to improve students' learning achievement.	1 "Workbook" developed by the Project are distributed to schools 2 "Assessment and Evaluation session module on mathematics and science education" is utilized at CTE and Inset	1 MoE and REBs reports 2 Interview with related directorates and REBs	1 Quality of question items of PSLCE in mathematics and science, and NLA is improved based on the outputs of the project.		
Project Purpose Quality of curriculum strategy to improve students' learning achievement in mathematics and science education at target grades is enhanced under curriculum consistency.	1 Understandings on quality of curriculum policy under curriculum consistency in mathematics and science education are deepened among the stakeholders 2 Materials developed by the Project have curriculum consistency	1 Project reports 2 Project reports	1 The Ethiopian Government fund is utilized for the outputs of the project, such as printing and distribution of the materials developed by the project and preset and inset. 2 Mathematics and Science textbooks are distributed nationwide.		
Output 1: (Subject WGs' members) Capacity of Subject WGs' members on mathematics and science education are enhanced	1 Improvement of M&E results of the trainings and WS in terms of the following contents:** (1) Participants' performance (2) Satisfaction toward the contents of the trainings and WS by the participants 2 Relevance of the quality of question items of Item Pool is secured through validation process.	1 Project reports 2 Project reports	1. Collaborative activities among stakeholders are maintained.		
Output 2: (Subject WGs' and Assessment and Evaluation WG's members) Item pool in mathematics and science education for Grade 7 and 8, and Sample Item pool in mathematics and science education for Grade 4 and 10 are developed.	1 Improvement of M&E results of the trainings and WS in terms of the following contents: (1) Participants' performance based on concrete question items developed by the participants (2) Satisfaction toward the contents of the trainings and WS by the participants 2 "Item pool" is allocated in accessible way for all related stakeholders 3 "Item Pool" is utilized by related stakeholders	1 Project reports 2 Project reports 3 Project reports			

Output 3: (Mainly NEAEA and REBs) Capacity of the following human resources on development of Item Banks is enhanced. - Item writers and experts for "NLA Item Bank on mathematics and science education for Grade 4, 8 and 10 (NEAEA)" - Subject experts for "PSLCE Item Bank on Mathematics and Science for Grade 8 and Ethiopian General Secondary Education Certificate Examination (EGSECE) in Grade 10 (NEAEA) " - Item writers for "PSLCE items for Grade 8 (REBs)"	1 Improvement of M&E results of the trainings and WS in terms of the following contents: (1) Participants' performance (2) Satisfaction toward the contents of the trainings and WS by the participants 2 Improvement of the results of M&E of WG's sessions related to Output 3	1 Project reports 2 Project reports			
Output 4: (Mainly CDID) "Workbooks on mathematics and science for Grade 7 and 8" are developed.	1 Relevance of the quality of the product is secured through validation process 2 Endorsement by MoE	1 Project reports 2 MoE			
Output 5: (Mainly MSIC) "Assessment session module on mathematics and science education for Grade 7 and 8" based on "Item Pool for Grade 7 and 8", as one of the CPD modules, is elaborated.	1 Relevance of the quality of the product is secured through validation process 2 E ndorsement by MoE	1 Project reports 2 MoE			
Output 6: (Mainly TELDD) "Assessment session module on mathematics and science education for Grade 7 and 8" based on "Item Pool for Grade 7 and 8", as one of the CTE modules, is elaborated.	1 Relevance of the quality of the product is secured through validation 2 Endorsement by MoE	1 Project reports 2 MoE			
Output 7: (Mainly CDID, MSIC and TELDD) Action plans, clarifying the utilization of developed materials, are prepared.	1 Approval by MoE	1 MoE			

