Ex-Post Project Evaluation 2016
Package I-4 (Kenya, Nigeria, Niger)

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Republic of Kenya

FY 2016 Ex-Post Evaluation of Japanese Grant Aid Project

"The Project for the Upgrading and Refurbishment of the Centre for Mathematics, Science and Technology Education in Africa"

External Evaluator: Takako Haraguchi, International Development Associates, Ltd.

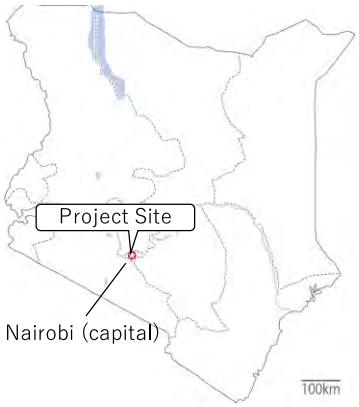
0. Summary

This project aimed to strengthen training and related activities for teachers, trainers for teachers and education administrators on the premises of the Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA), which is the implementing agency of in-service education and training (INSET) in mathematics and science in primary and secondary education in Kenya and serves as a center of the training for promotion of mathematics and science education in Africa, by expanding the facilities of CEMASTEA. The relevance of these objectives is high, as they were consistent with Kenya's and intra-regional development policies and development needs as well as with Japan's ODA Policy, with respect to strengthening teachers' capacity. The effectiveness and impact are evaluated to be high. By utilizing the facilities and equipment delivered by this project, the expected level of quantitative expansion of training was realized overall, missing the target only slightly. In addition, as the result of the improvement of the training and operation environment, the enhancement in the comfort and efficiency of training was confirmed. Coupled with the output of a JICA technical cooperation project, "Strengthening of Mathematics and Science Education" (2009-2013) (SMASE Phase 3), which was implemented almost simultaneously, the activities of CEMASTEA have contributed to the continuation and further development of INSET in mathematics and science in Kenya as well as to the incorporation of the contents of the CEMASTEA training into mathematics and science education in other African countries.

The project's efficiency is evaluated to be fair. While the increase in the project cost was justifiable considering the increase in the outputs, the project period was longer than planned. The sustainability of the project's effects is evaluated to be high, as no major problems have been observed in the institutional, technical and financial aspects of operation and maintenance of the CEMASTEA facilities as well as the implementation of training.

In light of the above, this project is evaluated to be highly satisfactory.

1. Project Description



Project Location

The Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA) (From the left) Administration building 1, administration building 2, lecture hall

1.1 Background

Despite the effort made in Kenya to expand access to education by implementing the Free Primary Education policy in 2003 and the Free Day Secondary Education policy in 2008, the improvement in the quality of education was stagnating. To improve the quality of education particularly in mathematics and science, the government of Kenya was promoting INSET in the aforementioned subject areas, with assistance from Japan, through technical cooperation projects such as the "Strengthening of Mathematics and Science in Secondary Education Project" (1998-2003) (SMASE[1] Phase 1) and the "Strengthening of Mathematics and Science in Secondary Education Project Phase 2" (2003-2008) (SMASE Phase 2). The adopted approach for pedagogical improvement was based on a principle of classroom improvement called "Activity, Student-centered, Experiment and Improvisation/Plan, Do, See and Improvement" (ASEI-PDSI). Those INSET programs that used this approach to train mathematics and science teachers, known as SMASE INSET, spread throughout the country. Also, in an attempt to introduce SMASE INSET in other African countries, an intra-regional cooperation network called the Strengthening of Mathematics and Science Education in Western, Eastern, Central and Southern Africa Association (SMASE-WECSA)[2] was launched in 2001 under SMASE

[1] The abbreviated title for the Phase 1 and Phase 2 technical cooperation projects was SMASSE (Strengthening of Mathematics and Science in Secondary Education) since they targeted secondary education (Grade 9 to Grade 12). The Phase 3 was abbreviated as SMASE (Strengthening of Mathematics and Science Education) as it extended its scope to primary education (Grade 1 to Grade 8, of which this project specifically targeted Grade 6 to Grade 8). For convenience, this report uses the abbreviation "SMASE" for all phases from Phase1 to Phase 3, and refers to the entire series of technical cooperation projects without specifying phases as "the SMASE project".

[2] The member countries of SMASE-WECSA reached 27 in total by 2011 (Angola, Benin, Botswana, Burkina Faso, Burundi, Cemeroon, Ethiopia, Gambia, Ghana, Kenya, Lethotho, Mali, Malawi, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Sudan, Swaziland, Tanzania, Uganda, Zambia, Zanzibar, and Zimbabwe). *In alphabetical order; the Ministry of Education of Zanzibar was registered separately from the Ministry of Education of Tanzania as they are distinct organizations.

Phase 1, reinforcing the efforts by the member countries to promote mathematics and science education and institutionalize the INSET system.

CEMASTEA was created by the government of Kenya in 2003 to lead these undertakings. However, the facilities of CEMASTEA, which had been converted from an existing vocational school, had problems such as lack of a large lecture hall for group training, limited capacity of the training rooms and laboratories, and inefficient administration facilities, which were making it difficult to respond to the increased need for training.

1.2 Project Outline

The objective of this project was to strengthen the training and other related activities of CEMASTEA on its premises in Nairobi for INSET trainers and education administrators by expanding the facilities of CEMASTEA, thereby contributing to the improvement of INSET in mathematics and science in Kenya and in Africa.

E/N Grant Limit or G/A Grant Amount / Actual Grant Amount	581 million yen / 577 million yen
Exchange of Notes Date (/Grant Agreement Date)	August 2011 / August 2011
Executing Agency	The Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA)
Project Completion	October 2013
Main Contractor(s)	Konoike Construction Co., Ltd.
Main Consultant(s)	Matsuda Consultants International Co., Ltd. and INTEM Consulting, Inc.
Basic Design	November 2010 – August 2011 (Preparatory Survey)[3]
Related Projects	"Strengthening of Mathematics and Science in Secondary Education Project" (JICA technical cooperation, 1998-2003) (SMASE Phase 1) "Strengthening of Mathematics and

[3] The basic design study was completed in May 2006, and an exchange of notes was signed by the Japanese and Kenyan governments later in the same year. However, the project was not implemented since the residents near the project site did not agreed on the project plan in the process of the environmental impact assessment (EIA). The Ministry of Education, Science and Technology (MOEST) continued the negotiations with the residents, and finally obtained their consent with the project, which led to the signing of the exchange of notes for the second time.

	Science in Secondary Education Project Phase 2" (JICA technical cooperation, 2003-2008) (SMASE Phase 2) "Strengthening of Mathematics and Science Education" (JICA technical cooperation, 2009-2013) (SMASE Phase 3)

This ex-post evaluation is conducted on a presumption that the objective of the overall plan including this grant aid project[4] was "to strengthen mathematics and science education in primary and secondary education in Kenya and the SMASE-WECSA member countries by training and strengthening trainers (teachers) in mathematics and science in aforementioned countries" (defined by referring to Basic Design Study Report). The overall plan included the activities by CEMASTEA itself and the activities of SMASE Phase 1 through Phase 3. Figure 1 shows the structure of SMASE INSET in Kenya and the scopes of this project and SMASE Phase 3, respectively.

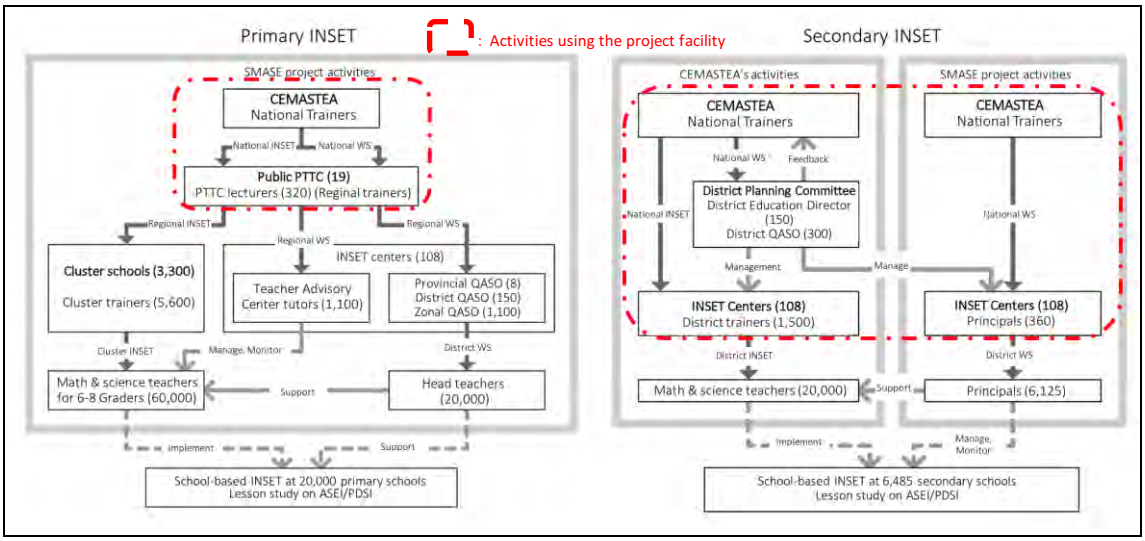


Figure 1: SMASE INSET System in Kenya

Source: Preparatory Survey Report (items encircled by red dotted lines were added by the ex-post evaluator)
Note: Terms are those used at the time of planning. Since 2013, "state" and "county" have been restructured, respectively, into "county" and "sub-county," while "zone" and "cluster" (education administration district) have been abolished. PTTC: Primary Teachers Training College. SMASE Project: SMASE Phase 3 in particular. WS: workshop.

[4] In an evaluation of a grant aid project, an "overall plan" is assumed to include a broad range of projects that are planned by the recipient country's government to resolve development issues.

2. Outline of the Evaluation Study

2.1 External Evaluator

Takako Haraguchi, International Development Associates, Ltd.

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: August 2016 – September 2017

Duration of the Field Study: November 14-22, 2016 and January 16 – February 9, 2017

In parallel to this evaluation, the evaluator conducted ex-post evaluation of SMASE Phase 3. Since the executing agency. Second, the scope and contents of the research conducted for Africa were generally more limited than in Kenya (field research was conducted only in Kenya). Therefore, the reliability of the results of evaluation is expected to be lower than that of the Kenyan evaluation.

2.3 Constraints During the Evaluation Study

The evaluation study faced several challenges due to the multiplicity of observation targets, as the impacts of this project were anticipated to materialize in Kenya and other SMASE-WECSA member countries (27 countries) in Africa. First, although the sampling attempted to achieve an acceptable level of representativeness by including localities and schools in different geographical conditions (urban, suburban, rural, and Arid and Semi-Arid Lands [ASAL]), not only was it non-probability sampling introducing potential biases in the study results, but also the sampling failed to include a sufficient number of cases to adequately compare the tendencies between primary and secondary education. Also, the areas that were difficult to visit due to security reasons were excluded from the study. Second, the scope and contents of the research conducted for Africa were generally more limited than in Kenya (field research was conducted only in Kenya). Therefore, the reliability of the results of evaluation is expected to be lower than that of the Kenyan evaluation.

Table 1: Outline of the beneficiary survey for the ex-post evaluation

Target (population size)			Respondents	Constraints on survey
Kenya	Former Kenyan attendees of CEMASTEA training and workshops	Regional INSET trainers (Approx. 300 individuals for primary education and approx. 1,400 individuals for secondary education)	Valid responses: 22 individuals All trainers who were present at the PTTCs in the two counties and the secondary schools in the seven counties visited by the evaluator.	While the counties and schools visited were representative of the population, respondents were not sampled randomly.
		Local education administrative officers (Total number is unknown but they consist of a few individuals each in 47 counties and their subordinate sub-counties, and principals)	Valid responses: 34 individuals County Directors of Education or Quality Assurance & Standards Officers, and principals of 27 schools (18 primary and nine secondary) in the seven counties visited.	While the counties and schools visited were representative of the population, respondents were not sampled randomly. Sub-county-level administrative officers were not surveyed.
Africa	Attendees of the Third Country Training Program (TCTP) held at CEMASTEA (27 countries in Africa; total number unknown; annual average number of attendees of 135 in 2009-2016)		Valid responses: 21 individuals (11 countries) CEMASTEA delivered the questionnaire via email to 223 individuals it randomly sampled.	Response rate was low. Survey results may be overrated as there may have been a selection bias favoring those attendees who are satisfied or highly utilizing what they learned.
	JICA overseas offices and field offices in the SMASE-WECSA member countries (27 African countries)		Valid responses: 20 offices (20 countries) The evaluator delivered the questionnaire via email to offices in 22 countries. The evaluator requested the offices to have the questions answered by JICA experts, or by other individuals like experts in the related field in case the offices were unable to answer.	The questions were very simple such as "Is there an INSET policy in place?" to which respondents were asked to answer based only on what they knew.

Note: The size of the population was estimated by the ex-post evaluator based on the Preparatory Survey Report, documentation provided by the executing agency, etc.

3. Results of the Evaluation (Overall Rating: A[5])

3.1 Relevance (Rating: ③[6])

3.1.1 Consistency with the Development Plan of Kenya

As part of the long-term national development plan "Vision 2030" (2008-2030), which has remained active from the time of project planning to the time of ex-post evaluation, Kenya has made efforts to become a medium income country by 2030 and improve the quality of education and research. With respect to the sector development plan, the Kenya Education Sector Support Programme (2005-2010) and the National Education Sector Plan (2013-2018), which were implemented at the times of planning and ex-post evaluation respectively, both included INSET as one of their priority investment projects.

[5] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[6] ③: High, ②: Fair, ①: Low

At the time of planning, improvement of teacher's capability in Africa was set as one of the strategic goals in the Second Decade of Education Plan (2006-2015) promoted by the African Union (AU), and the action plan within the Plan counted on the contribution of SMASE-WECSA's intra-regional activities. Revitalization of teaching profession and improvement of educational infrastructure are listed as the first and second strategic goals in the Continent Strategy for Education in Africa (2016-2025) at the time of ex-post evaluation.

3.1.2 Consistency with the Development Needs of Kenya

As discussed above, INSET is called upon as a means toward the improvement in the quality of education. There is continuous need for INSET in Kenya, where the number of schools as well as teachers has risen in both primary and secondary education (Table 2). CEMASTEA holds a significant position as the country's sole implementing body of INSET in mathematics and science.[7]

Table 2: Overview of Education in Kenya

		2010	2012	2014
Primary education	Number of public schools	19,059	20,307	21,718
	Number of private schools	5,055	6,242	7,742
	Total number of all schools	24,114	26,549	29,460
	Number of teachers (person)	173,388	191,034	299,697
	Number of students (person)	9,381,211	9,970,900	9,950,746
	Gross enrolment rate (%)	107%	106%	104%
Secondary education	Number of public schools	5,296	6,188	7,686
	Number of private schools	905	986	1,048
	Total number of all schools	6,201	7,714	8,734
	Number of teachers (person)	52,935	64,109	78,719
	Number of students (person)	1,653,384	1,914,823	2,331,697
	Gross enrolment rate (%)	46%	51%	58%

Source: Ministry of Education, Science and Technology (MOEST); Kenya National Bureau of Statistics.

The needs for improving teacher's capacity are inferred from the statistics[8] for the member countries of SMASE-WECSA between 2009 and 2014, which showed an expansion of teacher population in all countries. In the ex-post evaluation survey conducted with the previous attendees of the Third Country Training Program (TCTP) (21 respondents consisting of the central and local education administrative officers of the member countries as well as INSET trainers), several respondents pointed out the importance of continuous efforts to strengthen teacher's capacity.

Further, in the period between the planning and the ex-post evaluation, in addition to

[7] Outside of CEMASTEA, INSET is implemented by the Kenya Education Management Institute, which operates training in education management, and the Kenya Institute of Special Education, which operates training in special education.

[8] UNESCO Institute of Statistics website.

serving continuously as the center of the TCTP in Africa, CEMASTEA has functioned as the secretariat of the Inter-Country Quality Node for Math and Science Education (ICQN-MSE) within the Association for the Development of Education in Africa (ADEA),[9] and for SMASE Africa, which had been called SMASE-WECSA until 2013. CEMASTEA, thus, plays a significant role as the hub for intra-regional cooperation in mathematics and science education.

3.1.3 Consistency with Japan's ODA Policy

Japan's ODA: Rolling Plan for the Republic of Kenya (2009) designates human resource development as a key area, and the expansion of primary and secondary education as a key development agenda.

In Africa, Japan's basic approach toward ODA in Kenya states that Japan will "facilitate Kenya's self-supporting efforts and assist its efforts in poverty reduction and sustainable growth. It will also consider a regional approach that would bring positive effects to surrounding countries.[10]" Also, the Yokohama Action Plan (2008), which was adopted in the Fourth Tokyo International Conference on African Development (TICAD IV), promotes a goal of "expanding teacher training in mathematics and science through SMASSE (targeting more than 100,000 teachers)".

In this way, this project has been highly relevant to the country's development plan and development needs, as well as Japan's ODA policy. Therefore, its relevance is high.

3.2 Efficiency (Rating:②)

3.2.1 Project Outputs

This evaluation confirmed that the output was produced mostly according the plan. Modifications of the plan were minor, and the reasons were appropriate (Table 3).

[9] ADEA is a network created in 1988 to debate and exchange information on education policy in Africa. It facilitates intra-regional cooperation in education in Africa by working closely with AU.
[10] The Ministry of Foreign Affairs, "Data by country" 2010 edition.

Table 3: Planned and actual outputs of the project

	Plan	Actual
Japanese side	Civil works and procurement of equipment (1) Facilities: Total floor space of 3,349.41m^2 Two administration buildings, a lecture hall, a lecture building, a laboratory building, a dining hall, a connecting hall, a kitchen, a transformer, electric generator rooms, access corridors, and exterior structures. (2) Equipment: Educational equipment in mathematics and science (13 items for physics including electronic analytical scales, 11 items for chemistry including vacuum pumps, six items for biology including microtomes, three items for mathematics including geometric model sets); training equipment (audio-visual equipment and a courtesy bus); information and technology equipment (PCs and networking equipment); lecture hall equipment (audio-visual equipment); training furniture (whiteboards for the lecture hall, lab benches, etc. for laboratories, bookshelves, etc. for the library); and equipment/tools for accommodation, kitchen and dining hall.	Civil works and procurement of equipment (1) Facilities: Total floor space of 3,348.42m^2 Mostly as planned with minor modifications in some of the specifications and locations of the facilities based on the instructions from MOEST and the Ministry of Public Works, requests from the executing agency, and technical judgments based on the detailed review of the design, etc. (e.g., entrances were added to handle a large number of trainees at one time; some walls were changed to glass walls to obtain more natural light, etc.). (2) Equipment: Mostly as planned with small changes in models of some equipment due to discontinued production by the manufacturers.
	Consulting services Design, construction supervision, etc.	Consulting services Same as plan.
Kenyan side	Civil works Removal of existing buildings and site preparation before construction works.	Civil works Mostly as planned, but the kei apple (plant) hedges to separate the property from neighborhood were changed to stone walls with a gate for a security concern.

Source: Preparatory Survey Report; responses received from the executing agency; field research.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total project cost was 618 million Yen, and when it is nominally compared to the cost estimate, it exceeded the plan (102% against the plan) due to an increase in the project cost as the result of the changes Kenyan partners made on project output (Table 4). However, as those changes represented additional output that was necessary to enhance the facilities' security, the increase in the cost was proportional to the increase in the expansion of the output.

3.2.2.2 Project Period

The project period lasted longer than planned (129% against the plan) because a portion of the construction work required a longer time than expected and the confusion that occurred in the country following the presidential election protracted the construction of facilities and procurement of materials (Table 5).

Although this does not affect the project's rating when employing JICA's project evaluation method, it should be noted that an exchange of notes for this project was signed in the Japanese fiscal year (JFY) 2006 but the project was not implemented as it failed to obtain

residents' consent (see Footnote 3). According to the initial plan, SMASE Phase 3 was to be implemented in the facilities after completion of constructions, but the actual completion and handover of the facilities did not happen almost until the completion of the technical cooperation project. Although the technical cooperation project took place in the old facilities, CEMASTEA as well as former Japanese experts reported that the implementation of activities was not significantly affected. Some of the comments pointed out that this outcome had forced CEMASTEA to begin operating and maintaining the facilities on its own as soon as the facilities were handed over to it; as it will be discussed later, active administration of the facilities by the Kenyan partners worked positively for the development of SMASE INSET.

Table 4: Planned and actual project cost

	Plan	Actual
Japan	581 million yen	577 million yen
Kenya	24 million yen (24 million KSh)	41million yen (40 million KSh)
Total	605 million yen	618 million yen

Source: Preparatory Survey Report; documentation provided by JICA.
Note: Local currency is Kenya Shilling (KSh). The exchange at the time of planning was 1 KSh=1.04 yen (February 2011) and the actual rate was 1 KSh=1.02 yen (average for 2011-2013).

Table 5: Plan and actual project period

	Plan	Actual
Grant Agreement	September 2011	August 2011
Detailed design	(4 months)	September 2011 – January 2012 (5 months)
Tender	(3 months)	February-April 2012 (3 months)
Civil works / procurement of equipment	(13 months)	June 2012 – October 2013 (17 months)
Project completion (duration)	May 2013 (21 months)	October 2013 (27 months)

Source: Preparatory Survey Report; documentation provided by JICA.

In sum, while the increase in the project cost was justifiable considering the increase in the outputs, the project period was longer than planned. Therefore, the efficiency of the project is fair.

3.3 Effectiveness[11] (Rating: ③)

By referring to the analyses in existing reports, the evaluator identified and organized expected impacts of this project in the following way. The direct outcome (effectiveness) was measured by "the qualitative improvement and quantitative expansion of training at CEMASTEA," and the resulting indirect outcome (anticipated impacts) was measured by "qualitative and quantitative expansion of INSET in mathematics and science in Kenya and other countries in Africa." The subsequent impacts on "improvement in learning in mathematics and science" were classified as other impacts. All of these impacts have mostly materialized by the time of ex-post evaluation.

[11] Sub-rating for Effectiveness is to be put with consideration of Impact.

3.3.1 Quantitative Effects (Operation and Effect Indicators)[12]

As shown by the planned and actual operation and effect indicators (Table 6), the project in general achieved quantitative expansion of training through the utilization of the facilities as planned, missing the target only slightly in certain dimensions.

The actual values for Indicator 1 (the number training attendees per year) and Indicator 2 (the number of training courses per year) both increased consistently, and the average target achievement rate for these two indicators was 89%. In addition, when Supplemental Indicator 1 (the operation rate of CEMASTEA based on the anticipated number of training sessions per week as set in the planning) was added to the mix of the two indicators, the average target achievement rate was relatively high, at 88%. From the time of planning to the time of ex-post evaluation, national training and the TCTP have constituted the core of the training courses of SMASE INSET (INSET trainer's training) for primary and secondary education.

The operation rate of the facilities achieved more than 80% for both Supplemental Indicator 2 (the daily operation rate of CEMASTEA computed from the total number of users) and Supplemental Indicator 3 (the number of days in which the number of users exceeded the maximum capacity prior to the project); these two indicators are likely to reveal a more practical operation rate given that the project enabled CMASTEA, which had focused on weekly training prior to the project, to diversify the utilization of its facilities by hosting such activities as large conferences at the lecture hall and many daily seminars and conferences. By increasing training facilities' capacity from 92 people to 200 people,[13] CEMASTEA now offers training and other activities at a scale that was impossible before the project.

The possible reasons for the missed target in Indicator 1 include the scale down in the TCTP according to the agreement between JICA and CEMASTEA after completion of this project and in CEMASTEA's implementation of INSET for primary education as the result of the changes in the budgetary allocation by the Ministry of Education, Science and Technology (MOEST), as well as CEMASTEA's efforts to increase the efficiency and effectiveness of INSET by such means as offering training in counties and conducting monitoring and evaluation of schools at a greater scale. Although the shift in activities from training at CEMASTEA facilities to field activities at schools may work against the project's contribution to the operation rate of CEMASTEA, it can deliver positive outcome in terms of the

[12] Although Indicator 1 (the number of training attendees per year) and Indicator 2 (the number of training course per year) set at the time of planning can be both classified as operation indicators, it was found difficult to quantitatively capture the effect indicators as the result of project operation; therefore, these operation indicators were viewed to function also as effect indicators, and the effects of operation were evaluated by examining qualitative information. Also, in order to grasp the status of operation of the facility more accurately, the evaluator collected data of operation rate of CEMASTEA as Supplemental Indicators (operation indicators) and used it in the assessment.

[13] Since the bed capacity remains 92, CEMASTEA has been outsourcing accommodation. According to the documentation provided by JICA, expansion of the accommodation had been initially reqested from the Government of Kenya but dropped from the project scope in consideration of harmony with the local community (i.e., not to increase the night-time population of CEMASTEA much).

improvement of the quality of training as it made it easier to grasp the conditions at schools. In order to compensate for the shift, CEMASTEA is making efforts to expand facility utilization by hosting single, stand-alone seminars and conferences as mentioned above.

Table 6: Operation and Effect Indicators

		Baseline	Target	Actual			
		2010	2016	2014	2015	2016	
		Planned Year	3 Years After Completion	1 Year After Completion	2 Years After Completion	3 Years After Completion	Achievement
Indicator 1: Number of training attendees per year (person) (1)	Total	964	5,539	2,052	2,581	3,949	71%
	Kenya	-	-	1,995	2,354	3,724	-
	Africa	-	-	57	227	225	-
Indicator 2: Number of training courses per year (1)	Total	18	33	27	32	35	106%
	Kenya	-	-	26	26	31	-
	Africa (2)	-	-	1	6	4	-
(Supplemental Indicator 1) (3) Operation rate of CEMASTEA (weekly rate based on the number of training sessions per week) (%)		44	83	63	77	73	88%
(Supplemental Indicator 2) (4) Operation rate of CEMASTEA (daily rate based on the total number of users) (%)		20	38	22	31	32	84%(5)
(Supplemental Indicator 2-2) Total number of users per year (person day)		4,820	27,695	16,034	22,937	23,718	86%
(Supplemental Indicator 3) Number of days in which the number of users exceeded the maximum capacity of 92 people prior to the project		0	-	81	113	131	-

Source: Preparatory Survey Report (baseline values, target values); documentation provided by the executing agency (actual values).
Note: (1) Including the seminars and conferences that used CEMASTEA facilities. The number of attendees is the total of the attendees of individual courses.
(2) Among the training for other African countries, the number of TCTP courses implemented by JICA was one in 2014, five in 2015, and two in 2016.
(3) Calculation method at the time of planning: Operation rate = (the number of weeks in which training was held at CEMASTEA) ÷ (52 weeks) × 100%.
(4) Additional calculation method used in the ex-post evaluation: Operating rate = (total number of users) ÷ (maximum capacity x 365 days) × 100%. The maximum capacity was 92 in 2010, and the target and actual number for 2016 was 200. Note that the baseline and target values for Supplemental Indicator 2 were calculated by the ex-post evaluator using the actual operation results and the operation plan at the time of the ex-post evaluation.
(5) The target achievement rate does not match its source value (the target achievement rate in Supplemental Indicator 2-2) due to an error introduced when the operation rate value was rounded.