Activities	Inputs		Important Assumption
	The Japanese Side	The Ethiopian Side	1 Members of the WGs are not changed.
1-1. Plan WG's trainings and WS. 1-2. Coordinate WG's trainings and WS. 1-3. Conduct Subject WG's trainings and WS. 1-4. Monitor and evaluate the results of the Subject WG's trainings and WS.	• Experts from Japan - Chief Advisor - Mathematics Education - Science Education (Chemisry, Biology and Physics) - Educational Assesment/Test Development - Project Coordinator/Public Relation	• Counterparts (C/P) - Project Manager (State Minister) - Project Coordinator - Related officier in NEAEA - Related officier in Curriculum - Related officier in TELDD - Related officier in TELLRD - Related officier in MSIC - Related officier in REBs	2 Members of the WGs continue participating the respective trainings and WSs.
2-1. Trainings on development of question items for Item Pool. 2-2. Consolidate the procedure of development of Item Pool. 2-3. Draft question items for Grade 8. 2-4. Validate on reliance and relevance of drafted question items for Grade 8. 2-5. Finalize question items for Grade 8. 2-6. Draft question items for Grade 7. 2-7. Validate on relevance of drafted question items for Grade 7. 2-8. Finalize question items for Grade 7. 2-9. Draft sample question items for Grade 10. 2-10. Validate on reliance and relevance of drafted sample question items for Grade 10. 2-11. Finalize sample question items for Grade 10. 2-12. Draft sample question items for Grade 4. 2-13. Validate on reliance and relevance of drafted sample question items for Grade 4. 2-14. Finalize sample question items for Grade 4.	• Experts activity Cost • Activity costs related to Workshop in WG • Necessary equipment for the project activities • Necessary cost for trainings in Japan and third countries	• Assignment of specialists (subject expert, item developers/writes), and Assessment and Evaluation specialists/ experts as WG members at Federal and REBs level. • Assignment of appropriate number of primary and secondary schools for validation of Item Pool and other related materials. • Necessary cost for implementation of all related activities which each directorate and REB plan and implement, such as teacher trainings, printing and distribution of materials, etc. • Translation cost of final products of the Project from English to local language. • Project office with its running cost. • Necessary cost to conduct National Steering Committee and Technical Committee.	**Pre-Conditions** 1 The current Curriculum (Active learning and Competency based approach) is maintained. 2 Appropriate members are assigned to Subject and Assessment and Evaluation WGs. <Issues and countermeasures>
3-1. Plan Assessment and Evaluation WG' s trainings and WSs. 3-2. Coordinate Assessment and Evaluation WG's trainings and WSs. 3-3. Conduct Assessment and Evaluation WG's trainings and WSs. 3-4. Monitor and evaluate Assessment and Evaluation WG's trainings and WSs. 3-5. (To be determined) Activities for improving quality of mathematics and science Item bank.			

4-1. Establish editing concept of Workbook. 4-2. Consolidate development procedure. 4-3. Draft Workbook for Grade 8. 4-4. Validate drafted Workbook for Grade 8 at classroom level. 4-5. Finalize Workbook for Grade 8. 4-6. Draft Workbook for Grade 7. 4-7. Validate drafted Workbook for Grade 7 at classroom level. 4-8. Finalize Workbook for Grade 7.			
5-1. Establish editing concept of the modules. 5-2. Consolidate development procedure. 5-3. Draft module for Grade 8, based on the Item Pool for Grade 8. 5-4. Validate drafted module for Grade 8. 5-5. Finalize the module for Grade 8. 5-6. Draft module for Grade 7, based on the Item Pool for Grade 7. 5-7. Validate drafted module for Grade 7. 5-8. Finalize the module for Grade 7.			
6-1. Establish editing concept of the modules. 6-2. Consolidate development procedure. 6-3. Draft module for Grade 8, based on the Item Pool for Grade 8. 6-4. Validate drafted module for Grade 8. 6-5. Finalize the module for Grade 8. 6-6. Draft module for Grade 7, based on the Item Pool for Grade 7. 6-7. Validate drafted module for Grade 7. 6-8. Finalize the module for Grade 7.			
7-1. Define scaling up strategy of how to utilize materials developed by the project. 7-2. Develop action plan for scaling up. 7-3. Obtain approval of the action plan.			

* "Grade 7 and 8" are set as target grades of the initial stage of the strategy under curriculum consistency to be focused on in the Project. It is expected that other grades will be set as target grades after completion of the Project by the Ethiopian side.

** Appropriate indicators will be determined in feasible way, after commencement of the project.

Project Monitoring Sheet II (Revision of Plan of Operation)

Version 1
Dated: January 30, 2015

Project Title: Project for Capacity Development for Improving Learning Achievement in Mathematics and Science Education