3.3.2 Qualitative Effects (Other Effects)[14]

In terms of the qualitative impacts, it was anticipated at the time of planning that the improvement on the training rooms and laboratories and the consolidation of functions at the

[14] The ex-ante evaluation sheet listed "improving training environment/improving training quality" and "improving mathematics and science education in Africa" as the qualitative effects of this project, but the latter was re-assigned as an impact.

administration office would lead to improved training environment, hence an improvement in the quality of training. The project has largely accomplished this goal by the time of ex-post evaluation.

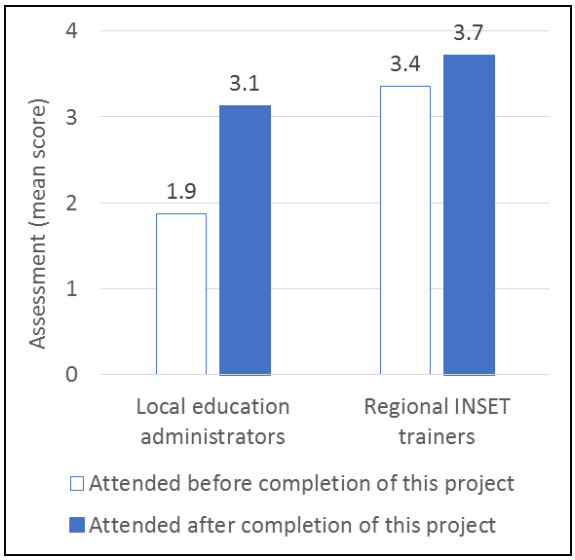


Figure 2: Evaluation of CEMASTEA facilities by former attendees

Source: Beneficiary survey
Note: Responses were scored by assigning the following points: 4 points for "Very good," 3 points for "Good," 2 points for "Fair," 1 point for "Not very good," and 0 points for "Not good."

(1) Improving the quality of training by improving training environment

The academic staff at CEMASTEA (the national INSET and TCTP instructors[15]) agreed that although the contents of the training did not vary significantly with or without the facilities,[16] "we can now provide high quality training because the laboratory and equipment have been renewed," and "the training can now be done more comfortably because of the spacious and convenient facilities." In addition, the academic staff had been spread over multiple buildings and rooms before the project, but the new academic office building now has separate offices for different subject areas, in which there are enough desks for all instructors (about ten); a staff member said, "it is now much easier to exchange information and discuss when we engage in activities such as creating training modules." Moreover, the improved library allowed resources and teaching materials that had previously been scattered to be consolidated in one location, and it now houses math and science textbooks from various countries the attendees of the TCTP brought, enhancing its function as an information clearing house in Africa. According to the CEMASTEA staff in charge of facility management, the logistical aspects also have dramatically improved as electricity supply, water supply, cooking, laundry, and shuttle service became more functional.

The attendees also gave high marks to the training facilities. The results of the surveys CEMASTEA conducted during training showed that the attendees were satisfied with the training facilities. Further, according to the results of the survey of previous attendees (local education administrative officers and INSET trainers) conducted at the time of the ex-post

[15] Interviews with the head of each subject area (mathematics, physic, biology, chemistry) and several other personnel who were present during the site visit.
[16] An evaluation of training conducted by the academic staff at CEMASTEA and Japanese experts in SMASE Phase 3, which provided technical cooperation to this project, confirmed that the target has been reached. The same academic staff continuously engage in provision of training after completion of this project.

evaluation, those who participated in the training and workshops at CEMASTEA after the completion of the project rated the facilities higher than did those who had attended earlier (Figure 2).[17]

(2) Status of training facility utilization

In addition to compiling the facility utilization data as shown in Table 6, the status of facility utilization has also been examined during the field visit. For example, SMASE Africa was holding an intra-regional meeting at CEMASTEA during the field visit for this ex-post evaluation, and the participants from Kenya and eight member countries were using the lecture hall as well as other facilities and equipment enabled by this project (before the project, large conferences had been held at hotels and other external facilities because a lecture hall was missing).

The facilities that existed before this project are being used as hostels (to increase the bed capacity so as to accommodate more attendees) in addition to printing and other support services offices such as Accounts and Human Resources. Also, a JICA's senior volunteer has repurposed the space that had been used as the laboratory before the project to display teaching materials produced by teacher-attendees of the training and himself, using it as a site to demonstrate *Improvisation* (turning resources and materials that are available at hand into teaching materials), which is one of the key components of SMASE INSET.

An international conference at the lecture hall built by this project

Laboratory

3.4 Impacts

3.4.1 Intended Impacts

The project contributed to the anticipated impact: "the improvement of INSET in

[17] However, according to CEMASTEA, attendees who are accommodated outside the center have raised concerns due to time spent in commuting. Also, the accommodation at CEMASTEA is double occupancy with common washroom area, which lowers attendees's satisfaction with the accommodation facility compared with other facilities.

mathematics and science in Kenya and in Africa." INSET in mathematics and science has continued to be operational since the completion of the project even though it has undergone changes in the implementation scale and selection methods for prospective teacher-attendees. In the member countries, although the status of implementation is not uniform and is affected by specific condition in each country, there has been a steady increase in the number of INSET trainers and education administrators who have studied at CEMASTEA, resulting in the incorporation of what was learned in the training into mathematics and science education in the member countries.

CEMASTEA is making positive contribution by serving as the center of teacher and trainer training in Kenya and Africa and as the implementing body of INSET in primary and secondary education. Although these accomplishments are the results of not only the present project but also the "overall plan" that encompasses technical cooperation projects and the undertakings by MOEST of Kenya, the expansion of the facilities and equipment at CEMASTEA is enabling its continuous activities particularly through the growth of attendees (quantitative expansion) and the improvement of the training and working environment. Further, the project enhanced CEMASTEA's status as an educational institution in Kenya and had positive impacts on its policy, institutional, and financial sustainability by upgrading the training facilities to the level appropriate to the greater ability to conduct training it achieved through technical cooperation projects and the central role it plays in mathematics and science education in Kenya and Africa.

(1) Implementation of INSET in mathematics and science in Kenya

Table 7 shows the status of SMASE INSET implementation. SMASE INSET for primary education started in 2010 under SMASE Phase 3, and became Kenya's first INSET in mathematics and science in primary education. SMASE INSET was temporarily interrupted when the technical cooperation was completed in 2013, but, since 2014, MOEST and CEMASTEA have implemented SMASE INSET in primary education in the ASAL areas, which were not part of the SMASE project, and conducted workshops on lesson study in several sub-county areas that were included in SMASE.[18]

Because almost all math and science teachers in secondary education have attended SMASE INSET by 2013, the original system in which all teachers would receive one cycle of training each year in a total of four cycles (four years) was replaced by a new, experience-specific system starting in 2014 (in a given year, only teachers who have the target number of

[18] Lesson study workshops are conducted in respective sub-counties (one sub-county in each of the 31 counties) by sub-county (district at the time of project implementation) education administrative officers called the Curriculum Support Officers (CSOs) who participated in training in Japan under the SMASE project (CSOs were used to be called Teacher Advisory Centre (TAC) tutors at the time of project implementation), and monitored and evaluated by CEMASTEA.

experience set for that year would be trained in a module designed for their amount of experience). As a result, the number of attendees has fluctuated between years. Also, teachers strikes were the primary reason why the workshops for school principals and education administrative officers were not held in 2010 and 2011.

Although SMASE INSET is the only INSET in mathematics and science for secondary education, for primary education MOEST, with assistance from other organizations such as the United States Agency for International Development (USAID), implements INSET in mathematics skills development program (Early Grade Mathematics, EGMA) for early grades (1st and 2nd grades).[19] According to the implementation team of EGMA, the program adopts a teacher-centered approach rather than a student-centered approach like ASEI-PDSI in order to strengthen most foundational skills when students are still in early grades so that the student-centered instructions in advanced primary grades (6th to 8th grades) can be implemented effectively.

Table 7: Number of Kenyan participants in SMASE INSET and related workshops

(Unit: person)

		2009	2010	2011	2012	2013	2014	2015	2016
Primary Education	National training (1)	0	272	286	284	274	0	28	47
	Regional training (1)	0	59,813	51,097	47,027	39,136	0	300	3,554
	Lesson study workshop (2)	0	0	0	0	0	0	2,578	762
	Workshops for principals and education officers	0	897	832	841	1,473	0	252	47
Secondary Education	National training (1)	509	0	1,412	1,412	0	1,330	1,330	1,323
	Regional training (1)	0	4,420	4,164	4,021	4,118	2,864	8,481	7,301
	School-based lesson study (3)	0	0	0	0	0	0	90	125
	Workshops for principals and education officers	1,113	0	0	5,540	3,430	94	1,420	2,601

Source: SMASE Phase 3 Terminal Evaluation Report; responses and documentation received from the executing agency.

Note: (1) National training is a type of INSET CEMASTEA provides to teachers who serve as regional INSET trainers (regional INSET trainer training); regional training is a type of INSET in which regional INSET trainers give to teachers. (2) Lesson study workshop for primary education (a workshop designed to spread the school-based training [lesson study]) was implemented at the sub-county level. The figure for 2016 reflects only those attendees who attended training in eight sub-countries monitored by CEMASTEA (it is unknown whether workshops were held in other sub-countries). (3) The figures for the school-based lesson study for secondary education were estimated by multiplying the number of schools where CEMASTEA conducted monitoring (18 in 2015 and 25 in 2016) by five, which is an estimate, based on interview results, for the number of teachers per school that attended training (no records were available for the actual number of participants).

[19] EGMA is organized under the Global Partnership for Education (GPE) and is part of the Kenya Primary Education Development Project (PRIEDE) supported by the World Bank, USAID, and others (2015-2018, with a plan to be extended to March, 2019). EGMA, together with TUSOME (a program in Swahili and English languages; meaning "Let's read" in Swahili), distributes learning materials to primary schools around the country and provides training for all primary school teachers in order to strengthen the foundational learning skills for early graders in reading, writing, and calculation (in Swahili, English, and mathematics),

As the implementation body of INSET in mathematics and science, CEMASTEA undertakes the development of modules, implementation of national training and workshops, and monitoring and evaluation of regional training. CEMASTEA also makes significant contribution to EGMA mentioned above, as it sends academic staff on loan to the implementation team of EGMA, and many of EGMA's master trainers (trainer education instructors) are either academic staff at CEMASTEA or regional INSET trainers who received national training at CEMASTEA.

(2) Implementation of INSET in mathematics and science in the African region

As shown in Table 7, CEMASTEA has provided training for attendees from Africa from the time before this project to the time of ex-post evaluation although the number varied from year to year. According to the survey of JICA's overseas offices and field offices on the implementation status of INSET in mathematics and science in member countries, respondents representing 15 countries out of the 20 member countries that responded to the survey reported "INSET in mathematics and science is actually implemented at the time of ex-post evaluation." The reasons cited for non-implementation (including those cases in which INSET was interrupted) were mainly related to implementation budget and institutional limitations in the education ministry in respective countries, which implements INSET. The responses from as many as 16 out of 20 countries agreed that "the TCTP at CEMASTEA contributed to the building and implementation of the INSET system in the member country." The content and modes through which such contribution was made include: "CEMASTEA attendees returned home and trained key personnel who would lead domestic efforts to promote INSET in math and science"; "what was learned was reflected when creating INSET modules and teaching materials in math and science"; "attendees are considering how they can apply what they learned in the country's context;" "attendees shared what they leaned with other teachers, trainers, and professionals in math and science education including those with the education ministry." Although this project may not be the exclusive reason for these results as these results are likely to reflect the outcome of the TCTP in the old CEMASTEA facilities before completion of this project, the contribution of this project should be acknowledged as it has supported the undertakings by CEMASTEA since 2014.

The results from the survey of former attendees of third country training were consistent with those of the JICA office survey just reported above. Seventeen out of 19 individuals who attended TCTP at CEMASTEA after the completion of the project reported that "I use what I learned at CEMASTEA (frequently, or at a certain level)." In terms of the content and circumstance of the use, all responses included concrete descriptions such as the incorporation of the ASEI-PDSI approach and inquiry based approach into module development and teacher

training, and sharing of knowledge and information with other teachers and education administrative officers.

(3) Contribution to TICAD IV "Yokohama Action Plan"

The total number of teachers who attended SMASE INSET between 2009 and 2012 exceeded 150,000 in primary education and 15,000 in secondary education. The total number of people who attended training at CEMASTEA from other countries in the region was 719, representing all 27 member countries of SMASE-WECSA. Based on the evidence, the implementation of SMASE INSET and TCTP have contributed positively to the following targets in TICAD IV "Yokohama Action Plan" (2008) set by the Japanese government: "to expand SMASE to train 100,000 teachers" by 2012; "to facilitate sharing of experience among SMASE-WECSA member countries"; and "to provide teacher training in math and science in all SMASE-WECSA member countries."

3.4.2 Other Positive and Negative Impacts

This evaluation identified other positive impacts. No negative impacts were found.

(1) Contribution to the improvement of math and science class and learning (in Kenya)

This impact is a higher order impact than the impacts discussed in "3.4.1 Intended Impacts." The ex-post evaluation for SMASE Phase 3, which was conducted along the present ex-post evaluation, found that the implementation of ASEI-PDSI for teachers in primary and secondary education had grown, contributing to greater motivation among students for class participation and learning.[20] The support this project has provided to the implementation and continued operation of INSET is also considered as one of the contributing factors.

(2) Impacts on the Natural Environment

At the time of planning, this project was evaluated to be a cooperation project with no serious adverse impacts on the environment and society, and was thus classified as Environment Category B as described in JICA Guidelines for Environmental and Social

[20] Major findings are as follows. 1. In the teacher survey (153 valid responses for primary school teachers and 100 for secondary school teachers), the results of self-scoring for the "Lesson Innovation Index" (0.00-4.00; the index is a simplified version of the measuring method used in the SMASE project), which measured the degree to which ASEI-PDSI was practiced, the average score for the primary school teachers was 3.44 out of 4 (target was 3.30) and 3.00 for secondary school teacher (target was 3.30). 2. In the detailed analysis by an expert conducted as part of the ex-post evaluation of SMASE Phase 3 (expert: Hideo Ikeda, professor emeritus, Hiroshima University), video analysis of nine mathematics and science classes confirmed the practice of ASEI-PDSI in primary and secondary education classes. 3. In the teacher survey mentioned above (finding #1), 84% of primary school teachers and 78% of secondary school teachers reported that the use of ASEI-PDSI contributed to an "improvement in student motivation." 4. Interviews with school principals and senior teachers (18 primary schools and nine secondary schools) revealed specific results such as reduction in anxiety in math and science and improvement in curiosity, and for secondary education, an increase in the enrollment in science electives such as physics and improvement in students' understanding and grades.

Considerations (enacted in April 2004). CEMASTEA obtained the environmental impact assessment license in 2010, implemented an environmental management plan to meet the incidental conditions of the issuing of the license, and was certified in 2013 in the environmental audit conducted by the National Environmental Management Authority of Kenya for carrying out the environmental management plan such as noise control as planned. While there is a wildlife reserve near the project site, it was anticipated at the time of planning that the project would have little impact on the ecosystem of the reserve. Concerns in this regard were not expressed by CEMASTEA during the ex-post evaluation interview.

In terms of operating its new facilities, CEMASTEA attempted to establish good relations with the local community by providing landscape work such as tree planting, thoroughly informing facility users about the importance of conducting themselves in a proper way on the premises, and reducing the use of underground water by recycling rain water. Environmental measures and monitoring have been reported to the Environmental Management Authority each year, and, in 2016, for example, the Authority evaluated that CEMASTEA met 95% of the "environmental sustainability goals" it had set. Consequently, CEMASTEA has not received complaints from the neighbors.

The project did not involve relocation of residents or acquisition of lands.

(3) Designing barrier free facilities

The training building constructed in this project used a barrier free design. According to CEMASTEA, its facilities such as wheelchair accessible to restrooms and the buildings that allow wheelchair to travel to the highest floor have become the role model of barrier free public facilities, and have been visited by personnel from schools and other public institutions in Kenya.

A ramp at the facilities
The ramp allows wheelchair travel between the lecture building and laboratory, and between floors.

Wastewater treatment/water recycling plant in the facilities.
The treated water meets the quality standards set by the Environmental Management Authority without using chemicals except for chlorine.
The fence and plant pots made from recycled PET bottles were installed after the completion of the project to raise awareness among visitors.
The plant has been visited by attendees from as far as India during their training at the Kenya Water Institute.

As stated above, this project has largely achieved its objectives. Therefore, the effectiveness and impact of the project are high.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance

CEMASTEA is responsible for its own operation and maintenance as it was at the time of planning. The supervising office in MOEST was the Field Service Department at the time of planning, but after the reorganization in February 2017, it was handed over to the Director General's Office for Field Coordination and Co-Curricular Activities that succeeded the function of the Field Service Department. According to MOEST, the reorganization did not affect the function, staffing, and the relationship with CEMASTEA.

The organizational structure of CEMASTEA has not changed. Of the 107 employees in total in 2016, 47 were academic staff including the director and vice director, and 60 were non-academic staff. The academic staff are responsible for operation management, module development, national INSET lectures, monitoring and evaluation of regional INSET, and research in mathematics and science education; although a total of 60 positions were originally created, with 15 positions in each of mathematics, physics, biology, and chemistry, the actual number of staff has declined because vacant positions after staff retirement have not been filled. Even though the operation is carried out by fewer than expected number of personnel, the staff size does not seem to be an issue because the understaffing did not hinder activities, and new projects, development and revision of modules, and other activities continue to be undertaken.[21]

Additional non-academic staff have been brought in as the result of the facilities expansion in this project. In the areas concerning the maintenance of the facilities and equipment of this project, five facilities maintenance personnel, four information and communication technology engineers, and three Science Laboratory assistants are currently assigned. While these personnel operate the facilities and equipment and conduct routine maintenance and minor repairs, regular maintenance and repairs are outsourced to professional service providers.

At the time of ex-post evaluation, the INSET policy to strengthen teachers' instructional abilities is being drawn up among MOEST, CEMASTEA, the Teachers Service Commission (an independent administrative agency that manages the employment of public school teachers and strengthening of teacher's capacity), and others; accompanying this policy discussion is a restructuring plan for the implementation agencies for INSET in Kenya. This plan would consolidate three existing bodies (CEMASTEA, the Kenya Education Management Institute,

[21] According to CEMASTEA, training on gender and integrity is commissioned to resource persons (external experts).

and the Kenya Institute of Special Education) into the Kenya School of Education, which, according to MOEST, will be formed by the end of 2017. According to CEMASTEA, the existing structure of CEMASTEA will remain intact under the changes in the plan, and it will continue to function as the specialized institution for math and science education (although a new name such as the Kenya School of Education CEMASTEA Campus is being considered). Further, a future plan is being considered to designate an existing teacher's college for primary education as the implementation body for non-math/science INSET and place it under the Kenya School of Education. The likelihood of CEMASTEA's continuation seems to be very high because CEMASTEA is the only organization that has experience and knowledge in INSET in individual subject areas.

As for the institutional setting for continued impacts of CEMASTEA in Africa, CEMASTEA is likely to remain as the center of intra-regional cooperation in mathematics and science, as it acts as the secretariat of ICQN-MSE and SMASE Africa.

Therefore, the institution of managing operation and maintenance is considered to be adequately established.

3.5.2 Technical Aspects of Operation and Maintenance

CEMASTEA is not facing any technical problems in operation and maintenance of its facilities as they are commissioned to outside agents except for routine maintenance and minor repairs. All personnel including the personnel in operation and maintenance receive a performance assessment and training in the organization. During the site visit by the ex-post evaluator, the person in charge of operation and maintenance provided thorough and accurate descriptions of individual facilities and equipment, demonstrating this person's adequate level of knowledge and experience. In addition, the evaluator observed that the instruction manuals and documentations for instruments and equipment were properly filed and were ready to be used.

In terms of the skills in conducting training and research, all academic staff have received technology transfer in the SMASE project, and have continued to engage in such activities as INSET in primary and secondary education (including updating of teaching materials and developing new modules), hosting of relevant conferences and workshops, training needs assessment with teachers, monitoring and evaluation of schools, research projects (including impact assessment), and continuation of intra-regional cooperation (TCTP, intra-regional conferences); they continue to upload some of the teaching materials and reports they create to the CEMASTEA website.

Therefore, this evaluation considers that an adequate technical level in operation and maintenance has been established.

3.5.3 Financial Aspects of Operation and Maintenance

The bulk of CEMASTEA's budget is allocated by MOEST and comes from the education budget within the national budget. The education budget has grown, even though its share in the national budget has decreased since the time of planning, and the share of general management expenses, which was criticized for being too high at the time of planning, has decreased (Table 8).

Table 9 shows CEMASTEA's budget. Although the budget is on an increasing trend, the expenses for training have fallen below the level before the project reflecting the fact that INSET in primary education is no longer administered nationally. On the other hand, the large increase in the development budget and training expenses for the Kenyan fiscal year (FY) 2015 reflected a change in the payment channel for the SMASE Fund in secondary education (SMASE INSET receives each year 1% of the capitation grant,[22] which is now paid to CEMASTEA rather than to individual schools as done in the past. According to CEMASTEA and local education offices, the change was welcoming because it directed the funds straight to SMASE INSET and eliminated the delay in payment to teachers who attended training. Although CEMASTEA has been requesting to MOEST for the creation of SMASE Fund in primary education in order to offer INSET in primary education in a national scale again, no development has taken place toward implementation. MOEST cites the availability of another INSET program in primary education other than the one provided by CEMASTEA as a factor for the lack of progress (although restricted to mathematics for early primary grades, EGMA will continue making INSET available nationally until March 2019; see Footnote 19).

With respect to the budget for the intra-regional cooperation in Africa, JICA is responsible, until JFY2017, for a portion of the training expenses for the TCTP, and continues its assistance on the training by dispatching an individual expert ("Regional Advisor"). Although there has not been any indication so far to suggest that the Kenyan government will foot the cost to continue the operation, this is not an issue because it has never been planned for the national government to independently continue the training for other African countries after the termination of JICA's TCTP. Other expenses for intra-regional cooperation would include the expenses for having meetings, but these expenses are expected to be covered through CEMASTEA and other member countries' own effort. A SMASE Africa meeting was held at CEMASTEA in November 2016 and collected fees from attendees, becoming the first intra-regional meeting that was held without financial assistance from donors.

It is, thus, reasonable to conclude that the financial aspects of operation and maintenance are adequately sound even though the funding for INSET in primary education remains to be further improved.

[22] Capitation grant = (unit amount) x (the number of enrolled students in each school)

Table 8: National budget and education budget (Unit: million KSh)

	FY2013	FY2014	FY2015
Total expenditure	1,532,993	1,950,709	2,223,980
of which, education	253,632	301,448	319,426
% of expenditure	17%	15%	14%
Breakdown of education expenditure			
Administration	171,104	181,711	193,218
Pre-primary and primary education	16,770	21,165	22,620
Secondary education	23,056	30,861	34,053
Higher education	40,436	60,471	62,255
Others	2,266	7,240	7,280

Source: Kenya National Bureau of Statistics
Note: The average exchange rate used by JICA in 2015 was 1 KSh = 1.22 yen.

Table 9: CEMASTEA budget (audited)

(Unit: thousand KSh)

	FY2010	FY2013	FY2014	FY2015
Revenue				
From national recurrent budget	71,433	106,935	106,432	104,824
From national development budget	200,000	97,374	155,801	586,023
Others (1)	27,969	6,638	16,779	13,391
Total	299,402	210,947	279,012	704,238
Expenditure				
Personnel	7,912	21,252	27,351	32,392
Training	259,858	117,464	134,754	530,183
Others including maintenance of facilities and equipment	75,721	79,259	122,677	128,272
Total	343,491	217,975	284,782	690,847

Source: Preparatory Survey Report (FY2010); documentation provided by the executing agency.
Note: (1) Other donors including JICA; income from rent; etc.

3.5.4 Current Status of Operation and Maintenance

The site visit during ex-post evaluation confirmed that the facilities and equipment enabled by this project are in good condition. CEMASTEA was certified on ISO 9001:2015 (quality management by an organization) by the Kenya Bureau of Standards, and the organization's documentation such as the maintenance records revealed that the maintenance has been managed according to the requirements. According to the documents at the time of planning including the Preparatory Survey Report, the facilities enabled by this project were designed to do away with advanced systems and complex specifications to achieve the ease of maintenance; as mentioned above, maintenance work except for routine maintenance and minor repairs are commissioned to outside vendors. According to CEMASTEA, expired parts such as the fuel pump on the generator have been properly replaced.

Based on the evidence, the status of operation and maintenance is free of any major problems.

Overall, no major problems have been observed in the institutional, technical, financial aspects as well as in the current status of the operation and maintenance system. Therefore sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project aimed to strengthen training and related activities for teachers, trainers for teachers and education administrators by expanding the facilities of CEMASTEA, which is the

implementing agency of INSET in mathematics and science in primary and secondary education in Kenya and serves as a center of the training for promotion of mathematics and science education in Africa. The relevance of these objectives is high, as they were consistent with Kenya's and intra-regional development policies and development needs as well as with Japan's ODA Policy with respect to strengthening teachers' capacity. The effectiveness and impact are evaluated to be high. By utilizing the facilities and equipment delivered by this project, the expected level of quantitative expansion of training was realized overall, missing the target only slightly. In addition, as the result of the improvement of the training and operation environment, the enhancement in the comfort and efficiency of training was confirmed. Coupled with the output of SMASE Phase 3 implemented almost simultaneously, the activities of CEMASTEA have contributed to the continuation and further development of INSET in mathematics and science in Kenya as well as to the incorporation of the contents of the CEMASTEA training into mathematics and science education in other African countries.

The project's efficiency is evaluated to be fair. While the increase in the project cost was justifiable considering the increase in the outputs, the project period was longer than planned. The sustainability of the project's effects is evaluated to be high, as no major problems have been observed in the institutional, technical and financial aspects of operation and maintenance of the CEMASTEA facilities as well as the implementation of training.

In light of the above, this project is evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

None.

4.2.2 Recommendations to JICA

Since CEMASTEA is expected to remain as the center of intra-regional cooperation in Africa by serving as the secretariat of ICQN-MSE and SMASE Africa after the completion of JICA's TCTP in JFY2017, JICA should maintain close contact with CEMASTEA. JICA should also continue dispatching a senior volunteer to CEMASTEA and maintain cooperative relations by co-hosting conferences to exchange information and opinions on math and science education.