Inputs	Plan / Actual	2014 I	2014 II	2014 III	2014 IV	2015 I	2015 II	2015 III	2015 IV	2016 I	2016 II	2016 III	2016 IV	2017 I	2017 II	2017 III	2017 IV	Remarks	Monitoring: Issue	Monitoring: Solution
Expert																				
Norimichi Toyomane	Plan				■	■	■	■	■	■	■		■		■		■			
	Actual				■	■														
Shuhei Oguchi	Plan				■	■				■	■		■	■	■		■			
	Actual				■	■														
Yasushi Wada	Plan				■		■		■	■		■		■						
	Actual				■															
Shimboku Miyakawa	Plan					■	■	■	■	■	■	■	■		■		■			
	Actual				■															
Etsutaro Tanaka	Plan						■	■	■		■		■		■	■				
	Actual																			
Masatsugu Murase	Plan				▒	▒	▒	▒	■	▒	▒	▒	▒	▒	▒	▒				
	Actual					■														
Atsushi Tsukui	Plan				■	■	■	■		■		■			■	■				
	Actual				■	■														
Hidetoki Ishii	Plan				▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒				
	Actual																			
Desalegn Chalchisa Jebena	Plan				▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒				
	Actual																			
Yosuke Sakurai/ Mitsuhiko Ishida	Plan				■	■	■		■	■		■		■			■	Replaced by Mitsuhiko Ishida in February 2015		
	Actual				■															
Equipment																				
	Plan																			
	Actual																			
	Plan																			
	Actual																			
	Plan																			
	Actual																			
	Plan																			
	Actual																			
	Plan																			
	Actual																			
Training in Japan																				
	Plan						■				■				■					
	Actual																			
In-country/Third country Training																				
	Plan																			
	Actual																			

Activities / Sub-Activities	Plan / Actual	2014 I	2014 II	2014 III	2014 IV	2015 I	2015 II	2015 III	2015 IV	2016 I	2016 II	2016 III	2016 IV	2017 I	2017 II	2017 III	2017 IV	Responsible Organization: Japan	Responsible Organization: Ethiopia	Achievements	Issue & Countermeasures
Output 1: (Subject Working Groups' members)																					
1.1 Plan WG's trainings and WS	Plan																	JICA Expert Team	MSIC		
	Actual																				
1.2 Coordinatte WG's trainings and WS	Plan																	JICA Expert Team	MSIC	All Subject Working Group members have been assigned.	
	Actual																				
1.3 Conduct Subject WG's trainings and WS	Plan																	JICA Expert Team	MSIC		
	Actual																				
1.4 Monitor and evaluate the results of the Subject WG's trainings and WS	Plan																	JICA Expert Team	MSIC		
	Actual																				
Output 2: (Subject WGs' and Assessment and Evaluation WG's members)																					
2.1 Trainings on development of question items for Item Pool	Plan																	JICA Expert Team	MSIC		
	Actual																				
2.2 Consolidate the procedure of development of Item Pool	Plan																	JICA Expert Team	MSIC		
	Actual																				
2.3 Draft question items for Grade 8	Plan																	JICA Expert Team	MSIC		
	Actual																				
2.4 Validate on reliance and relevance of drafted question items for Grade 8	Plan																	JICA Expert Team	MSIC		
	Actual																				
2.5 Finalize question items for Grade 8	Plan																	JICA Expert Team	MSIC		
	Actual																				
2.6 Draft question items for Grade 7	Plan																	JICA Expert Team	MSIC		
	Actual																				
2.7 Validate on relevance of drafted question items for Grade 7	Plan																	JICA Expert Team	MSIC		
	Actual																				
2.8 Finalize question items for Grade 7	Plan																	JICA Expert Team	MSIC		
	Actual																				
2.9 Draft sample question items for Grade 10	Plan																	JICA Expert Team	MSIC		
	Actual																				
2.10 Validate on reliance and relevance of drafted sample question items for Grade 10	Plan																	JICA Expert Team	MSIC		
	Actual																				
2.11 Finalize sample question items for Grade 10	Plan																	JICA Expert Team	MSIC		
	Actual																				
2.12 Draft sample question items for Grade 4	Plan																	JICA Expert Team	MSIC		
	Actual																				
2.13 Validate on reliance and relevance of drafted sample question items for Grade 4	Plan																	JICA Expert Team	MSIC		
	Actual																				
2.14 Finalize sample question items for Grade 4	Plan																	JICA Expert Team	MSIC		
	Actual																				
Output 3: (Mainly NEAEA and REBs)																					
3.1 Plan Assessment and Evaluation WG's trainings and WSs	Plan																	JICA Expert Team	MSIC		
	Actual																				
3.2 Coordinate Assessment and Evaluation WG's trainings and WSs	Plan																	JICA Expert Team	MSIC	Assessment and Evaluation Working Group members have	
	Actual																				
3.3 Conduct Assessment and Evaluation WG's trainings and WSs	Plan																	JICA Expert Team	MSIC		
	Actual																				
3.4 Monitor and evaluate Assessement and Evaluation WG's	Plan																	JICA Expert Team	MSIC		
	Actual																				