4.3 Lessons Learned

(1) Effective coordination of technical cooperation projects and facilities development

This project stands as a good example in which the sustainability of project impacts was realized because the facilities were delivered at the right moment when the technical cooperation succeeded in strengthening the capacity. Specifically, CEMASTEA's status as the

country's education agency has risen as a result of the facilities improvement, which matched the central role it began to play in education after receiving technical cooperation. Moreover, the timing allowed the executing agency to put the knowledge transferred in the technical cooperation project to practical use while operating the facilities with a high degree of ownership from the very start.

The sequence between the technical cooperation and the ensuing facilities development worked well in this project because the technology transfer, which was part of the overall plan that targeted basic education in mathematics and science, did not require advanced systems or complex specifications, nor did this grant aid project introduce sophisticated equipment (if it did, the project would have necessitated specific technology transfer for introducing such equipment).

(2) Building facilities in harmony with the local community

Even though the lack of consent from the nearby residents initially prevented the project from being launched when the first exchange of notes was signed in 2006, this project avoided causing friction with the local community by consulting with the residents and making such efforts as providing landscape work like tree planting, thoroughly informing facility users about the importance of conducting themselves in a proper way on the premises, and reducing the use of underground water by recycling rain water. Thus, as it happened in this project, smooth implementation and administration would ensue by incorporating, at the time of project planning, such processes as locating the source of anxiety and concern among the residents and undertaking measures to address potential issues (in case of this project, deterioration of the environment in the surrounding area and lowering of underground water level by excess use had been the issues of particular concern) upon adequate discussion between the executing agency and the local community.

Republic of Kenya

FY 2016 Ex-Post Evaluation of Technical Cooperation Project[1]

"Strengthening of Mathematics and Science Education (SMASE)"

External Evaluator: Takako Haraguchi, International Development Associates, Ltd.

0. Summary

This project was implemented to establish or strengthen (i) in-service education and training (INSET) for mathematics and science teachers in primary and secondary education in Kenya and (ii) training for the member countries of the Strengthening of Mathematics and Science Education in Western, Eastern, Central and Southern Africa (SMASE-WECSA), an intra-regional cooperation network in Africa,[2] which were both implemented by the Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA). The project was planned and implemented in two components, one for Kenya (the Kenya component) and the other for African countries (the WECSA component). The evaluation of each component is as follows.

(1) The Kenya component: The relevance of the component is high, as its objectives were consistent with Kenya's development policies and development needs as well as with Japanese aid policies with respect to strengthening teachers' capacity. Although the project's purpose of strengthening mathematics and science education in Kenya was mostly achieved, students' interests, an alternative indicator to measure the overall goal of upgrading students' capabilities in mathematics and science, missed the target slightly. The effectiveness and impact are evaluated to be high by taking into account other observed positive impacts, such as the diffusion of the project's effects to other subjects than math and science and pre-service training in the primary education level, which was the central sub-component in the Kenya component. The project's efficiency is evaluated to be high, as the project cost and the project period were both within the plan. The sustainability of the component's effects is evaluated to be fair, as there is a concern about the financial aspects of INSET in primary education in the future.

(2) The WECSA component: The relevance of the component is high, as it was consistent with Africa's intra-regional development policies and development needs as well as with Japanese aid policies with respect to strengthening teachers' capacity in member countries. The effectiveness and impact are evaluated to be fair. Although the project purpose of strengthening capacity of INSET providers to provide training in member countries was mostly achieved, the

[1] In order to objectively measure the extent of improvement in science and mathematics classes at the time of ex-post evaluation, this ex-post evaluation also carried out in depth analysis by a Japanese researcher who had wide experience of direct and indirect involvement in the science and mathematics education improvement projects implemented by JICA in Asia and African countries. Selection of the researcher was done by the external evaluator, and subsequently agreed by JICA.

[2] The member countries of SMASE-WECSA reached 27 in total by 2011 (Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Ethiopia, Gambia, Ghana, Kenya, Lesotho, Mali, Malawi, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Sudan, Swaziland, Tanzania, Uganda, Zambia, Zanzibar and Zimbabwe). *In alphabetical order; the Ministry of Education of Zanzibar was registered separately from the Ministry of Education of Tanzania as they are distinct organizations.

overall goal of improving the quality of teaching and learning of math and science in each country is judged to be partially achieved. Despite the presumption that the quality of teaching and learning is improving, it was difficult to set judgment criteria to determine the level of achievement and to estimate the level of contribution of this component to the improvement. The project cost and the project period were common between this component and the Kenya component; therefore, as mentioned above, the efficiency of the project is high. The sustainability of the component's effects is evaluated to be high, for the policy background and the organizational, technical, and financial arrangements necessary for intra-regional cooperation by CEMASTEA are ensured.

The overall evaluation of the entire project was conducted with greater emphasis on the Kenya component, to which larger inputs and activities were allocated than the WECSA component. As a result, the relevance, effectiveness/impact, and efficiency are rated as high, and the sustainability is rated as fair. In light of the above, this project is evaluated to be highly satisfactory.

1. Project Description

Project Location

A primary school where teachers record and assess the degree of achievement of the learning objectives introduced through SMASE INSET

1.1 Background

Despite the effort made in Kenya to expand access to education by implementing the Free Primary Education policy in 2003 and the Free Day Secondary Education policy in 2008, the improvement in the quality of education was stagnating. To improve the quality of education particularly in mathematics and science, the government of Kenya was promoting INSET in secondary education in the aforementioned subject areas, with assistance from Japan, through technical cooperation projects such as the "Strengthening of Mathematics and Science in

Secondary Education Project" (1998-2003) (SMASE[3] Phase 1) and the "Strengthening of Mathematics and Science in Secondary Education Project Phase 2" (2003-2008) (SMASE Phase 2). The adopted approach for pedagogical improvement was based on a principle of classroom improvement called "Activity, Student-centered, Experiment and Improvisation/Plan, Do, See and Improvement" (ASEI-PDSI). Those INSET programs that used this approach to train mathematics and science teachers, known as SMASE INSET, spread throughout the country. Furthermore, efforts to promote mathematics and science education and institutionalize the INSET system in the member countries had intensified since 2001 when SMASE-WECSA was formed in SMASE Phase 1 (which also served as SMASE-WECSA's secretariat) with a mission to introduce SMASE INSET in other African countries.

Based on these results, the Ministry of Education, Science and Technology (MOEST) of Kenya requested the government of Japan for assistance for this project, which would become SMASE Phase 3, in order to implement SMASE INSET for primary education in Kenya as well and to further strengthen intra-regional assistance in Africa.

1.2 Project Outline

Kenya Component	Overall Goal	Capability of young Kenyans in Mathematics and Science is upgraded.
	Project Purpose	Quality of Mathematics and Science education at Primary and Secondary school levels in Kenya is strengthened through In-Service Education and Training (INSET).
	Outputs	1. A system of National INSET for Regional Trainers is established at CEMASTEA. 2. A system of Regional INSET and Regional workshop is established at Primary Teachers' Training Colleges (PTTCs). 3. Existing system of Cluster INSET is strengthened. 4. Secondary Mathematics and Science teachers' "Activity, Student Centred, Experiment, and Improvisation/Plan, Do, See, and Improve (ASEI/PDSI)" practices in classroom are enhanced. 5. Role of CEMASTEA as resource centre for mathematics and science education is strengthened.

[3] The abbreviated title for the Phase 1 and Phase 2 technical cooperation projects was SMASSE (Strengthening of Mathematics and Science in Secondary Education) since they targeted secondary education (Grade 9 to Grade 12). This project (Phase 3) was abbreviated as SMASE (Strengthening of Mathematics and Science Education), and it extended its scope to primary education (Grade 1 to Grade 8, of which this project specifically targeted Grade 6 to Grade 8). For convenience, this report uses the abbreviation "SMASE" for all phases from Phase1 to Phase 3, and refers to the entire series of technical cooperation projects as "the SMASE project" without specifying phases.

WECSA Component	Overall Goal	Quality of Teaching and Learning of Mathematics and Science in member countries is improved.
	Project Purpose	Capability of INSET providers to implement ASEI/PDSI based INSET in member countries is strengthened.
	Outputs	1. ASEI/PDSI based INSET providers from member countries are trained. 2. SMASE-WECSA network is strengthened. 3. Role of CEMASTEA is strengthened as resource centre for mathematics and science education in Africa.
Total cost (Japanese Side)		1,003 million yen
Period of Cooperation		January 2009 – December 2013
Implementing Agency		Ministry of Education, Science and Technology (MOEST) / Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA), MOEST
Other Relevant Agencies / Organizations		None
Supporting Agency/Organization in Japan		None
Related Projects		<Japanese Technical Cooperation> "Strengthening of Mathematics and Science in Secondary Education Project" (1998-2003) (SMASE Phase 1) "Strengthening of Mathematics and Science in Secondary Education Project Phase 2" (2003-2008) (SMASE Phase 2) <Japanese Grant Aid> "The Project for the Upgrading and Refurbishment of the Centre for Mathematics, Science and Technology Education in Africa" (August 2011) <Assistance by Other Development Partners> The World Bank, the United States Agency for International Development (USAID) and others, "Kenya Primary Education Development Project (PRIEDE)" (2015-2019)

Figure 1 shows the structure of this project, and Figure 2 shows the mechanism of SMASE INSET, which was the target of assistance in the Kenya component of this project. The Kenya

component consisted of subcomponents for primary education (Outputs 1 to 3), secondary education (Output 4), and both primary and secondary education (Output 5). Indicators for the project purpose and the overall goal were set for each subcomponent. While the primary education subcomponent aimed to launch SMASE INSET from the beginning, the secondary education subcomponent sought to disseminate school-based lesson study (activities such as peer observation of classes followed by meetings to discuss what was observed to improve lessons) to further enhance the effects of SMASE INSET that had been developed under the two preceding phases.

In this ex-post evaluation, the evaluator first rated each component and then rated the overall project based on the component-wise rating. The overall evaluation (rating) added a weight to the Kenya component, to which larger inputs and activities were allocated than the WECSA component. Similarly, rating of the Kenya component added a weight to the primary education level.[4]

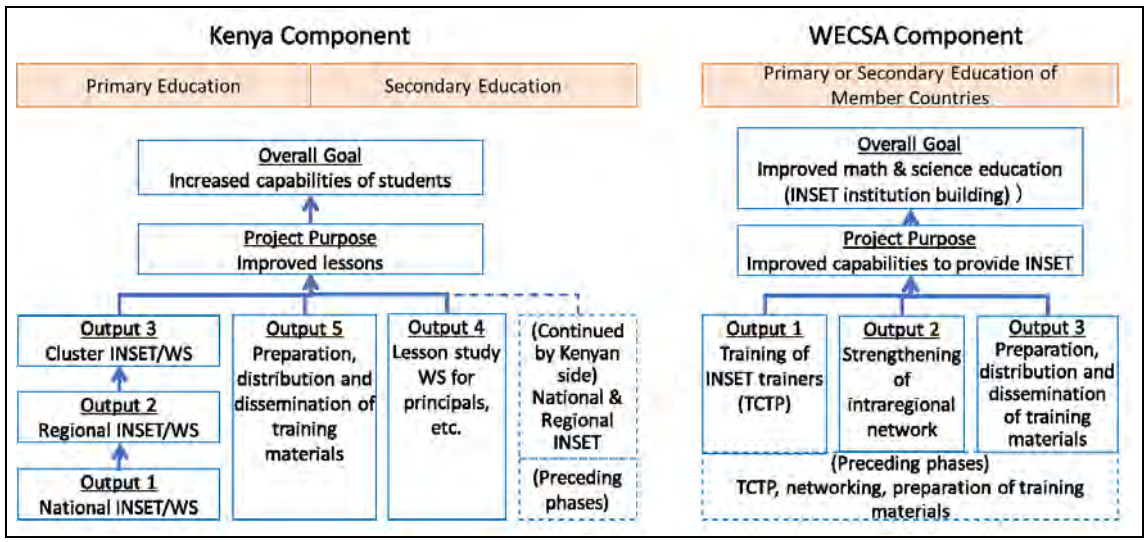


Figure 1: Logic model of this project

Source: Prepared by the evaluator.
Note: (1) "WS" stands for workshops (for disseminating SMASE INSET to education administrators conducted in parallel with training of teachers). (2) The dotted lines indicate the components that were not included in this project. (3) "Preceding phases" refers to both SMASE Phase 1 and Phase 2.

[4] Since it is difficult to disaggregate the inputs in each category (element of inputs) by component and subcomponent, weighting between the two components and within the Kenya component is based on a comprehensive analysis of the information such as the activities recorded by JICA experts in their reports, the number of deliverables produced, and interviews with former JICA experts.

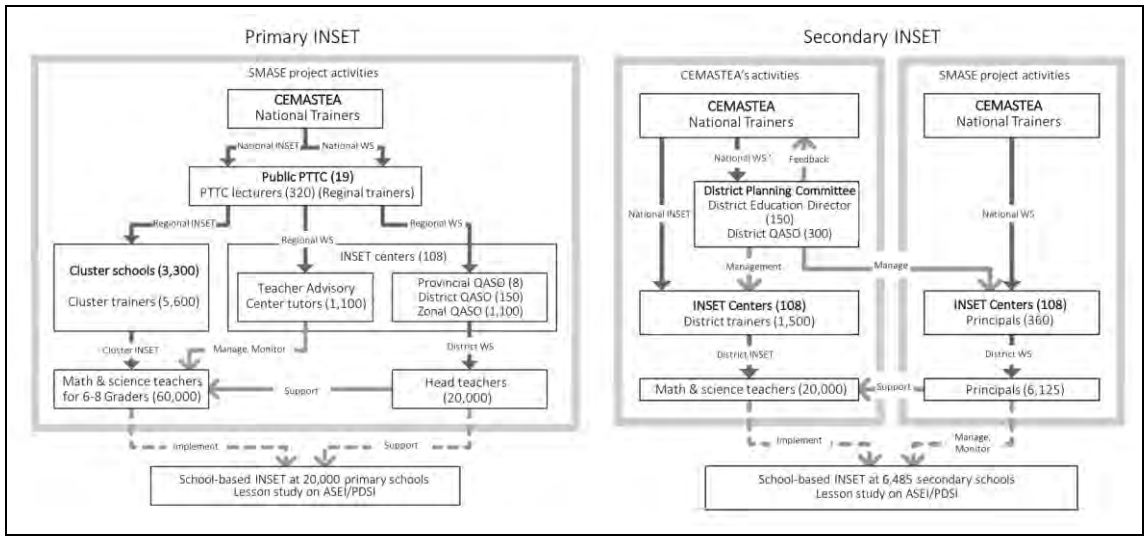


Figure 2: SMASE INSET System in Kenya

Source: Preparatory survey report for the grant aid, "The Project for the Upgrading and Refurbishment of the Centre for Mathematics, Science and Technology Education in Africa."
Note: (1) Terms and figures are those used at the time of planning. In 2013, "state" and "county" were restructured, respectively, into "county" and "sub-county," while "zone" and "cluster" (education administration district) were abolished. (2) SMASE Project: SMASE Phase 3 in particular. (3) The dotted lines indicate those activities under the INSET system that were outside the scope of SMASE project activities and CEMASTEA's activities. (4) QASO: Quality Assurance and Standards Officer.

1.3 Outline of the Terminal Evaluation

1.3.1 Achievement Status of Project Purpose at the Terminal Evaluation

The achievement of the project purpose for the Kenya component was assessed as "likely to be achieved" in primary education and "limited" in secondary education, based on the measurements of improvement of lessons instructed by teachers who attended INSET and participation of students in the class.

Regarding the WECSA component, the project purpose was assessed as "mostly achieved" as strengthening of capabilities to provide INSET was observed among participants in the Third Country Training Program (TCTP).

1.3.2 Achievement Status of Overall Goal at the Terminal Evaluation

For both the Kenya and the WECSA components, the assessment at the time of terminal evaluation was inconclusive for the prospect for achieving the overall goal due to inadequate pre-defined indicators and lack of statistically significant results.

On the other hand, the evaluation team highlighted the following cases as other positive impacts. In the Kenya component, schools or districts undertook their own initiatives to share and practice what they had learned from INSET. For the WECSA component, the assessment acknowledged that SMASE-WECSA was preparing to continue its activities after the completion of this project and several member countries were engaging in additional activities

resulting from the project such as conducting workshops.

1.3.3 Recommendations from the Terminal Evaluation

In order to establish sustainable, effective, and high quality INSET systems for both primary and secondary education, the terminal evaluation of the Kenya component specifically recommended to (1) continue SMASE INSET by making SMASE INSET mandatory, establishing SMASE Fund for primary education (i.e., securing the budget for implementing SMASE INSET), securing personnel, etc., and (2) enhance the effects of SMASE INSET by strengthening monitoring, identifying and supporting best practices in school, creating a new approach to support mathematics and science education based on the situation on the ground, strengthening coordination by CEMASTEA, etc.

Regarding the WECSA component, it was recommended to establish a foundation that enables SMASE-WECSA to continuously provide technical support to its member countries by strengthening SMASE-WECSA's function as an intra-regional platform for mathematics and science education in Africa, granting CEMASTEA a status to conduct intra-regional activities, providing further assistance in the TCTP, carrying out such activities as needs assessments, targeting and indicator-setting, etc.

2. Outline of the Evaluation Study

2.1 External Evaluator

Takako Haraguchi, International Development Associates, Ltd.

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: August 2016 – September 2017

Duration of the Field Study: November 14-22, 2016 and January 16 – February 9, 2017

In parallel to this evaluation, the evaluator also conducted ex-post evaluation of the grant aid project, "The Project for the Upgrading and Refurbishment of the Centre for Mathematics, Science and Technology Education in Africa" (August 2011) (hereafter "the grant aid project"). Since the implementing agency and many related agencies overlapped between these two projects, the evaluator conducted the data collection for the two evaluations in an integrated manner. However, the objects of the evaluations were these two respective projects, not the overall plan in which they were encompassed.

2.3 Constraints during the Evaluation Study

The main source of information for evaluating the projects' impact is the beneficiary survey (sample survey) results as the information provided by the implementing agency alone was insufficient to grasp the achievement status of the overall goal and the degree to which the achievement level of the project purpose is being maintained (Table 1). However, the study faced several challenges due to the multiplicity of observation targets, as the impacts of this project were anticipated to materialize in Kenya and other SMASE-WECSA member countries (27 countries) in Africa.

First, the evaluator selected six counties in an attempt to include and well represent localities and schools in different geographical conditions (urban, suburban, rural, and Arid and Semi-Arid Lands [ASAL]), and selected within these six counties a total of 29 schools for site visit in varying school sizes and types (boys/girls/co-ed schools and national/county/sub-county schools), consisting of two primary teachers training colleges (PTTCs), 18 primary schools, and nine secondary schools.[5] Therefore, although the study achieved a certain level of representativeness, potential biases in the study results introduced by non-probability sampling could not be ruled out. Also, the areas that were difficult to visit due to security reasons were excluded from the study. Second, the scope and contents of the research conducted for Africa were generally more limited than in Kenya (Field research was conducted only in Kenya). Therefore, the reliability of the results of evaluation is expected to be lower than that of the Kenyan evaluation.[6]

[5] The counties and the number of schools selected are as follows: Kiambu County (two primary schools and one secondary school) and Kisumu County (three primary schools and two secondary schools) from the urban areas; Makueni County (three primary schools and one secondary school) and Siaya County (two primary schools and one secondary school) from the suburban areas; and Kajiado County (five primary schools and three secondary schools) and Homa Bay County (three primary schools and one secondary school) from ASAL.

[6] Response rate to the questionnaire for former TCTP attendees was low at approximately 10 percent. The survey results may be overrated as there may have been a selection bias favoring those attendees who are satisfied or highly utilizing what they learned.

Table 1: Outline of the beneficiary survey (sample survey) for the ex-post evaluation

	Target (population size) (Note)	Respondents	Survey method
Kenya component	Local education administrative officers (A few individuals each in 47 counties and their subordinate sub-counties, and principals)	Valid responses: 34 individuals Eight officials from education offices, etc. (six females and two males) and 26 principals or vice principals (seven females and one male)	・ Self-administered questionnaire: Delivered to all individuals who were present on the day of evaluator's site visit. ・ Key informant interviews: Conducted with all individuals who completed the questionnaire.
	Regional INSET trainers (300 individuals for primary education and 1,400 individuals for secondary education)	Valid responses: 22 individuals Primary education: Thirteen individuals (six females and seven males) Secondary education: Nine individuals (three females and six males)	・ Self-administered questionnaire: Delivered to all individuals who were present on the day of evaluator's site visit and were available to respond in relation to their lesson schedule and other conditions. ・ Key informant interviews: Conducted with a few individuals at each school. ・ Classroom analysis using video recordings (detailed analysis by an expert): Four primary school teachers and five secondary school teachers.
	Primary school teachers teaching math and science to 6th – 8th graders	Valid responses: 153 individuals Attendees of SMASE INSET: 84 individuals (40 females, 43 males, one without gender information) Non-attendees of SMASE INSET: 69 individuals (43 females, 25 males, one without gender information)	
	Secondary school math and science teachers	Valid responses: 100 individuals Attendees of SMASE INSET: 84 individuals (24 females, 59 males, one without gender information) Non-attendees of SMASE INSET: 16 individuals (six females and ten males)	
	Primary school students: 6th to 8th graders	Valid responses: 380 individuals 7th and 8th graders (171 girls and 209 boys)	Self-administered questionnaire: Distributed to randomly-sampled individuals in all classrooms that were available to respond in relation to their lesson schedule, etc.
	Secondary school students: 9th to 12th graders	Valid responses: 264 individuals 9th to 12th graders (98 girls, 164 boys, two without gender information)	
WECSA component	Attendees of the TCTP (27 countries in Africa; annual average number of attendees of 135 in 2009-2016)	Valid responses: 21 individuals (ten females and eleven males) (eleven countries)	CEMASTEA delivered the questionnaire via email to 223 individuals it randomly sampled.
	JICA overseas offices and field offices (hereafter "JICA overseas offices") in the SMASE-WECSA member countries (27 African countries)	Valid responses: 20 offices (20 countries) Addressed to officers in charge of the basic education sub-sector or JICA experts, etc.	The evaluator delivered the questionnaire via email to offices in 22 countries.

Note: The size of the population was roughly estimated by the ex-post evaluator based on documentation provided by JICA, documentation provided by the implementation agency, etc. Although the number of math and science teachers at secondary schools and the number of students in the 6th to 8th grades at primary schools were not available, Figure 3 below shows the total number of schools and teachers.

3. Results of the Evaluation of the Kenya Component (Overall Rating: A[7])

3.1 Relevance (Kenya Component) (Rating: ③[8])

3.1.1 Consistency with the Development Plan of Kenya

The long-term national development plan "Vision 2030" (2008-2030), which is active at the times of both project planning and project completion, aims to become a medium income country by 2030 and improve the quality of education and research. With respect to the sector development plan, the Kenya Education Sector Support Programme (2005-2010) implemented at the time of planning and the National Education Sector Plan (2013-2018) implemented at the times of project completion and ex-post evaluation both include INSET in primary and secondary education as their priority investment projects.

3.1.2 Consistency with the Development Needs of Kenya

In Kenya, the number of schools as well as teachers rose in both primary and secondary education (Figure 3), indicating a continuous need to strengthen teachers' capability as mentioned in "1.1 Background." CEMASTEA was occupying a significant position as the country's sole implementing body of INSET in mathematics and science.[9]

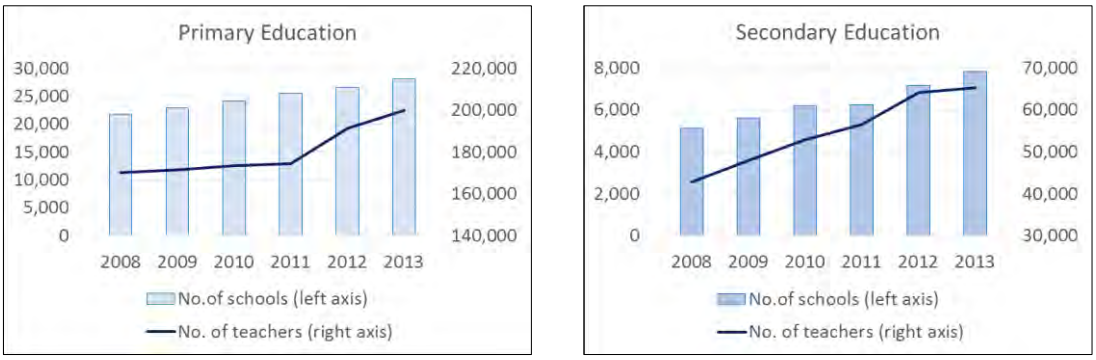


Figure 3: Numbers of primary and secondary schools and teachers in Kenya

Source: Prepared by the evaluator based on data from the Kenya National Bureau of Statistics.

3.1.3 Consistency with Japan's ODA Policy

The Country Assistance Program for Kenya (2000) states "Primary and secondary education: Improvement of quality and pedagogy of primary and secondary school teachers in mathematics and science, and improvement of facilities through such means as the construction of primary schools utilizing the grant aid for Grass-Roots Human Security" at the

[7] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[8] ③: High, ②: Fair, ①: Low
[9] Outside of CEMASTEA, INSET was implemented by the Kenya Education Management Institute, which operates training in education management, and the Kenya Institute of Special Education, which operates training in special education (this situation is the same at the time of ex-post evaluation).

beginning of the section on human resources development, one of its priority areas of assistance.

In this way, the Kenya component was highly relevant to the country's development plan and development needs, as well as Japan's ODA policy. Therefore, its relevance is high.

3.2 Effectiveness and Impact[10] (Kenya Component) (Rating: ③)

3.2.1 Effectiveness

3.2.1.1 Achievement of Project Purpose

As the outputs in the primary education level, the project established the mechanism of INSET by introducing throughout the country SMASE INSET, which was designed around the three-cascade training, namely, national (Output 1), regional (Output 2) and cluster[11] (Output 3) training, and implementing training for Regional INSET Trainers (PTTC instructors), Cluster INSET trainers (selected primary school teachers) and primary school teachers (teaching mathematics and/or science to 6th to 8th graders) as well as workshops for education administrators (including school principals) according to the plan.[12] Consequently, lessons by teachers who attended SMASE INSET showed improvement during the project implementation period (Table 2). All of three indicators that measured the degree to which classroom lessons improved (i.e., Lesson Innovation Index based on self-assessment by teachers, ASEI/PDSI Lesson Observation Index based on National INSET Trainers, etc., and Student Participation Index based on assessment by students) generally achieved the respective targets. In this way, the project purpose for the primary education level was mostly achieved.

With respect to the secondary education level, the project introduced workshops mainly for school principals on lesson study and ASEI-PDSI-related instructions (Output 4), aiming to reinforce Secondary INSET that had been established through the preceding two phases. However, the number of workshops that was conducted was fewer than planned due to strikes by teachers, delays in project activities, and other reasons, and the expected effects of the workshops were not clearly demonstrated in teachers' practice in the classroom. Therefore, the project purpose for the secondary education level is judged to be partially

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[10] Sub-rating for Effectiveness is to be put with consideration of Impact.

[11] In Kenya, MOEST had once implemented cluster-level training for head teachers (principals) or core teachers. This project utilized the existing training mechanism from such training for establishing SMASE INSET.

[12] It should be noted, however, that some results such as the number of participants in some training/workshops and the submission rates of INSET implementation reports on time did not reach the level expected in the plan. For example, cluster training was not conducted in ASAL since accommodation expenses were not covered even though teachers could not commute every day to attend the training. Also, teachers did not attend the training in some regions due to opposition mainly from teachers' unions. Regarding INSET implementation reports, it is reported that most of them were submitted after the due date (e.g., within one month). Some former Japanese experts explained that the priority for punctual submission was low among teachers.

achieved[13].

Table 2 summarizes the degree to which the project purpose was achieved. Also, Table 3 shows the number of participants in Primary and Secondary INSET and related workshops to date including those during the project implementation period.

Table 2: Achievement of project purpose (Kenya component)

<table>
<tr><th>Project Purpose</th><th>Indicator (1)</th><th>Actual (2)</th></tr>
<tr><td rowspan="7">Quality of Mathematics and Science education at Primary and Secondary school levels in Kenya is strengthened through INSET.</td><td colspan="2">Primary Education Level</td></tr>
<tr><td>[1] Lesson Innovation Index attains to 3.3 on a 0-4 scale.</td><td>Mostly achieved.
<table><tr><td>Subject</td><td>2009</td><td>2011</td><td>2013</td><td>Achievement</td></tr><tr><td>Math</td><td>3.17</td><td>3.25</td><td>3.31</td><td>108%</td></tr><tr><td>Science</td><td>3.28</td><td>3.20</td><td>3.26</td><td>-</td></tr></table>Sample size (person): 111 for math and 82 for science in 2009; 78 each for math and science in 2011, 38 each for math and science in 2013.</td></tr>
<tr><td>[2] ASEI-PDSI Lesson Observation Index attains to 2.0 on a 0-4 scale.</td><td>Achieved.
<table><tr><td>Subject</td><td>2009</td><td>2011</td><td>2013</td><td>Achievement</td></tr><tr><td>Average</td><td>1.54</td><td>2.14</td><td>2.34</td><td>174%</td></tr></table>Sample size (person): 202 in 2009; 62 in 2011; 62 in 2013.</td></tr>
<tr><td>[3] Student Participation Index attains to 2.5 on a 0-4 scale.</td><td>Achieved, based on measurement on a scale of 0 to 2. (3)
<table><tr><td>Subject</td><td>2009</td><td>2011</td><td>2013</td><td>Achievement</td></tr><tr><td>Math</td><td rowspan="2">1.33</td><td>1.51</td><td>1.71</td><td>224%</td></tr><tr><td>Science</td><td>1.58</td><td>1.75</td><td>247%</td></tr></table>Sample size (person): 2,302 in 2009; 1,406 in 2011; 1,033 in 2013.</td></tr>
<tr><td colspan="2">Secondary Education Level</td></tr>
<tr><td>[4] Lesson Innovation Index attains to 3.0 on a 0-4 scale.</td><td>Partially achieved.
<table><tr><td>Subject</td><td>2009</td><td>2013</td><td>Achievement</td></tr><tr><td>Average</td><td>2.7</td><td>2.9</td><td>67%</td></tr></table>Sample size: 72 in 2009; 134 in 2013.</td></tr>
<tr><td>[5] ASEI/PDSI Lesson Observation attains to 3.0 on a 0-4 scale.</td><td>Partially achieved.
<table><tr><td>Subject</td><td>2009</td><td>2013</td><td>Achievement</td></tr><tr><td>Average</td><td>2.8</td><td>2.9</td><td>50%</td></tr></table>Sample size (person): 72 in 2009; 134 in 2013.</td></tr>
<tr><td>[6] Student Participation Index attains to 3.0 on a 0-4 scale.</td><td>Unable to evaluate (no comparable data available).</td></tr>
</table>

Source: Terminal evaluation report.

Note: (1) The indices convert the following assessments on the level of ASEI-PDSI practice into scores. Lesson Innovation Index: self-assessment by teachers using a questionnaire. ASEI-PDSI Lesson Observation Index: results of lesson observations by National INSET Trainers, etc. using a checklist. Student Participation Index: assessment of lessons by students using a questionnaire. (2) The level of achievement was calculated at the time of ex-post evaluation using the following formula: (score in 2013 – score in 2009) / (target score – score in 2009) x 100. (3) The degree of achievement of the indicator 3 for the primary education level was calculated by converting the target score to 1.5 on a 0-2 scale, as was done in the terminal evaluation.

[13] The project used the same three indices as the indicators for the project purpose in both secondary education and primary education levels. In the secondary education level, however, the project could have additionally measured the degree to which principals instructed teachers on lesson study and the degree to which teachers actually carried out lesson study, since they are likely to be intermediary steps to connect the output (i.e., implementation of workshops for principals, etc.) and the project purpose (i.e., improvements in the classroom).

From above, it is judged, by putting weight on the primary education level, that the project mostly achieved its purpose.

3.2.2 Impact

The assessment of the impact of the Kenya component focused on the degree to which the following impacts materialized: (1) Prompted by the continuous implementation of SMASE INSET (i.e., whether the outputs have sustained), (2) teachers have continuously applied the training they received in practice (i.e., whether the outcome achieved for the project purpose has sustained), resulting in, (3) enhancement of students' capability in mathematics and science (i.e., whether the overall goal has been achieved in terms of motivation, level of understanding, and academic performance of students).

3.2.2.1 Achievement of Overall Goal[14]

(1) Continuation of SMASE INSET (Whether the outputs have sustained)

After the completion of this project in 2013, SMASE INSET in the primary education level was suspended in 2014 due to unavailability of budget from MOEST. It resumed in 2015, and INSET in ASAL (the region this project had not covered) and lesson study workshops in some sub-counties in other regions have been conducted since then.[15] Although MOEST and CEMASTEA reported that the scale of SMASE INSET was reduced following the relative decrease in its budget reflecting the additional implementation of non-SMASE INSET in primary education (See "3.2.2.2 Other Positive and Negative Impacts"), related policies and planning documents (See "3.4.1 Related Policy and Institutional Aspects for the Sustainability of Project Effects") evince that efforts have been made to continue SMASE INSET in primary education.

Regarding the secondary education level, nation-wide SMASE INSET has been continuously implemented in a more evolved form than during the project implementation period. That is, the original system in which all teachers would receive one cycle of training each year in a total of four cycles (four years) was replaced by a new, experience-specific system starting in 2014 (in a given year, all teachers who have the target number of experience set by CEMASTEA for that year would be trained in a module designed for their amount of experience). This change made the training more targeted and responsive to the needs. Such development was possible for the secondary education level because almost all teachers had attended INSET by 2013, establishing the foundation for ASEI-PDSI. Other

[14] Since the target year for the overall goal is not mentioned in existing documents, the status of achievement was assessed at the time of this ex-post evaluation (three years after project completion).

[15] Lesson study workshops are organized by individual Curriculum Support Officers (CSOs) of Sub-County Education Offices who attended training in Japan under this project, and are administered in the respective sub-counties they are in charge of (one sub-county each in 31 counties). CEMASTEA monitors and evaluates the workshops. CSOs were called Teacher Advisory Centre (TAC) Tutors during the project implementation period.

project activities for the secondary education level such as workshops for school principals and school-based lesson studies have been continuing as well.

CEMASTEA prepares and updates necessary modules and training materials for all of the aforementioned training and workshops, and conducts monitoring and evaluation of them.

It is therefore concluded that SMASE INSET generally remains operational in both the primary and secondary education levels, while there have been changes in the implementation scale and targeting. Table 3 shows the number of participants in training and workshops in the period between project implementation and ex-post evaluation.

Table 3: Number of participants in SMASE INSET and related workshops

(Unit: person)

		2009	2010	2011	2012	2013	2014	2015	2016
Primary Education	National training	0	272	286	284	274	0	28	47
	Regional training (1)	0	59,813	51,097	47,027	39,136	0	300	3,554
	Lesson study workshop (2)	0	0	0	0	0	0	2,578	762
	Workshop for principals and education administrators	0	897	832	841	1,473	0	252	47
Secondary Education	National training	509	0	1,412	1,412	0	1,330	1,330	1,323
	Regional training	0	4,420	4,164	4,021	4,118	2,864	8,481	7,301
	School-based lesson study (3)	0	0	0	0	0	0	90	125
	Workshop for principals and education administrators	1,113	0	0	5,540	3,430	94	1,420	2,601

Source: Terminal evaluation report; responses and information provided by the implementing agency.
Note: (1) The figures of "Regional training" in primary education are the sum of the participants in regional training (second cascade) and the cluster training (third cascade). Upon facing a reduction of CEMASTEA' budget for primary education, these two cascades have merged since 2015 because the smaller budget reduced and limited the coverage of training to ASAL, which had not been covered during the project implementation period, cutting down the number of targeted teachers to a level that no longer required multiple cascades.
(2) Lesson study workshops for primary education were implemented in one sub-county per country in 31 counties. The figure for 2016 only includes participants in the eight sub-counties where CEMASTEA conducted monitoring.
(3) The figures for "School-based lesson study" in secondary education were estimated by multiplying the number of schools where CEMASTEA conducted monitoring (18 in 2015 and 25 in 2016) by five, which is an estimate, based on interview results, for the number of teachers per school that attended training (no records were available for the actual number of participants).

(2) Application of ASEI-PDSI (Whether the outcome achieved for the project purpose has sustained)

The evaluator verified that the measured values at the time of ex-post evaluation for two of the three indicators of the project purpose were mostly unchanged from the project implementation period (Table 4),[16] indicating teachers are generally applying what they had learned from the training in the class.

[16] Although most of the measured values exceeded the target values in the table, the fact that the measurement method at the time of ex-post evaluation was simpler than during the project implementation makes it difficult to interpret the increase or decrease in the values with rigor. Therefore, the measured values were only judged as "mostly unchanged" on the ground that no large fluctuations occurred.

In both the primary and secondary education levels, the values of Lesson Innovation Index (based on teachers' self-assessment) measured at the time of ex-post evaluation show no statistically significant differences by region, sex, and attendance/non-attendance, timing of attending and frequency of attending SMASE INSET.[17] High self-assessment scores among those primary school teachers who did not receive SMASE INSET might be due to a spillover of the training effects. It was observed from interviews in all schools the evaluator visited that teachers shared the contents of SMASE INSET with other teachers[18] at subject panel meetings or school-based training including lesson studies (organized as school-based INSET by each school) and that even teachers who did not receive the training had knowledge of ASEI-PDSI. Interview results also suggested that some of the teachers with SMASE INSET who were actually practicing ASEI-PDSI more frequently than teachers without SMASE INSET might have reported lower frequencies of practicing ASEI-PDSI in the survey as they might have interpreted the practice of ASEI-PDSI more strictly.[19] With respect to secondary school teachers, most of whom have completed SMASE INSET, the evaluator attempted to analyze the relationship between the frequency of ASEI-PDSI practice and the number of times teachers attended the training (i.e., whether or not they received each of Cycles 1 to 4). However, the data were insufficient for this analysis as some teachers could not correctly recall their training history. Nevertheless, it was observed that greater frequencies of supervision by the principal and implementation of school-based lesson studies tended to result in higher values in Lesson Innovation Index, possibly indicating effects of the workshops conducted for school principals.[20]

Conducted along with this ex-post evaluation was a detailed analysis by an expert, which analyzed video recordings of nine classroom lessons on mathematics or science subjects using the revised Bloom's Taxonomy of Educational Objectives[21] (expert: Hideo Ikeda, Professor emeritus, Hiroshima University). The analysis confirmed that ASEI-PDSI was being practiced in the observed lessons and the quality of teaching techniques was relatively high (See Appendix).

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[17] Mainly based on the result of linear regression analyses with a significance level of 10 percent. Also, no differences were observed in SMASE INSET attendance history between men and women.

[18] One to several teachers had received SMASE INSET in each school. Due to frequent transfers of teachers, many of them said that they had attended the training when they worked at their previous schools.

[19] Several teachers provided relatively low self-assessment in the survey questionnaire despite the results of interviews and classroom observation that revealed a high degree of ASEI-PDSI practice among those teachers. The survey questionnaire followed the design of the one used under the project and asked respondents to report their frequency of practicing activities such as "I give pupils opportunities to do activities" using response categories, "Always," "Often," "Sometimes," "Rarely," and "Never"; the views towards the choices such as "Often" and "Sometimes" were potentially less strict among teachers without SMASE INSET.

[20] However, both the regression coefficient and the determination coefficient were less than 0.1.

[21] This taxonomy classifies educational objectives to "Remember," "Understand," "Apply," "Analyze," "Evaluate," and "Create," ordered from lowest to highest. It is incorporated in SMASE INSET as educational objectives pursued by the ASEI-PDSI approach.

A science lesson in a primary school. Each student is experimenting moves of his/her lungs.

A biology lesson in a girl's secondary school. Girls' interests in mathematics and science subjects have increased with introduction of ASEI-PDSI.

Teachers pointed out a number of issues in the survey and interviews. Common responses include the followings: in the primary education level, "we will forget what we learned from the training because SMASE INSET for primary school teachers has not been provided since 2014 except in ASAL"; "because each teacher is responsible for a very large number of students (e.g., 80 students in a classroom), it makes it impossible to do any other activities other than grading students' work, and to let students conduct many experiments"; "schools lack teaching and learning materials and tools (e.g., "teachers cannot improvise test tubes")." In the period after the completion of this project, three years have passed since the nation-wide SMASE INSET for primary school teachers was suspended. There is a risk for the prevalence of ASEI-PDSI practice mentioned above to fade in the future if it remains unavailable. Regarding teaching and learning materials, publication and distribution of materials developed by CEMASTEA to the public, which did not take place during the project implementation period (Output 5), have partially realized by the time of ex-post evaluation in a form of uploaded materials on the CEMASTEA website. However, a lot of materials are still distributed only during SMASE INSET sessions. At CEMASTEA facilities, a JICA Senior Volunteer displays teaching/learning materials created by himself and teachers who attended the training. While this serves as a demonstration of "Improvisation," one of the main components of ASEI-PDSI (i.e., utilization of readily available materials in teaching), its existence does not seem to be adequately informed to teachers.

Comments from secondary school teachers tended to be divided among schools. In some schools, a typical comment was, "it is difficult to practice student-centered teaching in the class because teachers are under strong pressure to have their students perform well on the Kenya Certificate of Secondary Education (KSCE) examinations and to complete the syllabus," while some schools did not see it as a problem and were positive about practicing ASEI-PDSI. Such discrepancy does not seem to be related to the type of school (i.e., national schools or schools under local governments) or the attendance at workshops for principals. Instead, teachers' attitudes toward SMASE INSET and ASEI-PDSI seem to be affected by school principals' stance.

Table 4: Comparison of the measured values of the project purpose indicators between the times of project completion and ex-post evaluation

Indicator		Subject	Target	2013 (Project completion)	2017 (Ex-post evaluation)
Primary education	[1] Lesson Innovation Index (0.00-4.00)	Math	3.30	3.31	3.44
		Science		3.26	
	[3] Student Participation Index (0.00-2.00)	Math	1.50	1.71	1.49
		Science		1.75	1.54
Secondary education	[4] Lesson Innovation Index (0.00-4.00)	Math & Science	3.00	2.90	3.00
	[6] Student Participation Index (0.00-4.00)	Math	3.00	N/A	3.39
		Physics		N/A	3.37
		Chemistry		N/A	3.26
		Biology		N/A	3.41

Source: Terminal evaluation report for the target values and the measured values for 2013 (See Table 2 for sample size.); beneficiary survey for the measured values for 2017 (sample size: 153 primary school teachers for [1], 380 primary school students for [3], 100 secondary school teachers for [4], 264 secondary school students for [6]).
Note: The numbers in the brackets indicate the indicator numbers for the project purpose (See Table 2 for the list of all indicators.). "ASEI/PDSI Lesson Observation" is excluded from the table since the ex-post evaluation did not involve lesson observations by observers such as national INSET trainers. In 2013, all indices were measured based on the detailed survey tools (questionnaires and checklists), but the measurement in 2017 used a simplified questionnaire, which was developed by the ex-post evaluator by selecting questions that appeared representative from the original questionnaire.

(3) Enhancement of students' capability in mathematics and science (Whether the overall goal has been achieved)

Table 5 shows the status of achieving the overall goal indicators. The project had originally planned to measure the capability of students by the improvement in the scores on the Kenya Certificate of Primary Education (KCPE) (national examination) for the primary education level, and, for the secondary education level, by the results of the SMASSE Project Impact Assessment Survey (SPIAS). However, the ex-post evaluator did not use either measurement to assess the status of achieving the overall goal, as KCPE results do not always reflect changes in students' academic ability[22] and it was difficult for the present study to conduct SPIAS, which would entail an achievement test for students. Instead, the evaluator used an alternative indicator measuring "improvement in students' motivation, understanding, and grades in math and science subjects (as assessed by teachers and principals)," as well as the results of a student survey as supplementary information. Since the project did not set an expected level of improvement for students' capability, the

[22] The terminal evaluation report states that KCPE scores in a given year are not comparable with those in other years since the contents of KCPE change from year to year and the mean scores may vary according to the level of difficulty of the test in a particular year. This situation was confirmed by the results of interviews with CEMASTEA, former Japanese experts, teachers, etc., at the time of ex-post evaluation.

evaluator set a general threshold that the target would be considered as reached if 80 percent or more respondents reported that students' motivation, understanding and grades had improved.

In the survey completed by primary and secondary school teachers, approximately 70 percent to 80 percent of the responses answered "improved" for each of the three questions concerning students' "motivation," "understanding," and "grades." School principals acknowledge in the interviews that SMASE INSET contributed to such improvement. Specific comments include, "students now show less anxiety and more curiosity in math and science (reflected in such behaviors as continue working on exercises even during a break between classes, completing their homework promptly, and listening to the teacher more intently, etc.," "students' understanding and grades have improved," and "their academic performance in secondary schools they advanced to has improved (cited by primary school teachers)," and "more students take science electives (cited by secondary school teachers)," all as the result of enhanced participation of students in the class. In the student survey, most of the respondents in both primary and secondary schools reported that "I like math and science subject(s)" and cited as the reasons, "the subject is interesting," "the subject is easy," "I like the teacher (or the way the teacher teaches)," "the subject is useful in the future," and "the subject (science) deals with topics related to myself or things around me." The reasons why they do not like math and science subject(s) include, "the subject is difficult," and "the teacher (or the way the teacher teaches) is not good."

Table 5: Achievement of the overall goal (Kenya Component)

<table>
<tr><th>Overall Goal</th><th>Indicator</th><th>Actual</th></tr>
<tr><td rowspan="2">Capability of young Kenyans in Mathematics and Science is upgraded.</td><td>Primary Education Level</td><td></td></tr>
<tr><td>(1) Performance in National Examination in primary education (mean scores of KCPE) is improved.

(Alternative Indicator)
Improvement in students' motivation, understanding, and grades in mathematics and science subjects (as assessed by teachers and principals)</td><td>KCPE mean score (for reference only)
<table>
<tr><td>Subject</td><td>2008</td><td>2009</td><td>2010</td><td>2011</td><td>2012</td><td>2013</td><td>2014</td></tr>
<tr><td>Mach</td><td>47.16</td><td>49.56</td><td>53.80</td><td>52.18</td><td>56.30</td><td>52.86</td><td>52.04</td></tr>
<tr><td>Science</td><td>55.24</td><td>59.92</td><td>60.86</td><td>67.48</td><td>62.76</td><td>61.82</td><td>66.00</td></tr>
</table>
Alternative Indicator: partially achieved.
・ Interviews with principals or senior teachers (18 schools): Respondents reported, "students' motivation increased by SMASE INSET" in all schools visited.
・ Questionnaire survey with teachers (153 teachers): 84% reported, "students' motivation increased," 72% reported, "students' understanding increased," and 73% reported, "students' grades improved."
・ Questionnaire survey with students (380 students): 95% reported, "I like mathematics," and 97% reported, "I like science."</td></tr>
</table>

(Table 5 continued)

Overall Goal	Indicator	Actual
	Secondary Education Level	
	(2) Results of SPIAS in the secondary level are improved compared with the results of SPIAS at the end of Phase 2. (Alternative Indicator) Improvement in students' motivation, understanding, and grades in mathematics and science subjects (as assessed by teachers and principals)	SPIAS has not been conducted since the completion of this project. Alternative Indicator: partially achieved. ・ Interviews with principals or senior teachers (9 schools): Respondents reported, "students' motivation increased by SMASE INSET in all schools visited. In response to a question whether the number of students who take science electives increased, four schools reported "increased" (among other schools, one school reported, "there are no electives," one school reported, "teachers instruct students to select electives based on their grades rather than their preferences," and the remaining three schools did not provide clear responses. ・ Questionnaire survey with teachers (100 teachers): 78% reported, "students' motivation increased," 72% reported, "students' understanding increased," and 69% reported, "students' grades improved." ・ Questionnaire survey with students (264 students): 97% reported, "I like mathematics," 96% "physics," 92% "chemistry," and 95% "biology."

Source: Information provided by the implementing agency; beneficiary survey.

It should be noted that the qualitative investigation in this evaluation could not fully verify the changes among the students, especially the degree of improvement in their academic performance. In this regard, the detailed analysis by an expert (see (2) above and Annex of this report) observed improvements in pedagogy, which was the main subject of technical transfer under this project, while the analysis points out several problems, from technical points of view, in the contents of lessons where the project's intervention was relatively minor. These results suggest that further improvement could be made in course contents in SMASE INSET in order to enhance students' academic performance.

In sum, it was found that students' attitudes have improved in all primary and secondary schools visited for the present evaluation. On the other hand, the percentage of teachers who reported that students' motivation, understanding, and grades, have improved was slightly below 80 percent. Also, the qualitative study conducted in this evaluation was not equipped to fully verify the changes among the students, especially the degree of improvement in their academic performance. Therefore, it is concluded that the project has achieved its overall goal at a limited level.

3.2.2.2 Other Positive and Negative Impacts

The following positive impacts are observed although they include outcomes/impacts of the two preceding phases of technical cooperation and the grant aid project. No negative

impacts on the natural environment have been reported. The project did not involve land acquisition and resettlement.

- Contribution of CEMASTEA as a center of SMASE INSET in Kenya: Due to the achievements it has made and the facilities developed by the grant aid project, CEMASTEA is positioned as a central organization in the ongoing reorganization of teacher training institutions at the time of ex-post evaluation (See "3.4.2 Organizational Aspects for the Sustainability of Project Effects"). CEMASTEA also assumes a role as the implementing agency of a new mathematics and science project that is being planned by MOEST.[23]
- Practice of ASEI-PDSI in other subjects: In the questionnaire survey with principals and local education administrators, 22 out of the 35 respondents reported that they adopted the ASEI-PDSI approach to teach other subjects such as language and social studies. In particular, in cases where the principal was a language or social studies teacher, the principal himself or herself practiced components of ASEI-PESI (e.g., practical activities and student-centered approach) and encouraged other teachers to practice them.
- Practice of ASEI-PDSI in pre-service teacher training: Even though PTTC instructors who attended the national training under this project did not act as INSET trainers after the completion of this project except in ASAL, according to the instructors interviewed for this ex-post evaluation, they teach PTTC students ASEI-PDSI as part of course topics such as pedagogy and classroom evaluation, and practice it in the class. Under the teacher employment situation in Kenya at the time of ex-post evaluation, it is difficult for new PTTC graduates to be immediately appointed as full-time teachers at public schools; however, according to PTTC instructors and primary school teachers, PTTC graduates practice ASEI-PDSI as part-time teachers or teachers at private schools.
- Contribution to other INSET programs for primary education: Although SMASE INSET is the only INSET in mathematics and science for secondary education, for primary education MOEST, with assistance from other organizations such as the United States Agency for International Development (USAID), implements INSET in mathematics skills development program (Early Grade Mathematics, EGMA) for early grades (1st and 2nd grades).[24] According to the implementation team of EGMA, the

[23] The project aims to increase students' interests in the fields of science, technology, engineering, and mathematics (STEM) through activities including teacher training by designating a model school in each county. CEMASTEA was conducting the feasibility study for the project as of November 2016.

[24] EGMA is organized under the Global Partnership for Education (GPE) and is part of the Kenya Primary Education Development Project (PRIEDE) supported by the World Bank, USAID, and others (2015-2018, with a plan to be extended to March 2019). EGMA, together with TUSOME (a program in Swahili and English languages; meaning

program adopts a teacher-centered approach rather than, unlike ASEI-PDSI, a student-centered approach in order to strengthen most foundational skills when students are still in early grades so that the student-centered instructions in advanced primary grades (6th to 8th grades) can be implemented effectively. Thus, a mutually reinforcing relationship exists between EGMA and SMASE INSET. CEMASTEA makes significant contribution to EGMA because the former counterpart personnel who were trained in this project and the preceding two phases play a central role in the implementation team of EGMA, and many of EGMA's master trainers (trainer education instructors) are either academic staff at CEMASTEA or regional INSET trainers who received national training at CEMASTEA.

PTTC students who just came back from teaching practice that incorporated ASEI-PDSI.


Early grade primary school pupils in math class using EGMA learning materials.

This component mostly achieved the project purpose of strengthening mathematics and science education in Kenya (judged by the level of improvement in lessons). The overall goal (i.e., upgrading students' capabilities in mathematics and science as judged by the assessments by teachers on the extent of improvement in students' motivation, understanding, and grades) was partially achieved, as the beneficiary survey results showed that the percentage of teachers who acknowledged improvement was slightly below 80 percent, and there were issues on the appropriateness of the indicators and constraints on the measurement methods. Nevertheless, this evaluation confirmed positive impacts that are likely to assist the project in achieving the project purpose and the overall goal in the primary education level, which was the central sub-component of this component; the outcomes have generally sustained since project completion at the level specified in the project purpose, and the practice of ASEI-PDSI in pre-service teacher training and contribution of the project to other INSET programs in primary education have taken place. Considering all these findings comprehensively, the effectiveness and impact of the component are high.

"Let's read" in Swahili), distributes learning materials to primary schools around the country and provides training for all primary school teachers in order to strengthen foundational learning skills for early graders in reading, writing, and calculation (in Swahili, English, and mathematics).