3.5 (To be determined) Activities for improviing quality of mathematics and science Item Bank	Plan / Actual	JICA Expert Team MSIC		
Output 4: (Mainly CDID)				
4.1 Establish editing concept of Workbook	Plan / Actual	JICA Expert Team CDID	Discussion has been held on the concept of Workbooks.	Discuss further with monitoring mission.
4.2 Consolidate development procedure	Plan / Actual	JICA Expert Team CDID		
4.3 Draft Workbook for Grade 8	Plan / Actual	JICA Expert Team CDID		
4.4 Validate drafted Workbook for Grade 8 at classroom level	Plan / Actual	JICA Expert Team CDID		
4.5 Finalize Workbook for Grade 8	Plan / Actual	JICA Expert Team CDID		
4.6 Draft Workbook for Grade 7	Plan / Actual	JICA Expert Team CDID		
4.7 Validate Drafted Workbook for Grade 7 at classroom level	Plan / Actual	JICA Expert Team CDID		
4.8 Finalize Workbook for Grade 7	Plan / Actual	JICA Expert Team CDID		
Output 5: (Mainly MSIC)				
5.1 Establish editing concept of the modules	Plan / Actual	JICA Expert Team MSIC		
5.2 Consolidat development procedure	Plan / Actual	JICA Expert Team MSIC		
5.3 Draft modules for Grade 8, based on the Item Pool for Grade 8	Plan / Actual	JICA Expert Team MSIC		
5.4 Validate drafted module for Grade 8	Plan / Actual	JICA Expert Team MSIC		
5.5 Finalize the module for Grade 8	Plan / Actual	JICA Expert Team MSIC		
5.6 Draft module for Grade 7, based on the Item Pool for Grade 7	Plan / Actual	JICA Expert Team MSIC		
5.7 Validate drafted module for Grade 7	Plan / Actual	JICA Expert Team MSIC		
5.8 Finalize the module for Grade 7	Plan / Actual	JICA Expert Team MSIC		
Output 6: (Mainly TELDD)				
6.1 Establish editing concept of the modules	Plan / Actual	JICA Expert Team TELDD		
6.2 Consolidate development procedure	Plan / Actual	JICA Expert Team TELDD		
6.3 Draft module for Grade 8, based on the Item Pool for Grade 8	Plan / Actual	JICA Expert Team TELDD		
6.4 Validate drafted module for Grade 8	Plan / Actual	JICA Expert Team TELDD		
6.5 Finalize the module for Grade 8	Plan / Actual	JICA Expert Team TELDD		
6.6 Draft module for Grade 7, based on the Item Pool for Grade 7	Plan / Actual	JICA Expert Team TELDD		

6.7 Validate drafted module for Grade 7	Plan Actual	JICA Expert Team TELDD		
6.8 Finalize the module for Grade 7	Plan Actual	JICA Expert Team TELDD		
Output 7: (Mainly CDID, MSIC and TELDD)				
7.1 Define scaling up strategy of how to utilize maerials developed by the project	Plan Actual	CDID, MSIC, TELDD		
7.2 Develop acion plan for scaling up	Plan Actual	CDID, MSIC, TELDD		
7.3 Obtain approval of the action plan	Plan Actual	CDID, MSIC, TELDD		
Duration / Phasing	Plan Actual	Year 1 / Year 2 / Year 3		

Monitoring Plan		2014 I	2014 II	2014 III	2014 IV	2015 I	2015 II	2015 III	2015 IV	2016 I	2016 II	2016 III	2016 IV	2017 I	2017 II	2017 III	2017 IV	Remarks	Issue	Solution
Monitoring																				
National Steering Committee	Plan																			
	Actual				■															
Set-up of the Detailed Plan of Operation	Plan																			
	Actual				■															
Submission of Monitoring Sheet	Plan																			
	Actual																			
Monitoring Mission from Japan	Plan																	Receive from March 3-6		
	Actual																			
Joint Monitoring	Plan																			
	Actual																			
Post Monitoring	Plan																			
	Actual																			
Reports/Documents																				
Work Plan	Plan																			
	Actual				■															
Baseline Survey Report	Plan																			
	Actual																			
Progress Report	Plan																			
	Actual																			
Endline Survey Report	Plan																			
	Actual																			
Project Completion Report	Plan																			
	Actual																			
Public Relations																				
Newsletter	Plan																			
	Actual					■														
Homepage	Plan																			
	Actual																			
	Plan																			
	Actual																			