3.3 Efficiency (Common for Kenya Component and WECSA Component) (Rating:③)

3.3.1 Inputs

Table 6: Planned and actual inputs (Kenya component and WECSA component)

Inputs	Plan	Actual
(1) Experts	Long-term: Chief Advisor, Academic Advisor, Science Education, Mathematics Education, Coordinator Short-term: The number of experts not specified	Seven long-term experts: Chief Advisor, Deputy Chief Advisor/WECSA Advisor, Subjects Advisor (Science Education), Subjects Advisor (Mathematics Education), Project Coordinator I, Project Coordinator II/INSET Management, Academic Advisor Three short-term experts: Academic Advisor, Evaluation, Curriculum Development Dispatch of 38 Kenyan counterpart personnel to SMASE-WECSA member countries in the WECSA Component
(2) Trainees received	Training in Japan and a third country	Total of 162 counterpart personnel: 150 received training in Japan and 12 in a third country (Malaysia)
(3) Equipment	Provision of training materials and equipment necessary for training, provision of equipment related to the development of the foundation of training	Training materials and equipment
(4) Overseas activity cost	Training expenses	212 million yen (seminar expenses from the overseas activity cost and the domestic activity cost)
Japanese Side Total Project Cost	1,500 million yen	1,003 million yen
Kenyan Side Total Project Cost	1,818 million yen	999 million yen

Source: Ex-ante evaluation sheet; information provided by JICA
Note: The inputs are for both the Kenya component and the WECSA component unless otherwise mentioned. The exchange rate used for calculation of the actual cost: 1 Kenya shilling = 1.06 yen (average in 2009-2013).

3.3.1.1 Elements of Inputs

No issues are observed in the elements of inputs. It is noteworthy that (i) about the same number of Japanese experts and Kenyan counterpart personnel as in Phases 1 and 2 implemented the activities related to INSET in both primary and secondary education in Kenya and intra-regional cooperation, and produced most of the outputs except for a few outputs, while the preceding phases only covered secondary education and intra-regional cooperation, and (ii) the Kenyan side bore almost the same amount of expenses as the Japanese side to implement INSET.

Although it is difficult to verify quantitatively, the experience gained in the two preceding phases (especially the enhanced capability of the counterpart personnel) may have played a part in enabling the project to implement its wide-ranging activities. On the other hand, the grant aid project did not contribute to the achievement of the outputs of this project because

the completion of the development of CEMASTEA facilities and equipment in the grant aid project took place at around the same time as the completion of this project.

3.3.1.2 Project Cost

The project cost covering both the Kenya component and the WECSA component was lower than planned (67 percent of the plan). According to the terminal evaluation report, reasons for the decrease in the project cost included a change in the status of Academic Advisor from long-term expert to short-term expert (due to the availability of a successor), a change in the grade of personnel cost for some of the long-term experts (due to the availability of successors), and a reduction in the overseas activity cost as the result of revisions on the estimate.

3.3.1.3 Project Period

The project period was from January 2009 to December 2013 as planned (100 percent of the plan).

Both the project cost and project period were within the plan. Therefore, efficiency of both components is high.

3.4 Sustainability (Kenya Component) (Rating: ②)

With an assumption that the effect of the Kenya component that should sustain after project completion is the continuation of SMASE INSET (including the environment enabling former trainees to practice what they learned), the evaluator judged the component's sustainability based on whether the policy/institutional, organizational, technical, and financial conditions necessary for the continuation are secured and whether the latter conditions are likely to be secured in the future.

3.4.1 Related Policy and Institutional Aspects for the Sustainability of Project Effects

Among the development policies mentioned in "3.1.1 Consistency with the Development Plan of Kenya," Vision 2030 and the National Education Sector Plan are still active at the time of ex-post evaluation. The National Education Sector Plan upholds strengthening and institutionalization of INSET in primary and secondary education and specifically states "strengthening SMASE INSET" as the Plan's goal. In addition, MOEST, CEMASTEA, and the Teachers Service Commission (an independent administrative agency that manages public school teachers including employment and capacity strengthening), with assistance from a JICA individual expert dispatched to MOEST, are preparing the Continuous Teacher Professional Development Policy at the time of ex-post evaluation. This policy, which is

expected to be approved within 2017, would make INSET (as Teacher Professional Development) mandatory in all subjects in primary and secondary education and require teachers to renew their teaching licenses every five years. Therefore, it is judged that policy and institutional arrangements necessary for the deployment of SMASE INSET are ensured.

3.4.2 Organizational Aspects for the Sustainability of Project Effects

CEMASTEA is responsible for the implementation of SMASE INSET under the supervision of MOEST, as it was at the time of planning. The supervising office in MOEST was the Field Service Department at the time of planning, but after the reorganization in February 2017, it was handed over to the Director General's Office for Field Coordination and Co-Curricular Activities. According to MOEST, the reorganization did not affect the function, staffing, and the relationship with CEMASTEA. The responsibility for local educational administration is now assumed by county education offices of MOEST following the change of local administrative divisions from provinces/districts to counties/sub-counties, but this change has not affected the continuation of SMASE INSET.

The organizational structure of CEMASTEA has not changed. Of the 107 employees in 2016, 47 were academic staff including the director and vice director, and 60 were non-academic staff. The academic staff are responsible for operation management, module development, national INSET lectures, monitoring and evaluation of regional INSET, and research in mathematics and science education; although 60 positions were originally created, with 15 positions in each of mathematics, physics, biology, and chemistry, the actual number of staff has declined because vacant positions after staff retirement have not been filled. Even though the operation is carried out by a fewer number of personnel than anticipated, CEMASTEA reported that the understaffing did not hinder activities, and new projects, development and revision of modules, and other activities continued to be undertaken.[25] Therefore, the staff size does not seem to be an issue for continuing the activities implemented in this project.

At the time of ex-post evaluation, a restructuring plan for the implementation agencies for INSET in Kenya is being planned. This plan would consolidate three existing bodies (CEMASTEA, the Kenya Education Management Institute, and the Kenya Institute of Special Education) into the Kenya School of Education, which, according to MOEST, will be formed by the end of 2017. According to CEMASTEA, the existing structure of CEMASTEA will remain intact under the changes in the plan, and it will continue to function as the specialized institution for math and science education (although a new name such as the Kenya School of Education CEMASTEA Campus is being considered). Further, a future plan is being

[25] According to CEMASTEA, training on gender and integrity is commissioned to resource persons (external experts).

considered to designate an existing teacher's college for primary education as the implementation body for non-math/science INSET and place it under the Kenya School of Education. The likelihood of CEMASTEA's continuation seems to be very high because CEMASTEA is the only organization that has experience and knowledge in INSET in individual subject areas. Therefore, it is judged that an institutional structure necessary for deploying SMASE INSET is secured.

3.4.3 Technical Aspects for the Sustainability of Project Effects

All academic staff of CEMASTEA have received technology transfer in this project, and have continued to engage in activities related to SMASE Phase 3 such as INSET in primary and secondary education (including updating of teaching materials and developing new modules), hosting of relevant conferences and workshops, training needs assessment with teachers, monitoring and evaluation of schools, and research projects (including impact assessment); they continue to upload some of the teaching materials and reports they create to the CEMASTEA website. Although some of them have retired from CEMASTEA as mentioned above, all CEMASTEA personnel receive a performance assessment and training in the organization, and share knowledge and techniques among them. Therefore, no issues were found in relation to maintaining the projects' effects that have been attained so far. On the other hand, CEMASTEA commented that further development of school-based INSET (training centered on lesson study) is important for resuming nationwide implementation of SMASE INSET in primary education with limited budget; therefore, CEMASTEA is hoping to receive Japanese assistance such as sharing of experiences in school-based activities.

With respect to the skill level of Regional INSET Trainers, those trainers for primary education in ASAL (where SMASE INSET in primary education is implemented at the time of ex-post evaluation) and those for secondary education across the country have opportunity to receive national training every year. Regional INSET monitoring reports prepared by CEMASTEA state that the performance of the monitored trainers is maintained at a certain level although improvement could be made in some areas including trainers' understanding of training contents. After the completion of this project, Regional INSET Trainers in primary education in other areas than ASAL no longer have opportunity to serve as SMASE INSET trainers, to use SMASE INSET system to maintain their skill level, and to have their performance monitored by CEMASTEA. It nevertheless seems that PTTC instructors are maintaining a certain level of skills since the incorporation of ASEI PDSI in their pre-service teacher education has created opportunity to continue practicing this particular approach as mentioned in "3.2.2.2 Other Positive and Negative Impacts."

3.4.4 Financial Aspects for the Sustainability of Project Effects

The bulk of CEMASTEA's budget is allocated by MOEST and comes from the education budget within the national budget. The education budget has grown, even though its share in the national budget has decreased since the time of planning (Table 7).

Table 8 shows CEMASTEA's budget. Although the budget is on an increasing trend, the expenses for training have fallen below the level before the project reflecting the fact that INSET in primary education is no longer administered nationally. On the other hand, the large increase in the development budget and training expenses for the Kenyan Fiscal Year (FY) 2015 reflected a change in the payment channel for the SMASE Fund in secondary education (SMASE INSET receives each year 1 percent of the capitation grant),[26] which is now paid to CEMASTEA rather than to individual schools as done in the past. According to CEMASTEA and local education offices, the change was welcoming because it directed the funds straight to SMASE INSET and eliminated the delay in payment to teachers who attended training. Although CEMASTEA has been requesting to MOEST for the creation of SMASE Fund in primary education in order to offer INSET in primary education in a national scale again, no development has taken place toward implementation. MOEST cites the availability of another INSET program in primary education other than the one provided by CEMASTEA as a factor for the lack of progress (although restricted to mathematics for early primary grades, EGMA will continue making INSET available nationally until March 2019; see Footnote 24).

Therefore, there is a concern for the prospect for sustainability as the project's effects may decline in areas other than ASAL (where SMASE IMSET is continued) if the budget for SMASE INSET in primary education does not increase.

Table 7: National budget and education budget

(Unit: million KSh)

	FY2013	FY2014	FY2015
Total expenditure	1,532,993	1,950,709	2,223,980
of which, education	253,632	301,448	319,426
% of education expenditure in total	17%	15%	14%
Breakdown of education expenditure			
Administration	171,104	181,711	193,218
Pre-primary and primary education	16,770	21,165	22,620
Secondary education	23,056	30,861	34,053
Higher education	40,436	60,471	62,255
Others	2,266	7,240	7,280

Source: Kenya National Bureau of Statistics

[26] Capitation grant = (unit amount) x (the number of enrolled students in each school)

Table 8: CEMASTEA budget (audited)

(Unit: thousand KSh)

	FY2010	FY2013	FY2014	FY2015
Revenue				
From national recurrent budget	71,433	106,935	106,432	104,824
From national development budget	200,000	97,374	155,801	586,023
Others (1)	27,969	6,638	16,779	13,391
Total	299,402	210,947	279,012	704,238
Expenditure				
Personnel	7,912	21,252	27,351	32,392
Training	259,858	117,464	134,754	530,183
Others	75,721	79,259	122,677	128,272
Total	343,491	217,975	284,782	690,847

Source: Preparatory survey report for the grant aid project (2010); documentation provided by implementing agencies.
Note: (1) Other donors including JICA; income from rent; etc. (2) O&M refers to operation and maintenance.

Overall, the sustainability of the effects of the Kenya component is fair because of the problems in the financial aspect of the component.

4. Results of the Evaluation of the WECSA Component (Overall Rating: A[27])

4.1 Relevance (WECSA Component) (Rating: ③[28])

4.1.1 Consistency with the Development Plan of the Region

At the time of planning, improvement of teacher's capability in Africa was set as one of the strategic goals in the Second Decade of Education Plan (2006-2015) promoted by the African Union (AU), and the action plan within the Plan counted on the contribution of SMASE-WECSA's intra-regional activities.

4.1.2 Consistency with the Development Needs of the Region

The needs for improving teacher's capacity are inferred from the statistics[29] for the member countries of SMASE-WECSA between 2009 and 2013, which showed an expansion of teacher population in all countries. Further, in the period between the planning and the project completion, in addition to serving continuously as the center of the TCTP in Africa, CEMASTEA was functioning as the secretariat of Math and Science Working Group within the Association for the Development of Education in Africa (ADEA)[30] (since 2004; the Working Group evolved to the Inter-Country Quality Node for Math and Science Education [ICQN-MSE] of ADEA in 2014), and the secretariat of SMASE-WECSA, which was renamed SMASE Africa in 2013. CEMASTEA, was, thus, playing a significant role as the hub for intra-regional cooperation in mathematics and science education.

[27] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[28] ③: High, ②: Fair, ①: Low
[29] UNESCO Institute of Statistics website.
[30] ADEA is a network created in 1988 to debate and exchange information on education policy in Africa. It facilitates intra-regional cooperation in education in Africa by working closely with AU.

4.1.3 Consistency with Japan's ODA Policy

The Country Assistance Program for Republic of Kenya (2000) designates "human resources development" and other four areas as the priority areas of Japan's assistance to Kenya.[31] It also states that Japan would provide assistance that would contribute to peace building and consolidation in Kenya and its neighboring regions. Also, the Yokohama Action Plan (2008), which was adopted in the Fourth Tokyo International Conference on African Development (TICAD IV), promotes a goal of "expanding teacher training in mathematics and science through SMASSE (targeting more than 100,000 teachers)".

In this way, the WECSA component has been highly relevant to development plan and development needs in Africa, as well as Japan's ODA policy. Therefore, its relevance is high.

4.2 Effectiveness and Impact[32] (WECSA Component) (Rating: ②)

4.2.1 Effectiveness

4.2.1.1 Achievement of Project Purpose

The major outputs of the WECSA component, namely, the TCTP for member countries and networking that had been continuously carried out since Phase 1, were produced mostly as planned. During the implementation period of this project, a total of 849 individuals from the 27 member countries attended TCTP courses and/or workshops at CEMASTEA. In addition, the project held five intra-regional conferences (general meetings of SMASE-WECSA) and three technical meetings (intra-regional meetings to share technical information), and provided technical support in several member countries by sending CEMASTEA staff and Japanese experts. Through these, the project aimed to strengthen capability of INSET providers as the project purpose and achieved the target level in one of the two indicators, the Capacity Building Index. Regarding the second indicator, "the extent to which the ASEI/PDSI concept is reflected in the training manual/materials in the member countries," this evaluation did not use it as a basis of evaluation because the terminal evaluation team pointed out that the validity of this indicator was low (i.e., this indicator would not necessarily represent the level of trainers' capacity development because the degree to which the ASEI-PDSI concept is reflected in manuals, etc. would be affected by the presence or absence of existing manuals and government-level decision-making in each member country). Instead, the terminal evaluation team examined self-assessment by former TCTP attendees as an alternative indicator, which showed good results.

Table 9 summarizes the degree to which the project purpose was achieved. Also, Table 10

[31] "Human resources development," "agricultural development," "development of economic infrastructure," "health and medical care," and "environmental conservation."
[32] Sub-rating for Effectiveness is to be put with consideration of Impact.

shows the number of participants in the TCTP and other related events to date including those during the project implementation period.

Table 9: Achievement of the project purpose (WECSA Component)

Project Purpose	Indicator	Actual
Capability of INSET providers (trainers and administrators) to implement ASEI/PDSI based INSET in member countries is strengthened.	(1) INSET providers obtain a mean of 2.5 on a scale of 0-4 in the overall assessment of Capacity Building Index for INSET provision.	Indicator: Achieved. ・ The average score was 3.8 in an on-line survey of 69 attendees from 17 countries conducted in November 2011. ・ The average score was 3.3 in an impact study conducted in Zambia, Uganda, South Sudan, and Gambia in March to May 2013. This study team observed INSET sessions and confirmed that the facilitation skills of the former attendees it observed had improved adequately, and that the contents of INSET were appropriate in all four countries (based on interviews with about 10 to 30 former attendees per country and observations).
	(2) The extent to which the ASEI/PDSI concept is reflected in the training manual/materials in the member countries. Alternative indicator: The percentage of former TCTP attendees who assessed that their capacities were strengthened by assistance from this project	The aforementioned impact study found that the training contents reflected ASEI-PDSI in all four countries studied (reference information). Alternative indicator: Achieved. In a questionnaire survey of former attendees conducted by the terminal evaluation team, 96 percent of 47 respondents from 15 countries reported that their capacities were strengthened by assistance from this project. Also, seven out of eight Japanese experts in member countries reported that the capacities of their counterparts were enhanced by the training in Kenya. At the same time, terminal evaluation analysis indicated that these results also reflected contribution of JICA's technical cooperation projects in math and science teacher training in individual member countries.

Source: Terminal evaluation report.

In sum, this component mostly achieved its purpose. The project would be judged "achieved" if only the performance of one of the indicators and the alternative indicator were used; however, the project purpose is judged "mostly achieved" considering that this evaluation could not consider the other indicator because its validity was low.

4.2.2 Impact[33]

The assessment of the impact of the WECSA component focused on the degree to which the following impacts materialized: (1) Prompted by the continuous implementation of intra-regional cooperation (i.e., whether the outputs have sustained), (2) former attendees of the training incorporated what they learned into math and science INSET in their home

[33] The time by which the overall goal is expected to be achieved (i.e., target year) is not clearly mentioned in existing documents. In this ex-post evaluation, therefore, the status of achievement was judged based on the status at the time of ex-post evaluation (i.e., three years after project completion).

countries (i.e., whether the outcome achieved for the project purpose has sustained), (3) contributing to the construction of a mechanism of math and science INSET in each member country (i.e., whether the overall goal has been achieved).

4.2.2.1 Achievement of Overall Goal

(1) Continuation of intra-regional cooperation (Whether the outputs have sustained)

As Table 10 shows, CEMASTEA has continuously implemented the TCTP and other activities for participants from African countries in the period between before this project and ex-post evaluation, while the number of attendees fluctuated from year to year. Although JICA has continued its assistance for the TCTP by funding part of the training expenses and dispatching a JICA individual expert ("Regional Advisor"), operation of the TCTP is undertaken by CEMASTEA on its own according to CEMASTEA and the JICA individual expert. Intra-regional conferences and technical meetings were suspended after the completion of this project, but CEMASTEA resumed them in 2016 as an intra-regional conference of SMASE Africa by managing all aspects of it including funding.

Table 10: The number of training courses and meetings held at CEMASTEA for African countries

		2009	2010	2011	2012	2013	2014	2015	2016
TCTP	Number of participating countries	18	24	11	27	23	10	8	14
	Number of training courses	6	4	1	5	3	1	2	2
	Number of attendees (person)	208	213	62	236	130	57	177	120
Number of other meetings		2	1	1	2	2	0	0	1

Source: Documentation provided by JICA; documentation provided by the implementing agency.
Note: The number of TCTP courses is the sum of the number of regular and special courses. The number of other meetings is the sum of the number of intra-regional conferences and technical meetings.

(2) Incorporation of what member countries learned from CEMASTEA into their INSET in mathematics and science (Whether the outcome achieved for the project purpose has sustained)

As mentioned in the next section, the results of the surveys of JICA offices and former TCTP attendees both showed that many former attendees incorporated what they learned in math and science INSET in their respective countries.

(3) Improvement of mathematics and science education in member countries (Whether the overall goal has been achieved)

The overall goal of the WECSA Component is described in vague terms (improvement of

math and science education in member countries), but it was determined during the project implementation that the overall goal would be measured by verifying the existence of a mechanism of mathematics and science INSET in member countries through four indicators. As summarized in Table 11, the results of the JICA office survey[34] indicate that a certain amount of progress has been made toward the institutionalization of INSET. However, targets for achievement, such as the minimum number of countries that should have such a mechanism, had not been set. If we apply a commonly used threshold of 80 percent—presuming that the target is met with 80 percent or more respondents reporting "the INSET mechanism exists"—the survey results fell slightly below the threshold to judge that the overall goal has been achieved.

Regarding the contribution of this project (the WECSA component) to such achievement, the aforementioned survey of JICA offices revealed that the offices in 16 out of the 20 countries agreed that the TCTP at CEMASTEA contributed to the establishment and implementation of a math and science INSET system in each member country. The details and mechanisms of contribution included: "after returning to their countries, attendees nurtured core personnel who would lead the promotion of math and science INSET domestically;" "incorporated what was learned when they practiced developing INSET modules and teaching/learning materials in mathematics and science;" "how to adapt what was learned to the domestic circumstances is being considered;"[35] "former attendees shared what they learned with people and organization that were involved in math and science education such as other teachers, teacher trainers, and the education ministry at home;" and "the TCTP became instrumental in promoting domestic implementation of JICA's math and science education projects."

Responses from former TCTP attendees were similar. 17 out of 19 respondents who attended TCTP courses after project completion reported, "I apply what I learned at CEMASTEA (extensively or to some extent)." The methods and instruments that they reported they use frequently included ASEI-PDSI, the revised Bloom's Taxonomy of Educational Objectives, class evaluation methods, among others.

JICA offices in five out of 20 countries that responded to the survey reported that math and science INSET is not implemented (or interrupted) in the country at the time of ex-post evaluation, due mainly to implementation budget and institutional limitations in the education ministry in respective countries, which implements INSET. Agreeing to JICA offices, the respondents in the TCTP attendee survey also mentioned lack of budget and an

[34] The terminal evaluation team collected the same information in a questionnaire survey with former attendees of the TCTP. However, the reliability of the collected information was poor, i.e., contradicting answers of respondents from the same country to items such as the presence or absence of a policy. Therefore, this ex-post evaluation took a strategy to ask JICA offices about the overview of the countries.

[35] On the other hand, some JICA offices found it problematic that former attendees only followed the form without making such adjustments.

institutional system to implement INSET as the reasons behind the difficulty in practicing what they learned from the training. Further, respondents on both sides pointed out that majority of attendees of the TCTP are INSET trainers, and not many administrators attended it. While aiming at "strengthening of capability of INSET providers" as the project purpose is consistent with the training the TCTP provided for INSET trainers, it is doubtful whether the project purpose serves as a direct means to achieve the overall goal, which was defined as "establishing INSET system."[36]

Table 11: Achievement of the overall goal (WECSA Component)

Overall Goal	Indicator	Actual
INSET systems in member countries are established/strengthened (Note by the evaluator: a literal translation of the Japanese text in project-related documents is "Mathematics and science education in the member countries of SMASE-WECSA is improved.")	(1) Existence of Policy on INSET	Partially achieved. Ten out of 20 countries (50 percent) reported that it "exists" or "is either being developed or planned to be developed" in response to the questionnaire of JICA offices conducted at the time of ex-post evaluation.
	(2) Existence of Administrative structure for INSET system	Partially achieved. Thirteen out of 20 countries (65%) reported that it "exists" in the same questionnaire.
	(3) Existence of a funding mechanism for INSET	Partially achieved. Ten out of 20 countries (50%) reported that it "exists" in the same questionnaire.
	(4) Existence of monitoring and evaluation (M&E) systems of INSET	Unknown (Not asked in the questionnaire)
	(Supplementary Information) Implementation of INSET in mathematics and science	Partially achieved. Fifteen out of 20 countries (75%) answered it is "implemented" at the time of ex-post evaluation in the same questionnaire.

Source: Beneficiary survey.
Note: Since none of the existing indicators would check whether math and science INSET is actually being implemented, the evaluator added a question asking about it as supplementary information to the survey questionnaire for JICA offices Instead, the evaluator did not include a question asking about Indicator 4 in the questionnaire in order to keep the questionnaire simple.

In this way, the beneficiary survey confirmed that the institutionalization of math and science INSET is in progress in member countries, and it is considered in majority of these countries that this project (the WECSA component) has contributed to such progress. However, claims cannot be made that the level of the progress is sufficient in 80 percent of the countries, and the relationship between the project purpose and the overall goal is indirect and partial. Therefore, it is concluded that this component has achieved its overall

[36] The original overall goal indicator that was set at the time of planning was "practice of lessons based on ASEI-PDSI," which appears logically more consistent with the project purpose in terms of means-ends relationship, although it would have been difficult to measure the level of practice. Another point to note is that cooperation efforts in other member countries such as "The Project on Strengthening of Mathematics and Science in Secondary Education in Niger" (JICA technical cooperation project, 2006-2009), which was the first SMASE INSET project in Francophone Africa, are not counted as impacts of this project even though many of these projects were implemented to meet the needs that increased through participation in SMASE-WECSA; these efforts are impacts of the preceding two phases, not of this phase.

goal at a limited level.

4.2.2.2 Other Positive and Negative Impacts

Although it is not only an impact of this project alone but also of the two preceding phases of technical cooperation projects and the grant aid project, the role of CEMASTEA as the center of SMASE INSET in Africa has been established and expanded as it continuously serves as the secretariat of ICQN-MSE and SMASE Africa (See "4.1.2 Consistency with the Development Needs of the Region").

In addition, there have been cases where CEMASTEA provided training in other African countries in cooperation with international organizations, etc., indicating a further development of CEMASTEA activities. (Note that the latter information is described here in this sub-section but not in "4.2.2.1 Achievement of Overall Goal," because Table 10 does not include this information and it is difficult to identify its relation to the overall goal.) For example, CEMASTEA developed a module and provided training at an international workshop and training for enhancing teachers' capacity held in Ethiopia in September 2016 in partnership with the United Nations Educational, Scientific and Cultural Organization (UNESCO), UNESCO International Institute for Capacity Building in Africa (UNESCO-IICBA), and International Institute for Education (IIE). CEMASTEA also provided training sessions at a training event on mathematics and science education for girls organized by Institute for Capacity Development (ICD; a Namibia-based independent international organization) in Ethiopia in December 2016.

Since this component has achieved the project purpose and overall goal to some extent, the effectiveness and impact of the project are fair. The project purpose (strengthening of capability of INSET providers) was mostly achieved by the time of project completion. After project completion, activities such as the TCTP have continued, and attendees have been utilizing what they learned from the training in activities such as math and science INSET in their home countries. The overall goal (improvement of mathematics and science education in member countries) is judged to be partially achieved because, although institutionalization of INSET is in progress in many member countries, there were limitations in the judging criteria for the achievement level and in the estimation of the degree of contribution of this component.

4.3 Efficiency (Common for Kenya Component and WECSA Component) (Rating:③)

See "3.3 Efficiency (Common for Kenya Component and WECSA Component)." Both the project cost and project period were within the plan. Therefore, efficiency of both components is high.

4.4 Sustainability (WECSA Component) (Rating: ③

The evaluator defined the WECSA component's effects that are expected to sustain after project completion as (1) the continuation of intra-regional cooperation by SMASE-WECSA and CEMASTEA for improving mathematics and science education even after the termination of JICA's assistance (continuation of the output-level effects), and (2) the existence of an environment in member countries that enables educators to practice what was learned in TCTP courses at CEMASTEA (continuation of effects at the project purpose and the overall goal levels). Then, sustainability was judged by examining whether the policy/institutional, organizational, technical, and financial conditions necessary for the continuation of these effects are secured or can be expected to be secured in Kenya and member countries. The judgment gave greater weight to the first dimension, as the second dimension was not included in the perspectives of sustainability in the terminal evaluation and there were limitations in evaluation resources.

4.4.1 Related Policy and Institutional Aspects for the Sustainability of Project Effects

(1) Policy and institutional aspects in Kenya related to intra-regional cooperation after termination of the TCTP

The TCTP is scheduled to continue being implemented through the Japanese fiscal year (JFY) 2017. No official documents from the Kenyan government mention whether or not it would continue intra-regional cooperation related to SMASE INSET after the termination of the TCTP. However, MOEST supports the ideas of Kenya becoming the host country of ICQN-MST and CEMASTEA assuming the role of its secretariat. In addition, the vision of CEMASTEA is to be a center of excellence in teacher capacity development in Africa, and it clearly sees intra-regional cooperation as one of its missions. CEMASTEA also states that serving as the secretariat of SMASE Africa secretariat is one of its core functions.[37]

(2) Policy and institutional aspects in member countries to support the practice of what was learned from the TCTP

While the study could not fully examine policies in individual member countries, in the questionnaire survey with JICA offices conducted at the time of ex-post evaluation, the respondents in a total of ten countries out of 20 countries confirmed the existence of an INSET policy, and the respondents from five countries reported that such a policy is either being developed or planned to be developed (Table 11). With respect to multilateral policies, revitalization of teaching profession and improvement of educational infrastructure are listed as the first and second strategic goals in the Continent Strategy for Education in Africa (2016-2025), a related policy of AU. Therefore, the policy and institutional arrangements are

[37] Documentation provided by the implementing agency and JICA; CEMASTEA website.

mostly secured.

Therefore, the policy and institutional aspects of sustainability are mostly secured in terms of both (1) and (2).

4.4.2 Organizational Aspects for the Sustainability of Project Effects

(1) Institutional arrangements for implementing intra-regional cooperation in Kenya

As mentioned in "3.4.2 Organizational Aspects for the Sustainability of Project Effects" (for the Kenya component), CEMASTEA's overall organizational structure has been adequately established. The TCTP is implemented by a TCTP Team consisting of academic staff and non-academic staff under the direction of an academic staff member who acts as Training Coordinator. The TCTP Team also has been researching training needs in Africa as recommended in the terminal evaluation. Although the organization chart does not clearly show the implementation structure related to SMASE Africa and ICQN-MSE, personnel are assigned on CEMASTEA's activity plan chart in the past and for JFY2017.

(2) Institutional arrangements for practicing SMASE INSET/ASEI-PDSI in member countries

Former TCTP attendees are likely be practicing what they learned to the extent possible as stated in "4.2.2.1 Achievement of Overall Goal." At the same time, limitations on the implementation mechanism of SMASE INSET have been pointed out. As for the intra-regional structure to sustain the project effects, CEMASTEA, serving as the secretariat of ICQN-MSE and SMASE Africa, would continue to be the center of cooperation in mathematics and science education in Africa.

The first dimension is adequately established while available information indicates some issues regarding the second dimension. Assessing these two aspects together, the organizational aspects of sustainability are considered to be mostly secured.

4.4.3 Technical Aspects for the Sustainability of Project Effects

(1) Technical level of intra-regional cooperation in Kenya (CEMASTEA)

The technical level of CEMASTEA's academic staff is high as mentioned in "3.4.3 Technical Aspects for the Sustainability of Project Effects" (for the Kenya component). Since project completion, CEMASTEA has continued activities such as the TCTP and intra-regional conferences and continuously uploaded teaching materials and reports they created to the CEMASTEA website. According to the JICA individual experts who are still dispatched to CEMASTEA, the training contents have reached a certain level of quality, and CEMASTEA's capability in operating training is high. At a SMASE Africa intra-regional conference, which

was being held when the evaluator visited CEMASTEA in November 2016, the evaluator observed that CEMASTEA was properly undertaking, without assistance, such tasks as receiving participants from eight countries, handling the plenary meeting and related programs (including technical contents such as seminars), and providing hospitality.


SMASE Africa intra-regional conference

Further, as described in "4.2.2.2 Other Positive and Negative Impacts," CEMASTEA provides technical assistance in the projects of several international organizations.

(2) Opportunity to refresh what was learned in member countries

Although adequate information was not available, multiple respondents in the TCTP attendee survey reported, "follow-up is necessary after the TCTP."

In sum, while available information on the second dimension is limited, the first dimension is adequately secured. When these two dimensions are assessed together, the technical aspect of sustainability is considered to be mostly secured.

4.4.4 Financial Aspects for the Sustainability of Project Effects[38]

(1) Financial aspects of the TCTP/intra-regional cooperation in Kenya

JICA is responsible for a portion of the training expenses for the TCTP until JFY2017. Although there has not been any indication so far to suggest that the Kenyan government will foot the cost to continue the operation, this is not an issue because it has never been planned for the national government to independently continue the training for other African countries after the termination of JICA's TCTP. Other notable expenses for intra-regional cooperation would include the expenses for having meetings, but these expenses are covered through JICA's non-TCTP financial assistance and member countries' own effort. For example, expenses for an ICQN-MSE meeting in March 2016 were partially funded by JICA. On the other hand, the SMASE Africa meeting in November 2016 collected fees from attendees, becoming the first intra-regional meeting held without financial assistance from donors.

While the results of interviews with attendees of this intra-regional conference and CEMASTEA indicate high willingness to participate among these attendees at the time of

[38] The terminal evaluation excluded the financial aspect from its judgment on the sustainability of the WECSA component based on the premise that the TCTP would be funded by JICA. This ex-post evaluation included the financial aspect while limiting it to the funding condition for intra-regional conferences and the like after the TCTP was terminated.

ex-post evaluation, whether such self-help efforts by participants will sustain in the future may depend on the utility of the output of cooperation in member countries (at the time of ex-post evaluation, output such as sharing of good practices related to student-centered teaching methods in multiple countries seems to be useful).

In addition, as presented in "4.2.2.2 Other Positive and Negative Impacts," CEMASTEA engages in training in other African countries supported by UNESCO-IICBA, IIE, and ICD, suggesting that CEMASTEA has access to sources of funding other than the financial resources of JICA, CEMASTEA itself, and member countries to continue intra-regional cooperation. According to CEMASTEA, it is planning another training course in the ICD in 2017, and a new cooperation effort with UNESCO is under consideration.

(2) Financial aspect of utilization of outputs of intra-regional cooperation in member countries

This evaluation was unable to investigate the financial conditions of individual member countries. However, according to the JICA office survey conducted at the time of ex-post evaluation, respondents representing 10 countries out of 20 countries confirmed that an INSET funding mechanism did exist (Table 11). Although the situations are likely to differ among countries, it is also inferred that countries allocate a certain amount of funds to intra-regional cooperation, as some of the participants in the aforementioned SMASE Africa intra-regional conference were sent by their education ministry using the ministry budget. At the same time, lack of funds is recognized as an issue in many countries as observed in the said JICA office survey (offices in seven countries raised this issue) and the TCTP attendee survey (ten out of 21 respondents [five out of eleven countries] raised this issue as a constraining factor for practicing INSET).

From the above, the first dimension is secured in Kenya, and the second dimension, based on limited information, is secured in certain countries while uncertain in other countries. Assessing these two dimensions together, the financial aspects of sustainability are considered to be mostly secured.

Overall, no major problems have been observed in the policy background and the policy/institutional, organizational, technical, financial aspects for the continuation of intra-regional cooperation by CEMASTEA. Therefore, sustainability of the effects of the WECSA component is high.

5. Results of the Overall Evaluation of the Project as a Whole (Overall Rating: A[39])

Taking the Kenya component and the WECSA component together, the overall evaluation of

[39] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

the entire project is as follows.

The overall relevance of the entire project is evaluated to be high as it is rated as high for both components. The effectiveness/impact is rated as high for the Kenya component and fair for the WECSA component. After adding greater weight to the Kenya component, the overall effectiveness/impact of the entire project is evaluated to be high. The efficiency is common to both components and evaluated to be high. The sustainability is rated as fair for the Kenya component and high for the WECSA component, and overall fair for the entire project by placing weight on the Kenya component.

In light of the above, the project as a whole is evaluated to be highly satisfactory.

6. Conclusion, Lessons Learned and Recommendations

6.1 Conclusion

This project was implemented to establish or strengthen (i) INSET for mathematics and science teachers in primary and secondary education in Kenya and (ii) training for the member countries of SMASE-WECSA, an intra-regional cooperation network in Africa, which were both implemented by CEMASTEA. The project was planned and implemented in two components, one for Kenya (the Kenya component) and the other for African countries (the WECSA component). The evaluation of each component is as follows.

(1) The Kenya component: The relevance of the component is high, as its objectives were consistent with Kenya's development policies and development needs as well as with Japanese aid policies with respect to strengthening teachers' capacity. Although the project's purpose of strengthening mathematics and science education in Kenya was mostly achieved, students' interests, an alternative indicator to measure the overall goal of upgrading students' capabilities in mathematics and science, missed the target slightly. The effectiveness and impact are evaluated to be high by taking into account other observed positive impacts, such as the diffusion of the project's effects to other subjects than math and science and pre-service training in the primary education level, which was the central sub-component in the Kenya component. The project's efficiency is evaluated to be high, as the project cost and the project period were both within the plan. The sustainability of the component's effects is evaluated to be fair, as there is a concern about the financial aspects of INSET in primary education in the future.

(2) The WECSA component: The relevance of the component is high, as it was consistent with Africa's intra-regional development policies and development needs as well as with Japanese aid policies with respect to strengthening teachers' capacity in member countries. The effectiveness and impact are evaluated to be fair. Although the project purpose of strengthening capacity of INSET providers to provide training in member countries was mostly achieved, the overall goal of improving the quality of teaching and learning of math and science in each country is judged to be partially achieved. Despite the presumption that the quality of teaching

and learning is improving, it was difficult to set judgment criteria to determine the level of achievement and to estimate the level of contribution of this component to the improvement. The project cost and the project period were common between this component and the Kenya component; therefore, as mentioned above, the efficiency of the project is high. The sustainability of the component's effects is evaluated to be high, for the policy background and the organizational, technical, and financial arrangements necessary for intra-regional cooperation by CEMASTEA are ensured.

The overall evaluation of the entire project was conducted with greater emphasis on the Kenya component, to which larger inputs and activities were allocated than the WECSA component. As a result, the relevance, effectiveness/impact, and efficiency are rated as high, and the sustainability is rated as fair.

In light of the above, this project is evaluated to be highly satisfactory.

6.2 Recommendations

6.2.1 Recommendations to the Implementing Agency

<Recommendations related to the Kenya component>

(1) In order to maximize the impacts of the project, it is vital for CEMASTEA to continue requesting the SMASE Fund in primary education to MOEST. MOEST, by working with the TSC and CEMASTEA, is recommended to examine at the earliest possible time the sustainability of INSET in primary education including related programs for early primary graders (EGMA and TUSOME), which are carried out with assistance from other donor agencies such as USAID at the time of ex-post evaluation. By positioning SMASE INSET in primary education in such a mix, it is recommended that MOEST seek the implementation of SMASE INSET in primary education across the country like SMASE INSET in secondary education and the continuation of the project effects. There is a mutually reinforcing relationship between EGMA/TUSOME, which aims to develop foundational skills in reading and writing in early primary grades, and SMASE INSET, which uses those skills to introduce student-centered and inquiry-based learning in advanced primary grades; it is desirable to secure funding sources for INSET in primary education that would combine these two programs as the Primary SMASE Fund.

(2) The school-based surveys for this ex-post evaluation confirmed that ASEI-PDSI is practiced in the classroom at both primary and secondary schools. However, the detailed classroom analysis by an expert, though based on a small sample size, pointed out that some problems were found in the content of the class, in which the project's intervention was smaller compared to the technical transfer in pedagogy. In both primary and secondary education, CEMASTEA is recommended to re-evaluate SMASE INSET by attaching greater

importance to the content of the class (lesson) in addition to the pedagogy when monitoring SMASE INSET and revising the modules based on monitoring results.

<Recommendations related to the WECSA component>

MOEST is recommended to clearly express in policy documents that Kenya will take the leadership in capacity development of mathematics and science teachers in Africa and provide policy support to CEMASTEA's intra-regional cooperation efforts, in which CEMASTEA assumes a central role, even after the termination of the JICA-assisted TCTP after JFY2017. MOEST is further recommended to ensure the sustainability of technical assistance from CEMASTEA to member countries by continuously allocating budget to CEMASTEA so that CEMASTEA can use it, along with the membership fees and conference registration fees it receives from member countries and meeting participants, to fund its activities such as organizing intra-regional conferences. Also considered important is that CEMASTEA continuously plan and expand useful contents for member countries such as the sharing of good practices as was done at the time of ex-post evaluation.

6.2.1 Recommendations to JICA

<Recommendations related to the Kenya component>

In order to institutionalize SMASE INSET for primary education across the country (maximization and sustaining of the impacts), it is recommended that JICA advocate to MOEST and donor agencies at such venues as education donor meetings for the expansion of SMASE INSET for primary education, which is mutually complementary to EGMA/TUSOME. In addition, CEMASTEA considers it important, given the budget constraint, to enhance school-based INSET in order to implement SMASE INSET nationally. As for JICA, it would be worth considering working with CEMASTEA to utilize its in-country training scheme to provide follow-up training for mathematics and science teachers. While doing so, JICA is recommended to examine the prospect of additionally providing technical assistance to improve the content of classes, as recommended to CEMASTEA above.

<Recommendations related to the WECSA component>

Since CEMASTEA is expected to remain as the center of intra-regional cooperation in Africa by serving as the secretariat of ICQN-MSE and SMASE Africa after the completion of JICA's TCTP in JFY2017, JICA should maintain close contact with CEMASTEA. JICA should also continue dispatching a JICA senior volunteer to CEMASTEA, and maintain cooperative relations by co-hosting conferences to exchange information and opinions on teachers' capacity development such as SMASE INSET and ASEI-PDSI.

6.3 Lessons Learned

Establishing an INSET system that can be implemented without external support

Regarding the primary education level, given the budgetary constraints that have made it impossible to implement cascade training in the entire country every year, CEMASTEA has been attempting to sustain SMASE INSET by limiting training to specific regions and introducing lesson study. As for the secondary education level, SMASE INSET's shift toward experience-specific training (i.e., each year, training is provided to teachers with certain years of teaching experience such as 0-5 years, 6-11 years, or 12 years or longer) enabled CEMASTEA to conduct training more efficiently and be more responsive to needs, contributing to high sustainability. Targeting specific training groups could also contribute to reducing the number of cascades.

These undertakings, all devised and introduced by CEMASTEA after the completion of this project in order to continue the system after the withdrawal of JICA's assistance, can become reference cases for project evolution that may be informative when considering an exit strategy of assistance projects for INSET in other countries. However, it is important that INSET rotate the target regions or target years of teaching experience so that all regions and teachers would be covered within several years, and continuously engage in teachers' capacity development by helping transferred techniques to take root and introducing new techniques, among other efforts.

Appendix: Status of production of the outputs at the time of project completion

Output (achievement)	Indicator	Achievement of Indicator
Kenya Component		
1. A system of National INSET for Regional Trainers is established at CEMASTEA. (Mostly achieved)	4 cycles of training materials and programs for the National INSET for the primary education are developed.	Achieved
	Over 250 Regional Trainers are trained at CEMASTEA every year.	Achieved
	National INSET for the primary education at CEMASTEA obtains a mean of over 3 on the scale of 0 to 4 in the Quality of INSET Assessment Index.	Achieved
	100% of implementation Reports on National INSET and Workshops are submitted by CEMASTEA staff by the agreed deadlines (in one month).	Not achieved
2. A system of Regional INSET and Regional workshop is established at Primary Teachers' Training Colleges (PTTCs). (Partly achieved)	Regional INSET for Cluster Trainers at PTTCs is carried out four times.	Achieved
	4,500 (at least 4,400) Cluster Trainers are trained every year.	Mostly achieved
	Over 1,200 TAC Tutors/Zonal QASOs, 47 County QASOs and 287 Sub-county QASOs are trained.	Partly achieved
	Regional Trainers obtain a mean of over 2.5 on the scale of 0 to 4 in the overall assessment of capacity Building Index at the Regional INSET at PTTCs.	Partly achieved
	Regional INSET at PTTCs attains to a mean of over 2.5 on the scale of 0 to 4 in the Quality of INSET Assessment Index.	Partly achieved
	100% of M&E Reports on Regional INSET and Workshops are submitted by CEMASTEA staff by the agreed deadlines (in one month).	Not achieved
	100% of Implementation Reports are submitted by PTTCs by agreed deadlines (in one month).	Not achieved
3. Existing system of Cluster INSET is strengthened. (Partly achieved)	A guideline/manual on management of M/S INSET for primary school teacher is developed.	Mostly achieved
	At least 60,000 primary school teachers who teach mathematics and/or science in grades 6, 7, and/or 8 drawn from every cluster in the country participate in Cluster INSET every year.	Mostly achieved
	100% of M&E reports on Cluster INSET are submitted by CEMASTEA staff by the agreed deadlines (in one month).	Not achieved
	100% of Implementation Reports are submitted by DEOs in three months.	Not achieved
4. Secondary Mathematics and Science teachers' "Activity, Student Centred, Experiment, and Improvisation/ Plan, Do, See, and Improve (ASEI/PDSI)" practices in classroom are enhanced. (Partly achieved)	INSET and workshop contents for introducing lesson study are developed.	Achieved
	A guidebook on Lesson Study is developed.	Achieved
	At least 90% of Secondary School Principals are trained on pedagogical leadership including Lesson Study.	Partly achieved
	47 County Directors of Education, 47 County QASOs, 287 DEOs and 287 District QASOs are trained for District Workshops for Principals.	Partly achieved
	More than 80% of the Counties (clustered Districts) conduct workshops for Secondary School Principals to share and discuss experience in Lesson Study.	Achieved
	Principal's supervision on ASEI-PDSI practice is enhanced/improved by 10% compared with the results in the Situational Analysis.	Partly achieved
	100% of M&E Reports on Principals' Workshops are submitted by CEMASTEA staff by the agreed deadlines (in one month).	Not achieved
	At least 50% of Implementation Reports are submitted by the agreed deadlines (in three months) by DPCs.	Not achieved
5. Role of CEMASTEA as resource centre for mathematics and science education is strengthened. (Partly achieved)	Primary INSET materials (write-ups) for Cycle 1&2 are revised/refined as self-explanatory materials and published for teachers.	Partly achieved
	The revised Primary INSET materials for Cycle 1&2 are digitized and made available through the CEMASTEA website.	Mostly archived
	At least one booklet on ASEI/PDSI practices is published and distributed.	Mostly achieved
	At least one exemplary lesson video is produced and distributed.	Mostly achieved
WECSA Component		
1. ASEI/PDSI based INSET providers from member countries are trained. (Achieved)	TCTP at CEMASTEA is carried out five times.	Achieved
	At least 500 participants attend the TCTP at CEMASTEA.	Achieved
	At least 15 sets of training materials are produced.	Achieved
	Lesson Innovation Index attains a mean of 2.5.	Achieved
2. SMASE-WECSA network is strengthened. (Achieved)	Regional conferences and SMASE-WECSA delegates meetings are held at least four times.	Achieved
	Increased member countries participating in SMASE-WECSA activities and implementing INSET.	Achieved
	Technical workshops organized by Kenya or in collaboration with member countries are held at least three times.	Achieved
3. Role of CEMASTEA is strengthened as resource centre for mathematics and science education in Africa. (Partly achieved)	ASEI-PDSI prototype lesson plans, developed by member countries, are compiled and disseminated.	Partly achieved
	One of the TCTP materials (write-ups) is revised/refined for publication.	Achieved
	The revised material is digitized and made available from the CEMASTEA website	Partly achieved

Source: Terminal evaluation report, JICA documents, documents provided by the implementing agency.

Appendix

Detailed analysis by an expert: "Classroom analysis through video recordings"

(Excerpts of portions related to Kenya)

Expert: Hideo Ikeda (Professor emeritus, Hiroshima University)

This detailed analysis was conducted to supplement the ex-post evaluations of this project, namely, the "Strengthening of Mathematics and Science Education (SMASE)" (technical cooperation project for Kenya, 2009-2013), as well as the Niger "The Project on Strengthening of Mathematics and Science in Secondary Education in Niger Phase 2" (technical cooperation project for Niger, 2006-2009). The following is a portion of the analysis related to the Kenyan project.

(1) Purpose of the analysis: To objectively and quantitatively evaluate the extent of improvement in science classes at the point of ex-post evaluation.

(2) Summary of the analysis:

Materials and method: Classroom video analyses were conducted. The questions posed by the teacher and the questions asked by the students during the class have been classified and analyzed, and scored according to the revised Bloom's Taxonomy of Educational Objectives[40] (based on an assumption that questions posed by teachers and asked by students can be classified into a gradient ranging from those cognitively most basic questions based on "recollection" to those most cognitively advanced questions based on "creation," higher points were assigned as the question approaches the "creation" category): 1 point for *Remember*; 2 points for *Understand*; 3 points for *Apply*; 4 points for *Analyze*; 5 points for *Evaluate*; and 6 points for *Create*. When used in such a manner, the revised Bloom's Taxonomy, which has successfully been used in prior projects in Zambia, Ghana, Bangladesh, and Japan (hereafter referred to as "international comparison data"),[41] is expected to ensure objective examinations

[40] Bloom's Taxonomy of Educational Objectives classifies target learning outcomes into six psychological and cognitive levels. The original taxonomy (Bloom, 1956) used six levels consisting of *knowledge, comprehension, application, analysis, synthesis, evaluation*, but the present analysis adopts Anderson and Krathwohl's (2001) six revised categories mentioned in the main text.

[41] Over the last 20 years, the Laboratory of Science Education, Graduate School for International Development and Cooperation, Hiroshima University, with which the author of this report had been affiliated, has directly and indirectly participated in the science education improvement projects implemented by JICA in Asia and African countries, and has conducted a series of analyses of science classes using the revised Bloom's Taxonomy in Ghana (Beccles, 2013, doctoral dissertation; Kato, doctoral dissertation data, the School of International Cooperation, Hiroshima University; Ikeda, unpublished data), Zambia (Matsubara, 2009, doctoral dissertation), and Japan (Kato, doctoral dissertation data; Ikeda, unpublished data). The author developed a rating system for the revised Bloom's Taxonomy for the present analysis to compute Bloom's Scores in order to quantitatively measure the improvement in individual classes, and applied it retrospectively to the aforementioned research. According to our results, the classes in Ghana and Zambia scored below 2.0 in Bloom's Scores, with their instructors posing questions mostly in the *Remember* and *Understand* categories, rarely in the *Evaluate* category, and none in the *Create* category. In Japan, questions in the most advanced category, *Create*, were infrequent, and were limited in situations where students

of the level of classroom instructions as the aforementioned scoring system for different cognitive activities is consistent with the idea of "making students think," which was emphasized in JICA's technical cooperation projects for basic education in African countries.[42] In the present analysis, the scores that concern us (referred to as "Blooms' Scores" in this report) are computed by multiplying the aforementioned score within each cognitive category by its frequency, then by dividing the sum of the multiplications by the total frequency. This method overcomes the challenge of analyzing classroom instructions quantitatively, and is, thus, expected to contribute to the improvement in the quality of teacher education. However, the Bloom's Score primarily measures the psychological and cognitive level of a pedagogical method, and is not concerned with the level of instructional content taught in the class. Since a quantitative classification of instructional content has not been developed, the content will be textually described in this report.

Observation target: In Kenya, observations were made on the classes instructed by a total of nine math and science teachers consisting of four in primary education (The sampled teachers were specifically in charge of 7th and 8th graders. ID: Pri1, Pri2, Pri4, and Pri5[43]) and five in secondary education (in charge of 1st to 4th graders. ID: Sec1 to Sec5). The classes were videotaped after they were chosen (purposive sampling) in the six counties visited by external evaluators during the beneficiary surveys in a manner to maintain the representativeness of different geographical (urban/rural/ASAL: Arid and semi-arid lands) and school types (boys/girls/co-ed schools and national/county/sub-county schools) in the sample. Due to the limitations in field research, only one instructor (ID: Pri4) had no prior in-service education and training (INSET) courses.[44]

Hypothesis: Those teachers who had attended INSET provide higher-quality instructions (higher Bloom's Scores) than those teachers who had not attended INSET.

(3) Results of classroom analysis in Kenya

The Bloom's Scores of the nine teachers varied widely, from the highest 2.65 to the lowest 1.29. Among these nine teachers, eight had attended INSET (regional training or school-based

considered experiment methods in those classes that focused on experiments, or when the classes were instructed by expert teachers.

[42] SMASE INSET, which was implemented in this project as well as the Third Country Training Program (TCTP) for SMASE-WECSA member countries, set the revised Bloom's Taxonomy of Educational Objectives as the target for improvement in classes that adopted the ASEI-Plan, Do, See, Action (PDSI) approach.

[43] In addition to the classes listed in the table, a primary-level math class (Pri3) was videotaped but was eliminated from the sample due to poor video and audio quality.

[44] Although only one or two primary school teachers had completed the regional training for INSET (provided by trained regional INSET instructors), most primary school science teachers had attended school-based training (transferring of knowledge and techniques from the teachers who had received regional training to their peers). Due in part to the longer history of implementing INSET in secondary education, most secondary school teachers in science had attended regional training. Non-INSET trained teachers were instructing a few classes during our school visit, but we could not obtain their consent for videotaping.

training), and only one had not attended training. When the scores for these instructors are rank-ordered from the highest to the lowest, the top four instructors had attended regional training, the fifth highest (the median score) had not attended INSET, and the remaining four had attended regional or school-based training (the 7th and 8th scores belonged to those who had attended school-based training). Based on these results, the hypothesis (higher scores for teachers with training) was not supported in Kenya. However, in a qualitative analysis, the only instructor among the subject pool who had not attended training was found to possess solid foundations on pedagogy and subject knowledge, demonstrated by such things as showing in the math class several different ways to calculate multi-digit multiplications on paper, which exceeded Kenyan math standards that required only a single method, and frequent posing of advanced questions; therefore, it would be misleading to treat this teacher as "control," i.e., without INSET.

Next, the following are the comparisons between the results from Kenya and the international comparison data.

- Compared to the teachers in other developing countries (Ghana and Zambia), the Kenyan teachers who were analyzed in the present evaluation generally posed more questions that encouraged students to think (the average Bloom's Score in Kenya was higher than those of Ghana and Zambia by 0.14 points and 0.46 points, respectively).
- The three best teachers scored 2.65, 2.22, and 2.14 respectively, scoring much higher than in Ghana or Zambia, comparing even positively to the scores of Japanese teachers. These results are considered to be reflective of the effects of the training.
- Teachers did not pose questions in the *Apply* category. Previous studies have found the same pattern in developing countries such as African countries.
- There was one case of the *Create* category in Kenya (Sec2). This was the first documented case of this type of question in the research in Africa. This type of question is not frequent in Japan, either; this result is also notable because the Kenyan teacher encouraged student to ask this type of question.
- Some teachers' scores (1.29, 1.43, 1.56, and 1.72) showed large deviations from the best scores even though they had attended training.

Further, the scores have been compared between primary and secondary schools. The teachers from these two types of schools scored similarly, with the primary school teachers averaging 1.86 and the secondary school teachers 1.84. However, the teacher of the primary school Pri5 scored extremely high, and the teacher of the secondary school Sec5 scored the lowest. The results, therefore, should not be evaluated from the scores alone. Now, the following ranking of the nine teachers, ordered from the highest score to the lowest score (the number in a circle), indicates that primary school teachers except for the top scorer did not score

very high. On the other hand, secondary school teachers except for the lowest scorer scored somewhat higher than the primary school teachers.

Primary school teachers: ① ⑤ ⑦ ⑧

Secondary school teachers: ② ③ ④ ⑥ ⑨

These results may reflect several factors. First, Kenya, JICA's assistance was initially provided for secondary education (1998), preceding the assistance for primary education (2009). Second, the two of the INSET-trained primary school teachers except for the top scorer had received school-based INSET training from their colleagues who shared knowledge and techniques, instead of receiving the training directly from INSET trainers.

Below is a list of qualitative observations, obtained from the present analysis, on the effects of SMASE INSET on teachers.

- The dimension of *Activity* in ASEI (*Activity, Student-centered, Experiment, Improvisation*) appears to have taken root solidly given that all nine classes incorporated group activities or actual measurement of specimens.
- ASEI's *Student-centered* is most strongly tied to the Bloom's Scores analyzed in the present study. Therefore, with respect to the goal of the project—stimulating students by posing questions that make them think—the three teachers who scored high as mentioned above (Pri5, Sec3, Sec2) can be considered to be stimulating students as much as, or to a greater extent than, are their Japanese counterparts.
- *Experiment and Observation* in ASEI is greatly influenced by the subject area and topic of each class. For example, it is very difficult to incorporate experiments and observations into such classes as mathematics (Pri1 and Pri4), biology (sexually transmitted diseases), and chemistry (diffusion [theory])(Sec3) due to the nature of topics handled in these classes. The analysis of five other classes (Pri5, Sec1, Sec2, Sec4, and Sec5), which showed that they adopted experiments and observations that had rarely been used prior to JICA's assistance, therefore demonstrates the effects of the project.
- *Improvisation* (simplified experiments using available materials) in ASEI is aimed at improving class instructions by encouraging teachers to innovatively use course materials, teaching aids, and experiment methods available in the textbook by adapting to diverse local and school conditions. Measurement of this dimension was impractical in the present analysis as it would require a comparison of the materials introduced in the textbook and training to those used in the class. However, we observed a few concrete examples of improvisation, such as the teacher in Sec2, who explained an improvisation on preservation by studying specimen bottles, and the teacher in Sec5 (scoring 1.29, the lowest in Kenya), who displayed available materials such as cockroaches and two plant materials.

The following are the characteristics of three classes, Sec5 that scored the lowest and Pri5 and Sec2 that scored the highest, from which may emerge concrete indications in Kenya.

- As noted in the last section, Sec5 "Taxonomy of living organisms" (scoring 1.29) can be rated positively in terms of the instructor's effort in improvisation as shown in the example of displaying actual materials as noted in the last section. In addition, questions posed by the teacher included more advanced *Analyze* and *Evaluate* questions. However, its low score is likely the result of the fact that of 102 questions posed by the teacher, 87 (85.3 percent) fell in the *Remember* category, with many of them verifying students' existing knowledge by repeating the same questions or by posing questions in a way to induce students to utter terms. Similar tendencies were observed in Pri1 (1.43) and Pri4 (1.78). These results, thus, suggest that further improvement can be expected by being more selective with questions designed for memorization and by increasing higher-level questions that encourage students to think.
- Questions in the *Remember* category were used in Pri5 (2.65) "Emunctory" to review previously studied items, but these questions were transformed into higher-level, *Evaluate* questions by asking other students to verify the answers. The teacher attempted to pose many questions in the *Analyze* and *Evaluate* categories during the development part of the lesson. These factors contributed to the highest score for the level of questions posed by the teacher in this class. Also, even though hands-on activities related to human body are difficult to practice in the class, the teacher incorporated creative activities, such as asking students to put their hands on the chest so that they could conceive breathing as it relates to internal body structure and functions. In addition to being judged intuitively and qualitatively as the "most effective class" among all 13 classes in Kenya and Niger, the analysis revealed that this class also ranked the highest when evaluated quantitatively. However, the lungs should be discussed as a respiratory organ because another important function of the lungs, absorption of oxygen, would be underemphasized if they were treated as an emunctory organ for carbon dioxide; this problem should be attributed to the science curriculum in Kenya rather than to the teacher himself/herself.
- Sec2 (2.14) "Collection of living organisms (animals)" ranked the third highest in terms of the score. Its score was pushed down because a fair number of the questions posed by the teacher were in the *Remember* category. After guiding the lesson by asking students to consider collection tools and collection methods, the teacher prompted students to ask questions, and one of them asked, "how do we collect a snake?" (a question in the *Create* category). Prompted by this question, the teacher expanded the lesson by having students to consider actual methods for collecting a snake. Accordingly, this class is considered to be the class in which students were stimulated the most.

Results of the analysis of the questions posed by teachers and asked by students

The top row (shaded cells) shows frequency (number of times); the bottom row shows the score. The number in the parenthesis indicates the number of questions asked by students.

	Re-member	Under-stand	Apply	Analyze	Evaluate	Create	Total	Bloom's Score
Pri 1Primary Math Attended school-based training	42	7	0	4	1	0	54	1.43
	42	14	0	16	5	0	77	
Pri 2 Primary Science Attended school-based training	15	8	0	2	0	0	25	1.56
	15	16	0	8	0	0	39	
Pri 4 Primary Math Not attended training	157	53	0	3	32	0	245	1.78
	157	106	0	12	160	0	435	
Pri 5 Primary Science Attended regional training	19	1	0	8	9	0	37	2.65
	19	2	0	32	45	0	98	
Sec 1 Secondary Biology Attended regional training	87 (1)	115	0	5	6 (1)	0	213 (2)	1.72
	87	230	0	20	30	0	367	
Sec 2 Secondary Biology Attended regional training	29	12	0	9	5	1 (1)	56	2.14
	29	24	0	36	25	6	120	
Sec 3 Secondary Chemistry Attended regional training	16	2	0	5	4	0	27	2.22
	32	4	0	20	20	0	60	
Sec 4 Secondary Biology Attended regional training	16	16	0	5	0	0	37	1.84
	16	32	0	20	0	0	68	
Sec 5 Secondary Biology Attended regional training	87	8	0	6	1	0	102	1.29
	87	16	0	24	5	0	132	
Average individual score								1.85
Average of all scores (N=9)	468	222	0	47	58	1	796	1.75
	468	444	0	188	290	6	1,396	

Remaining issues in Kenya: The present analysis of questions posed by teachers primarily focused on the analysis of pedagogical methods. However, in order to enhance teaching, the content of the class is as important as the pedagogy. Even though every class requires contents, this project, by emphasizing pedagogical techniques, appeared to have made very little interventions regarding course contents. This project dispatched very few experts in course contents in science, and none in in the areas of human body, health, and hygiene in biology. It

should be pointed out that the organization of the lesson materials for “sexually transmitted diseases” was highly problematic. The class made students to memorize the names and preventive methods for each sexually transmitted disease, repeated essentially the same preventive methods for other infectious diseases, offered redundant information regarding preventive methods, and let students to engage in activities (discussion) that lacked scientific bases. It is necessary, therefore, to use a more structured approach in the lesson backed by scientific evidence. The level of the lesson reflects the expert knowledge of the teacher. In this regard, the inadequate level of teachers regarding course contents remains as a major issue to be resolved, as evidenced by the various professional deficiencies exhibited not only by the teacher for Pri5 but also by eight other teachers.

JICA Evaluation Department

On Views of Experts

In this ex-post evaluation, opinion of academia was invited to capture more specialized and diverse views for the projects, in addition to the perspectives of the DAC five evaluation criteria to be conducted by the external evaluator. The external evaluator selected and enlisted the support of a leading figure in the field: Hideo Ikeda, Professor emeritus of Hiroshima University.

Prof. Ikeda, author of this report, specializes in the science and mathematics education, and lesson study. Over the last 20 years, the Laboratory of Science Education, Graduate School for International Development and Cooperation, Hiroshima University, with which the author had been affiliated, has directly and indirectly participated in the science education improvement projects implemented by JICA in Asia and African countries. For these reasons, the external evaluator asked him to conduct in depth analysis based on his expertise and experience.

Specifically, "Lesson analysis through video recordings" was conducted to supplement the ex-post evaluations of these project, namely, the "Strengthening of Mathematics and Science Education (SMASE)" (technical cooperation project for Kenya, 2009-2013), as well as the Niger "The Project on Strengthening of Mathematics and Science in Secondary Education in Niger Phase 2" (technical cooperation project for Niger, 2006-2009).

The purpose of the analysis is to objectively measure the extent of improvement in science and mathematics classes at the point of ex-post evaluation. Thereby the author tried gaining insights regarding the impact of in-service education and training (INSET) for primary and/or secondary education, which were implemented under the two projects mentioned above. Moreover, the expert shared his comments and suggestions for the further development and improvement of capacity of teachers, which are obtained through the analysis. The result of the analysis related to the Kenyan project was appended to the evaluation report as attachments.

Federal Republic of Nigeria

FY2016 Ex-Post Evaluation of Technical Cooperation Project

"Strengthening of Mathematics and Science Education in Nigeria Project Phase 2"

External Evaluator: Sawa Hasegawa, OPMAC Corporation

0. Summary

The objectives of this project were 1) to enhance the ability of primary school teachers of mathematics and science in the three pilot states by conducting In-Service Education and Training (INSET) on teaching methods for student centred lessons and 2) to enhance the ability of State Trainers as INSET providers in primary mathematics and science education while establishing a system to implement INSET in other states across the country. Through the achievement of the objectives, the project aimed to raise the general level of teaching skills of primary school teachers in mathematics and science education in the country and to improve the future capability of primary school pupils in mathematics and science education.

This project was consistent with the development plan and development needs of Nigeria, as well as with Japan's ODA policy in view of quality improvement of education. Therefore, the project relevance is high. The project contributed to largely enhancing both the abilities of primary school teachers of mathematics and science for student centred lessons in the three pilot states and State Trainers as INSET providers in primary mathematics and science education in other states. In addition, it is also confirmed that the general level of teaching skills of primary school teachers in mathematics and science education had been enhanced in the area where INSET was introduced as of the time of the ex-post evaluation. The project therefore has produced its desired effects including those effects which were expected as the future impacts, the result being that its effectiveness and impact are high. On the other hand, both the project cost and the project period exceeded the plan due to insufficient and delayed allocation of INSET funds which frustrated the planned implementation of INSET schedule. Thus the efficiency of the project is fair. The sustainability of project effects is also fair since the funds for INSET implementation and monitoring were still insufficient for its implementation nationwide. However, INSET has been continuously implemented by the Nigerian side, on their own, after project completion as well as no special problem has been identified in the institutional, organizational and technical aspects.

In light of the above, this project is evaluated to be satisfactory.

1. Project Description

Project Location

Science class at a primary school in Abuja

1.1 Background

The educational system in Nigeria is the 6-3-3-4 system and the nine-year of primary education and lower secondary education are regarded as 'basic education.' Since 1999, the Nigerian Government had been promoting free and compulsory basic education under the universal basic education policy. As a result, the enrolment of pupils in primary schools increased from 17.9 million in 1999 to 22.3 million in 2005[1]. Although the access of children to primary education improved, the low quality of education in schools remained a serious challenge. Although one of the important factors influencing the quality of education is the teaching skills of teachers, nearly 50% of primary school teachers did not have a proper teacher certificate in Nigeria. Besides, lectures provided at teacher-training courses in universities and teacher's colleges had not been conducted with the sufficient use of experimental techniques due to shortages of teaching aids and materials. Thus, teachers graduating from these courses also had insufficient teaching skills and experience in making lesson plans for mathematics and science which were experimentally based. Given the necessity of strengthening teachers' ability in mathematics and science education, the Nigerian Government had conducted its own teacher training. However, the teacher training had not been implemented in effective and systematic manner, and thus, teachers hardly had an opportunity to improve their subject knowledge and teaching skills on regular basis.

In this situation, JICA conducted the "Project on Strengthening of Mathematics and Science Education in Nigeria" (hereinafter called Phase 1 Project) from 2006 to 2009 in Kaduna, Niger and Plateau States, which implemented the development of training materials as well as the training of trainers with the INSET cascade system for

[1] UNESCO "EFA Global Monitoring Report" 2008

mathematics and science in primary education. The Phase 1 Project used the knowhow on INSET implementation for mathematics and science teachers provided from the JICA's technical cooperation "Project on Strengthening Mathematics and Science in Secondary Education (SMASSE)" (1998-2003) and SMASSE Phase 2 (2003-2008) where Kenyan experts of SMASSE were received. Four National Trainers at the national level and 24 State Trainers as well as about 600 Core Teachers in the three pilot states were trained under the Phase 1 Project.

The Nigerian Government highly valuated the INSET introduced at the Phase 1 Project and requested that the Japanese Government implement the second phase of the project, which included the implementation of Local INSET in the three pilot states as well as National INSET in the remaining 34 states including 33 states and the Federal Capital Territory (FCT). This project was the Phase 2 Project.

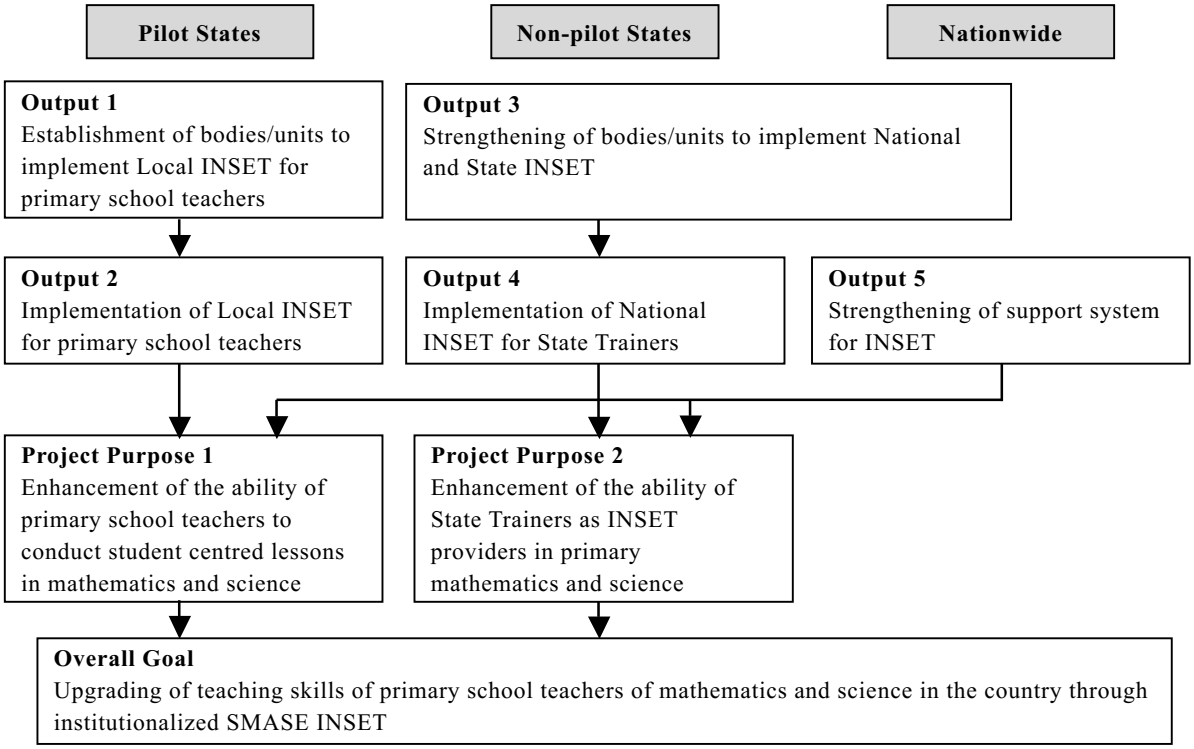
1.2 Project Outline

Overall Goal		Upgrading of teaching skills of primary school teachers in mathematics and science education in the country through institutionalized SMASE INSET[2]
Project Purpose		1. Enhancement of the ability of primary school teachers in pilot states to conduct student centred lessons in mathematics and science. 2. Enhancement of the ability of State Trainers as INSET providers in primary mathematics and science education in the other states.
Outputs	Output 1	Establishment of bodies/units to implement the Local INSET for primary school teachers in the pilot states.
	Output 2	INSET for primary school teachers is conducted and assessed in the pilot states.
	Output 3	Strengthening of bodies/units to implement the INSET at national and state levels.
	Output 4	National INSET for State Trainers in the other remaining states is conducted and assessed.
	Output 5	Strengthening of support system for INSET.
Total Cost (Japanese Side)		520 million yen
Period of Cooperation		August 2010 – February 2014 (Extension period: August 2013 – February 2014)

[2] SMASE (Strengthening of Mathematics and Science Education) INSET collectively refers to a three-level cascade system of INSETs (National INSET, State INSET and Local INSET) conducted for the project.

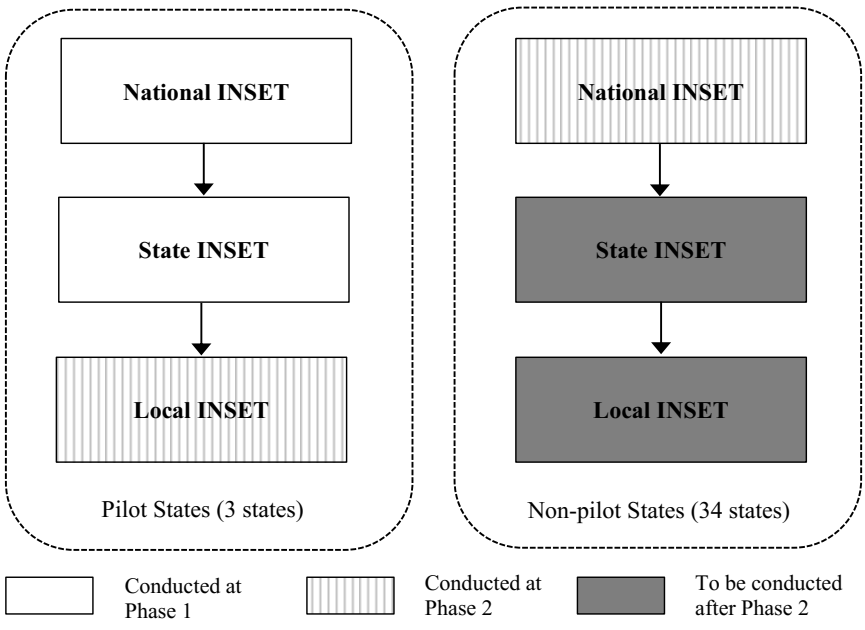
Implementing Agencies	1. Federal Ministry of Education (FME) 2. National Teachers' Institute (NTI) 3. National Commission for Colleges of Education (NCCE) 4. Universal Basic Education Commission (UBEC) 5. State Universal Basic Education Boards (SUBEB): 37 in total 6. Local Government Education Authorities (LGEA) in the pilot states: 65 in total
Other Relevant Agencies / Organizations	1. Nigerian Educational Research and Development Council 2. National Mathematical Centre 3. Teachers Registration Council of Nigeria
Supporting Agency/Organization in Japan	IC Net Limited
Related Projects	<Technical Cooperation> - Strengthening of Mathematics and Science Education in Nigeria Project (2006-2009) - Follow-up on Strengthening of Mathematics and Science Education in Nigeria Project (2014) <Grant Aid> - The Project for Construction of Additional Classrooms for Primary Schools (Phase I: August 2004, Phase II: July 2005, Phase III: July 2006) - The Project for Construction of Additional Classrooms for Primary Schools Phase 2 (June 2010) - The Project for Construction of Classrooms for Primary School in Oyo State (September 2014)

As shown in the Project Outline above, this project consists of two Project Purposes. The relationship between the two Project Purposes and the five Outputs as well as the scopes of Phase 1 and Phase 2 Projects are shown as follows.



Source: Made by the external evaluator
Notes: Pilot states: 3 states of Kaduna, Niger and Plateau
Non-pilot states: 33 states and FCT, 34 states in total
National INSET: Training where National Trainers train State Trainers, which is conducted at NTI in Kaduna
State INSET: INSET where State Trainers train Core Teachers
Local INSET: INSET where Core Teachers train primary school teachers (basically all teachers)

Figure 1: Composition of Overall Goal, Project Purposes and Outputs



Source: Made by the external evaluator

Figure 2: Scopes of Phase 1 and Phase 2 Projects

SMASE INSET consists of three repetitions of Cycle 1, 2 and 3 for National, State and Local INSET, the training periods of the respective cycles being from ten days to two weeks each. It was planned that both Local INSET in the pilot states and National INSET for State Trainers in the non-pilot states would be implemented with one cycle a year and all cycles were to be completed within three years of the project period. The insufficient and delayed allocation of INSET funds, however, caused a significant delay in the implementation schedule of both INSET, which resulted in participation in Cycle 1 only in Kaduna, Cycle 3 for some teachers in Niger, and Cycle 2 for some teachers in Plateau for Local INSET as well as participation in Cycle 1 only for National INSET by the end of the project (The remaining cycles have been implemented by the Nigerian side, on their own, after project completion).

1.3 Outline of the Terminal Evaluation

While it was planned that project would be completed in July 2013, the implementation of both Local INSET in the pilot sates and National INSET for the non-pilot states fell considerably behind schedule as described above. The terminal evaluation of the project was conducted in February 2013 and it was proposed that the project be extended for approximately one year due to the delayed schedule. The project period was finally extended for seven months up to February 2014.

1.3.1 Achievement Status of Project Purpose at the Terminal Evaluation

It was judged that the achievement of the Project Purpose by the end of the project would be difficult as the number of participants in Local INSET in the pilot states as well as the number of participants in National INSET for the non-pilot states had fallen below the target values, although the enhancement of the abilities of participants in both was largely achieved.

1.3.2 Achievement Status of the Overall Goal at the Terminal Evaluation

While many cases of improvement in the teaching skills of primary school teachers in mathematics and science education were reported, as of the terminal evaluation, it was estimated that the implementation of Local INSET across the country would take roughly ten years.

1.3.3 Recommendations from the Terminal Evaluation

It was recommended that the project period be delayed and delayed activities, including the implementation of INSET, be carried out during the extended period. The recommendations were largely completed during the extended period.

2. Outline of the Evaluation Study

2.1 External Evaluator

Sawa Hasegawa, OPMAC Corporation

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: August, 2016 – September, 2017

Duration of the Field Study: November 6 – 18, 2016 and May 18 – 23, 2017

2.3 Constraints during the Evaluation Study

There were several constraints in this ex-post evaluation.

(1) The project scope was huge. The target site was the whole country and the target group was primary school teachers across the country (more than 700 thousand in total). In addition, the external evaluator was unable to visit some states for the field survey due to the unfavourable security situation in Nigeria. It was impossible to conduct the field survey in all the states due to constraints of time, cost and security. The target sites of the beneficiary survey for primary school teachers therefore had to be selected in an arbitrary manner, resulted in the selection of only five states including the three pilot states, FCT and Kogi State. Furthermore, the selection of respondents of the beneficiary survey was also arbitrary since primary schools were extensively scattered over the respective states making it very difficult to select respondents in the five states with random sampling. In view of this there were constraints in judging the project impact such as the achievement of the Overall Goal and the possibility of overvaluation or undervaluation.

(2) As described above, the target site and the target group of the project were huge. In addition, due to the difficulty in obtaining exact educational statistical data in Nigeria, including from the central and regional related agencies, there were cases where accurate data on numbers of INSET participants, expenditures, etc. were unavailable. In addition, there were discrepancies between data obtained at the ex-post evaluation and data obtained from past project documents. Thus there were constraints in the accuracy and reliability of the data obtained.

(3) The “lesson observation index” and “pupils’ participation index” were set as indicators for Project Purpose 1. The data for the lesson observation index was collected by observing actual mathematics and science lessons performed by 30

primary school teachers (10 teachers from the respective three pilot states) who were selected as sample data. The data for the pupils' participation index was collected by conducting a questionnaire survey with pupils who took the lessons of the 30 primary school teachers on the same day as lesson observation index data was collected. While the target of Project Purpose 1 was all primary school teachers in the pilot states (approximately 70 thousand), it would have been impossible to collect data on indicators by observing such a large number of mathematics and science lessons and therefore the sample size was greatly reduced to only 30 out of 70 thousand. In this regard, the data on the indicator obtained from 30 teachers cannot be said to be sufficient as representative data for all primary school teachers in the pilot states. However, as it was not possible to collect inter-annual data on this indicator at the time of the ex-post evaluation, the achievement of Project Purpose 1 had to be judged based on the data obtained during the project period.

(4) This ex-post evaluation was conducted for the Phase 2 Project as a project-level evaluation. As shown in Figure 2, however, SMASE INSET in Nigeria has been conducted not only by this project, but also by the Phase 1 Project, the Phase 2 Project and through initiative activities of the Nigerian side after the project completion, which is regarded as the national program. It is therefore difficult to specify a single effect of the project among the series of SMASE INSET; judgement of the effectiveness and impact of the project should include the effects of other efforts. It was therefore difficult to measure the effectiveness and impact of the single project as ex-post evaluation was conducted for this project only, based on the project-level evaluation.

3. Results of the Evaluation (Overall Rating: B[3])

3.1 Relevance (Rating: ③[4])

3.1.1 Consistency with the Development Plan of Nigeria

The Nigerian national development plan "Nigeria Vision 2020" (2010-2020) rates the education sector as one of the most important sectors and clearly states the enhancement of human resource development as a goal for the education sector.

In addition, education sector policies in Nigeria including the "National Policy on Education" (2004-), the "10 Year Strategic Plan for Federal Ministry of Education" (2010-2020), the "Roadmap for Nigerian Education Sector" (2008-2014) and the "National Teacher Education Policy" (2009-) stipulate the importance of the capacity

[3] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[4] ③: High, ②: Fair, ①: Low

development of teachers to secure the quality of education as well as the necessity of the continuous implementation of INSET to maintain and improve the quality of teachers. Thus the project was consistent with the development plan of Nigeria both at the time of project planning and completion.

3.1.2 Consistency with the Development Needs of Nigeria

As described in "1.1 Background," the Phase 1 Project was responsible for the development of training materials and the training of trainers for SMASE INSET in Kaduna, Niger and the Plateau States. The Nigerian Government attached a high value on SMASE INSET at the time of the completion of the Phase 1 Project and had a strong preference for the continuous implementation of SMASE INSET not only in the three states but also in other states across the country. At the same time, the Government thought that the establishment of the INSET system was not enough to disseminate SMASE INSET throughout the country, including the implementation of Local INSET in the three states after the completion of the Phase 1 Project and showed a strong desire to implement Local INSET in the three states as well as to establish the implementation system of SMASE INSET in the remaining 34 states. At the time of the completion of this project the government also indicated their intention to continuously implement SMASE INSET on their own after project completion. Thus, the project was consistent with the development needs of Nigeria throughout the time of project planning and completion.

3.1.3 Consistency with Japan's ODA Policy

The third economic cooperation policy meeting between the Nigerian and Japanese Governments held in October 2007 placed 'basic education' as one of the priority areas for assistance and emphasized technical cooperation for implementation focused on the qualitative and quantitative expansion of teachers. In addition, the "Yokohama Action Plan" adopted in the Fourth Tokyo International Conference on African Development (TICAD IV) held in May 2008 set the goal of expanding teacher training in math and science through SMASE by expanding SMASE projects for 100,000 teachers. Thus the project was consistent with Japan's ODA policy towards Nigeria at the time of project planning.

This project was highly relevant to the Nigeria's development plan and development needs, as well as to Japan's ODA policy. Therefore, its relevance is high.

3.2 Effectiveness and Impact[5] (Rating: ③)

3.2.1 Effectiveness

3.2.1.1 Relations between Project Purpose and Outputs

This project consists of two Project Purposes. As shown in Figure 1 in "1.2 Project Outline," the project aimed to achieve Project Purpose 1: enhancement of the ability of primary school teachers to conduct student centred lessons in mathematics and science, through the achievements of Output 1: the establishment of bodies/units to implement Local INSET in the three pilot states and Output 2: the implementation of Local INSET. The second aim was the achievement of Project Purpose 2: enhancement of the ability of State Trainers as INSET providers in primary mathematics and science education in the non-pilot states, through the achievements of Output 3: strengthening of bodies/units to implement National INSET and State INSET in the non-pilot states and Output 4: implementation of National INSET for State Trainers in the non-pilot states.

The implementation of Local INSET in the pilot states for Output 2 was planned with approximately all 70,000 primary school teachers in the three states participating in the Local INSET three Cycles, 1, 2 and 3. However, implementation according to the original plan was regarded as impossible, mainly due to the insufficient and delayed allocation of INSET funds. The target value was revised downward in the middle of the project with 35,000 teachers participating in at least Cycle 1. Finally, 42,982 primary teachers participated in Local INSET[6].

In the same way, while it was planned that National INSET for State Trainers in the non-pilot states for Output 4 would be implemented in three Cycles, 1, 2 and 3, this was revised to just Cycle 1. The number of participants in National INSET was not revised from the original plan. Approximately 12 from the respective states and 413 State Trainers in total from 33 states, not including Lagos State, participated in National INSET. The only state out of 34 non-pilot states not participating was Lagos State[7].

Meanwhile, School-based Training (SBT), where participants of Local INSET teach other teachers in the same school about what they learned at SMASE INSET, was

[5] Sub-rating for Effectiveness is to be put with consideration of Impact.

[6] The insufficient and delayed allocation of INSET funds was caused by their not being disbursed from the Nigerian side as planned (to be described in "3.3 Efficiency.") Other reasons for the delayed schedule were as follows; 1) Kaduna State had a shortage of SMASE INSET funds which were allocated for another, preceding, INSET on a priority basis and 2) Plateau State experienced strikes by teachers during the project period and had a period of being unable to implement INSET. For this reason, the implementation schedules of Local INSET differed according to the three states. Local INSET had been completed up to participation in Cycle 1 in Kaduna, Cycle 3 for some teachers in Niger, Cycle 2 for some teachers in Plateau by the end of the project.

[7] Lagos State had the policy of conducting capacity development of teachers on their own and indicated their intention of not participating in SMASE INSET throughout the project period.

introduced to the pilot states as measures to the decrease in the number of participants in Local INSET. Workshops were held for headteachers in all primary schools and supervisors in the pilot states during the project period to introduce and encourage the implementation of SBT in their schools and states.

In light of the above, it can be seen that, as a result of revising the numbers of participants and times for Local INSET in the pilot states, as well as National INSET for the non-pilot states, the respective outputs were largely achieved by project completion.

3.2.1.2 Achievement of Project Purpose

The achievement of Project Purpose is judged by the results of the indicators set for the project. The indicators and their actual results are as follows.

Table 1: Achievement of Project Purpose

<table>
<tr><th>Project Purpose</th><th>Indicator</th><th>Actual</th></tr>
<tr><td>1. Enhancement of the ability of primary school teachers to conduct student centred lessons in mathematics and science in the pilot states.</td><td>The ability of primary school teachers in 3 pilot states will improve with a lesson observation index obtained on a scale of $1 < x < 5$ with $x \geq 3$ as an acceptable mean.

Note: The method of measuring this index is by directly observing the lessons of sample teachers according to the checklist and rating them on a scale of 1 to 5 in terms of 1) teaching procedure, 2) fundamental techniques/methodology and 3) class management/control.</td><td>The data from the lesson observation index before participating in Local INSET, after participating in Cycle 1, and after participating in Cycle 2 were collected from sample teachers, 10 each from the 3 pilot states, 30 in total[8]. The respective mean scores of the lesson observation index are as follows.

<table><tr><th></th><th>Baseline</th><th>After Cycle 1</th><th>After Cycle 2</th></tr><tr><td>Kaduna</td><td>2.0</td><td>3.0</td><td>NA</td></tr><tr><td>Niger</td><td>1.7</td><td>2.6</td><td>3.0</td></tr><tr><td>Plateau</td><td>1.9</td><td>3.0</td><td>NA</td></tr></table>Source: Internal documents provided by JICA
Note: The baseline data is the data obtained before participating in training for each state.
Note: The data for after Cycle 2 was not collected in Kaduna and Plateau as Cycle 2 had not been conducted by the time of project completion in Kaduna and only some teachers had participated in Cycle2 in Plateau.

The mean scores of the 3 states was 3, as seen above.</td></tr>
</table>

[8] The sampling method was 1) randomly selecting the respective 10 Local Government Areas (LGAs) in the three states; 2) randomly selecting one school each from the 30 selected LGAs; and 3) selecting one teacher in charge of mathematics and science mainly for 4th, 5th and 6th grades each from the 30 selected schools.

<table>
<tr><th>Project Purpose</th><th>Indicator</th><th>Actual</th></tr>
<tr><td></td><td>The ability of primary school teachers in the 3 pilot states will improve with a pupils' participation index obtained on a scale of 1 < x < 5 with x ≥ 3 as acceptable mean.

Note: The method of measuring this index was through questioning pupils who took the lessons of the sample teachers which were for the lesson observation index and the rating was on a scale of 1 to 5.</td><td>The mean scores of the pupils' participation index obtained from lessons conducted by the sample teachers above are as follows.

<table><tr><th></th><th>Baseline</th><th>After Cycle 1</th><th>After Cycle 2</th></tr><tr><td>Kaduna</td><td>2.2</td><td>2.3</td><td>NA</td></tr><tr><td>Niger</td><td>1.7</td><td>2.4</td><td>2.8</td></tr><tr><td>Plateau</td><td>2.5</td><td>2.4</td><td>NA</td></tr></table>Source: Internal documents provided by JICA

The mean scores of the 3 states did not reach 3 although they increased somewhat after training as seen above.</td></tr>
<tr><td>2. Enhancement of the ability of State Trainers as INSET providers in primary mathematics and science education in other remaining states.</td><td>The ability of State Trainers will improve in the attitude of teachers to the teaching of mathematics and science with obtainments on the index on a scale of 1 < z < 5 with z ≥ 3 as an acceptable mean.

Note: The method of measuring this index is rating the attitudes of participants on the following five categories, A to E, on a scale of 1 to 5.
A: Attitude towards the purpose of teaching/learning of mathematics and science
B: Attitude towards methodology
C: Attitude towards lesson planning
D: Attitude towards overcoming limitations
E: Attitude towards teaching/learning activities</td><td>The data on the attitude of teachers to the teaching of mathematics and science before and after participating in Cycle 1 of National INSET were collected from 413 State Trainers. The mean scores of the 5 categories are as follows.

<table><tr><th>Category</th><th>Before Training</th><th>After Training</th></tr><tr><td>A</td><td>3.90</td><td>4.59</td></tr><tr><td>B</td><td>4.25</td><td>4.64</td></tr><tr><td>C</td><td>3.88</td><td>4.62</td></tr><tr><td>D</td><td>3.27</td><td>4.33</td></tr><tr><td>E</td><td>4.19</td><td>4.60</td></tr></table>Source: Internal documents provided by JICA

The mean scores by all categories increased after training and reaching more than 4, as seen above.</td></tr>
</table>

Regarding Project Purpose 1, as shown in Table 1, while in the lesson observation index, out of two indicators, achieved the target value, the pupils' participation index did not. However, although SMASE INSET was completed with participation in the three times Cycle, 1, 2 and 3 for National, State and Local INSETs, the target teachers had not participated three times at the end of the project due to the decrease in the number of participating in Local INSET in the middle of the project. The data on both indexes above is based on participation in Cycle 1 and 2 for Niger and for Cycle 1 only for Kaduna and Plateau. Although the target values ($x \geq 3$) of two indicators could have been downgraded together with the decrease in the number of times of participation, it was difficult to set exact target values consistent with the decreased rate and therefore the initial values were kept. As a result of this, the level of the target values of $x \geq 3$ was to a certain extent high.

Although the pupils' participation index did not achieve its target value, data largely increased after Cycle 1 and 2. Looking at trends in the data for Niger, where

teachers completed Cycle 2, it is anticipated that the target value would be achieved in the three states with the completion of Cycle 3. In addition, by way of its nature, the achievement of the pupils' participation index takes more time to take effect compared to the lesson observation index. Considering the results of the two indicators in a comprehensive manner, it is considered that the ability of primary school teachers to conduct student centred lessons in mathematics and science in the pilot states was largely enhanced and that Project Purpose 1 was largely achieved.

Regarding Project Purpose 2, data on the attitude of teachers to the teaching of mathematics and science index increased and reached its target value after teachers participated in National INSET. Meanwhile, the data were based on the participation in only Cycle 1 for State Trainers in the non-pilot states. It is considered that ability as INSET providers in mathematics and science education was enhanced and that Project Purpose 2 was achieved.

In light of the above, the project largely achieved its purpose.

3.2.2 Impact

The Overall Goal of the project is "Upgrading of teaching skills of primary school teachers of mathematics and science in the country through institutionalized SMASE INSET." It is unclear when judging the achievement of the Overall Goal whether it targets all primary school teachers in the country or all the participants in Local INSET. At the time of project planning, it was planned that all primary teachers across the country would participate in Local INSET so that all primary teachers would be equal in their participation in Local INSET. It was not possible for all primary teachers to participate in Local INSET due to financial constraints, which resulted in including teachers who had not participated in Local INSET among all primary school teachers in the country if targeting all the teachers.

Considering that the intention of the Overall Goal was the "improvement in the general level of teaching skills of primary school teachers in mathematics and science education in the country," all primary school teachers in the country should have been targeted. The beneficiary survey for primary school teachers conducted at this ex-post evaluation to judge the achievement level of the Overall Goal therefore targeted both participants and non-participants in Local INSET (participants in SBT were included in the non-participants). However, it should be noted that the result of this beneficiary survey does not represent all primary school teachers in the country since the survey was conducted only in five states, including the three pilot states, FCT and Kogi State. Furthermore, the selection of survey respondents had to be made with arbitrariness as described at (1) in "2.3 Constraints during the Evaluation Study."

In addition, in the original plan, this project did not clearly specify the target year for achieving the Overall Goal and so this ex-post evaluation evaluated how much the indicators set for the Overall Goal were achieved as of the time of the ex-post evaluation.

3.2.2.1 Achievement of the Overall Goal

The achievement of the Overall Goal is also judged according to the results of the indicators set for the project. The indicators and their actual results are as follows.

Table 2: Achievement of Overall Goal

Overall Goal	Indicator	Actual
Upgrading of teaching skills of primary school teachers of mathematics and science in the country through institutionalized SMASE INSET.	Positive change in teachers' attitude and improved performance in subject mastery, pedagogical skills and ASEI-PDSI in classroom activities Note: 'ASEI-PDSI' is a kind of approach commonly used in JICA technical cooperation projects for the strengthening of mathematics and science education and stands for "Activity, Student-centred, Experiment, Improvisation / Plan, Do, See, Improve."	- The beneficiary survey with 100 primary school teachers (50 participants and 50 non-participants in Local INSET) in the five states, including the three pilot states, of Kaduna, Niger and Plateau, FCT and Kogi was conducted in the ex-post evaluation[9]. An overview of respondents of this survey is shown in Table 3-Table 6. - According to the results of the beneficiary survey, both the levels of understanding of Local INSET on the part of participants and of SBT on the part of non-participants were high and more than 90% of them responded that their teaching skills had improved after participating in Local INSET or SBT. Furthermore, it was confirmed that more than 80-90% of participants and 70-80% of non-participants had practiced ASEI-PDSI in their mathematics and science lessons. Considering all the results of the beneficiary survey, the general level of the teaching skills of primary school teachers in the five states have been improved. The reasons why non-participants practiced ASEI-PDSI were their participation in SBT as well as their having received instruction from participants. The specific results of the survey are shown in Figure 3-Figure 12[10].

[9] FCT and Kogi State were selected from the 15 non-pilot states where Local INSET had been implemented at the time of the ex-post evaluation taking into consideration geographical and security conditions as described in "2.3 Constraints during the Evaluation Study." The sample size of the survey was 100 in the total5 states and although it was intended that there would be 10 schools in the respective states and 1 school from a LGA, schools were selected from 3-4 LGAs in the respective states since it was difficult to select 10 LGAs due to constraints in time, location and security. Furthermore, it was difficult to contact the target schools without any introduction, so the schools were basically introduced by the respective SUBEBs or State Trainers.

[10] Regarding the "improved performance in subject mastery, pedagogical skills and ASEI-PDSI in classroom activities" in the indicator, SMASE INSET was designed for teachers to improve their teaching skills by adopting the ASEI-PDSI approach in their lessons and not to increase their knowledge of the subjects themselves. In addition, this project targeted primary education, which did not include advanced levels of science and mathematics, so it was confirmed among the implementing agencies and experts during the project period that they would not evaluate teachers' levels of knowledge and understanding of their subjects. 'Pedagogical skills' and 'ASEI-PDSI in classroom activities' except for 'subject mastery' in the indicator were therefore analyzed for the ex-post evaluation. This beneficiary survey examined such questions as 'understanding level of training,' 'improvement in teaching skills after participating in training,' 'practice level of ASEI-PDSI in lessons,' etc. and the achievement of this indicator were judged with all the survey results considered.

Overall Goal	Indicator	Actual
	Regular SMASE INSET is conducted systematically.	- Local INSET was continuously conducted in the three pilot states after project completion. The numbers of participants in Cycles 1, 2 and 3 as of November 2016 are shown in Table 7. - State and Local INSET were also continuously conducted in the non-pilot states after project completion. The implementation status of the National, State and Local INSET in non-pilot states as of May 2017 is shown in Table 8.

Table 3: Numbers of Respondents of Beneficiary Survey for Each State and LGA

Unit: persons

States	LGAs	Participants	Non-participants
Kaduna	Chikun	3	3
	Kaduna South	3	3
	Kaduna North	3	3
	Igabi	1	1
	Sub-total	10	10
Niger	Chanchaga	1	1
	Lapia	2	2
	Paikoro	4	4
	Bosso	2	2
	Gurara	1	1
	Sub-total	10	10
Plateau	Barkin Ladi	2	2
	Pankshin	1	1
	Jos South	3	3
	Jos North	2	2
	Mangu	1	1
	Bassa	1	1
	Sub-total	10	10
FCT	Amac	8	8
	Bwari	2	2
	Sub-total	10	10
Kogi	Lokoja	8	8
	Ajaokuta	1	1
	Koton karfi	1	1
	Sub-total	10	10
	Total	50	50

Source: Beneficiary survey (sample numbers: 100)

Table 4: Numbers of Male and Female Respondents of Beneficiary Survey

Unit: persons

	Participants	Non-participants
Male	14	9
Female	36	41
Total	50	50

Source: Beneficiary survey (sample numbers: 100)

Table 5: Numbers of Participants in Respective Cycles of Local INSET [Note]

Unit: persons

	Participants
Cycle 1	43
Cycle 2	41
Cycle 3	16

Source: Beneficiary survey (sample numbers: 50)
Note: Although there is a general rule in SMASE INSET that only the participants of Cycle 1 can participate in Cycle 2 and 3, some teachers participated in Cycle 2 and 3 without participating in Cycle 1.

Table 6: Numbers of Participants in SBT among Non-participants

Unit: persons

Participated in SBT	41
Did not participate in SBT	9

Source: Beneficiary survey (sample numbers: 50)

Table 7: Numbers of Primary Teachers, State Trainers, Core Teachers, and Participants in Local INSET in the 3 Pilot, FCT and Kogi States (as of November 2016)

Unit: persons

	Kaduna	Niger	Plateau	FCT	Kogi
Number of primary teachers	34,004	21,086	15,794	9,438	17,831
Number of State Trainers	9	9	10	12	12
Number of Core Teachers	163	200	200	200	200
Number of participants in Local INSET (Cycle 1)	4,600 (4,600)	10,129 (9,570)	15,520 (15,520)	2,600	600
Number of participants in Local INSET (Cycle 2)	4,600 (2,300)	6,586 (5,400)	5,700 (2,992)	2,684	600
Number of participants in Local INSET (Cycle 3)	2,300 (0)	6,000 (2,600)	Yet to be conducted	Yet to be conducted	Yet to be conducted

Source: Questionnaire responses from the respective SUBEBs
Note 1: The numbers above are based on the results of questionnaire responses from the respective SUBEBs, so some numbers are approximate calculations.
Note 2: The numbers of participants in Local INSET are total numbers of participants and the lower numbers noted in brackets are numbers of participants who took Local INSET during the project period.

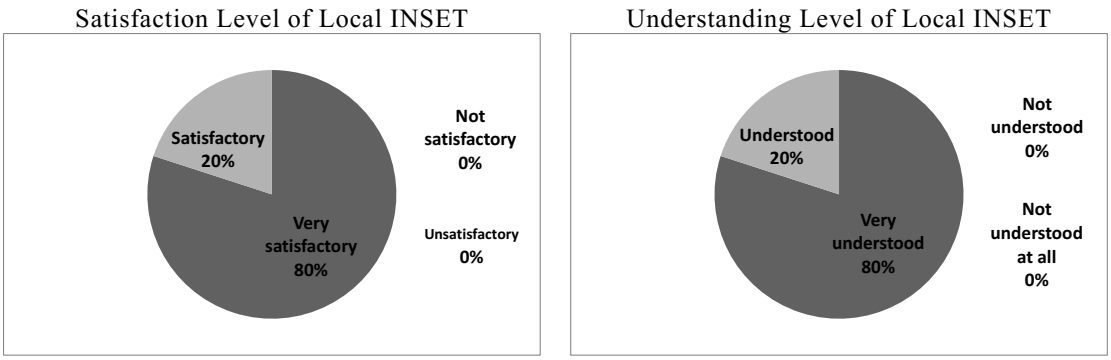
Table 8: Implementation Status of SMASE INSET in Non-pilot States (as of May 2017)

States		National INSET			State INSET			Local INSET		
		Cycle 1	Cycle 2	Cycle 3	Cycle 1	Cycle 2	Cycle 3	Cycle 1	Cycle 2	Cycle 3
1	ABIA	Done	(Done)	(Done)	Done	(Done)	(Done)			
2	ADAMAWA	Done	(Done)		Done	(Done)				
3	ANAMBRA	Done	(Done)		(Done)	(Done)		(Done)		
4	AKWA-IBOM	Done	(Done)		Done	(Done)		(Done)		
5	BAUCHI	Done	(Done)	(Done)	Done	(Done)				
6	BAYELSA	Done			(Done)					
7	BENUE	Done	(Done)		Done	(Done)		Done		
8	BORNO	Done	(Done)		Done	(Done)	(Done)	(Done)		
9	CROSS-RIVER	Done	(Done)	(Done)	Done	(Done)				
10	DELTA	Done	(Done)		Done	(Done)		(Done)		
11	EBONYI	Done	(Done)	(Done)	Done	(Done)	(Done)	Done		
12	EKITI	Done	(Done)	(Done)	Done	(Done)	(Done)			
13	EDO	Done			(Done)					
14	ENUGU	Done	(Done)	(Done)	Done			(Done)		
15	FCT-ABUJA	Done	(Done)		Done	(Done)		Done	(Done)	
16	GOMBE	Done	(Done)	(Done)	Done	(Done)			(Done)	
17	IMO	Done	(Done)		Done	(Done)		Done	(Done)	
18	JIGAWA	Done	(Done)		Done					
19	KEBBI	Done	(Done)		Done	(Done)		Done		
20	KOGI	Done	(Done)		Done	(Done)		Done	(Done)	
21	KANO	Done			(Done)					
22	KASTINA	Done	(Done)	(Done)	Done	(Done)				
23	KWARA	Done	(Done)		(Done)	(Done)				
24	LAGOS									
25	NASSARAWA	Done	(Done)	(Done)	Done	(Done)	(Done)			
26	OYO	Done	(Done)	(Done)	Done	(Done)	(Done)			
27	ONDO	Done	(Done)	(Done)	Done	(Done)		(Done)		
28	OGUN	Done	(Done)		(Done)	(Done)				
29	OSUN	Done	(Done)	(Done)	Done	(Done)		(Done)		
30	RIVERS	Done	(Done)		(Done)	(Done)			(Done)	
31	SOKOTO	Done	(Done)		Done					
32	TARABA	Done	(Done)	(Done)	Done	(Done)		Done	(Done)	
33	YOBE	Done	(Done)	(Done)	Done			(Done)		
34	ZAMFARA	Done	(Done)		Done					
Total		**33**	**30**	**14**	**33**	**25**	**6**	**15**	**6**	**0**

Source: Made by the external evaluator based on documents provided by FME
Note: 'Done' means that the Cycle had been implemented during the project period and '(Done)' means that the Cycle was implemented after project completion.

(1) Survey Results for Participants

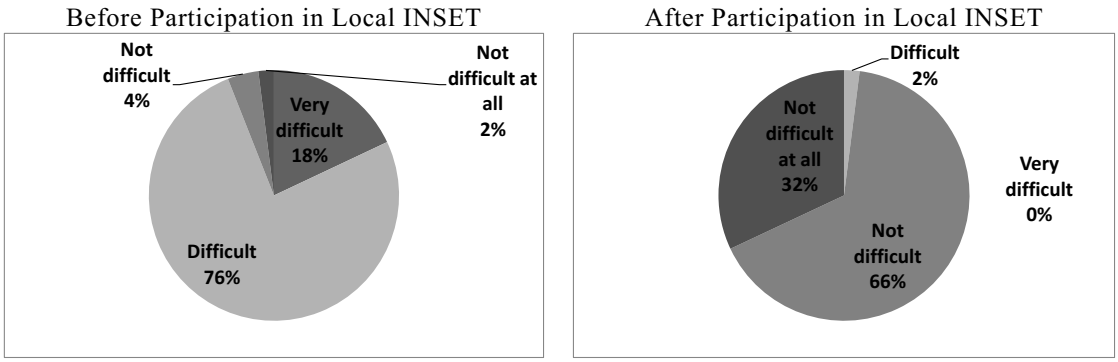
Figure 3 shows the levels of satisfaction and understanding of Local INSET among participants. All participants responded 'Very satisfactory' 'Satisfactory' and 'Very well understood' and 'Understood,' which means both levels were high.



Source: Beneficiary survey (sample numbers: 50)

Figure 3: Participants' Levels of Satisfaction and Understanding of Local INSET

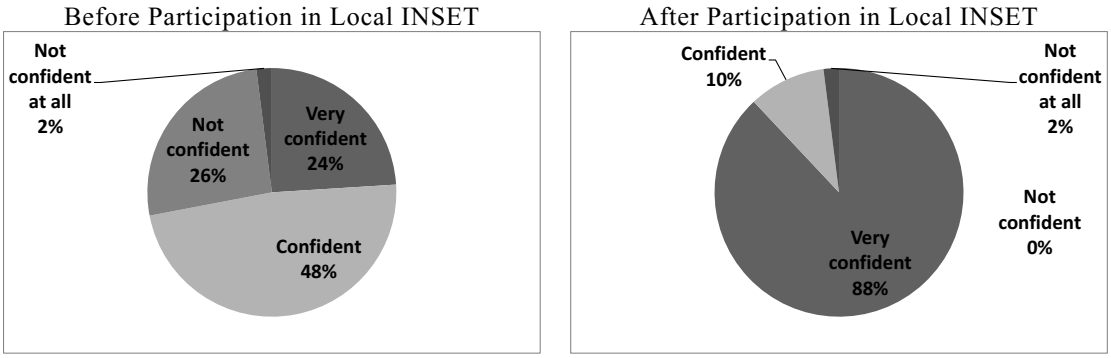
Regarding changes after participation in Local INSET, the rate of response concerning difficulty in teaching science and mathematics decreased (Figure 4) while the rate of response concerning confidence increased (Figure 5). There was no special change in the rate for the preparation of lesson plans for science and mathematics[11] since the rate of teachers who had made lesson plans before participation was high, but there were no teachers who did not make lesson plans at all after participation (Figure 6).



Source: Beneficiary survey (sample numbers: 50)

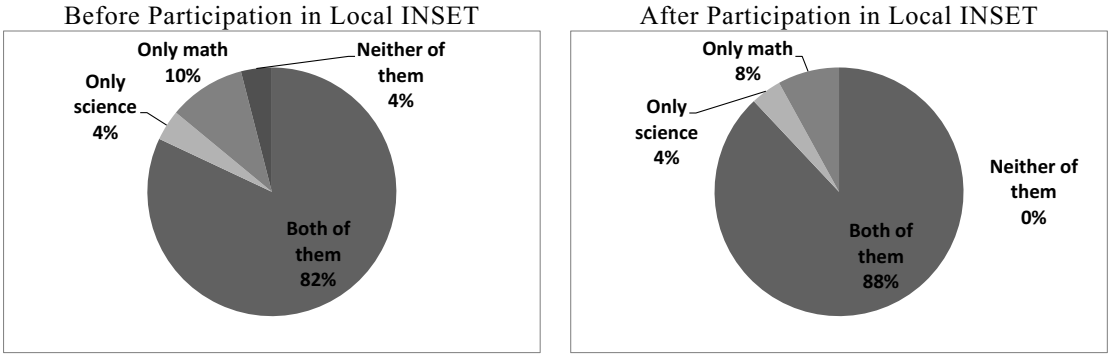
Figure 4: Participants' Challenges/Difficulties in Teaching Science and Mathematics Before and After Participation in Local INSET

[11] Making lesson plans is encouraged in the 'Plan' of ASEI-PDSI.



Source: Beneficiary survey (sample numbers: 50)

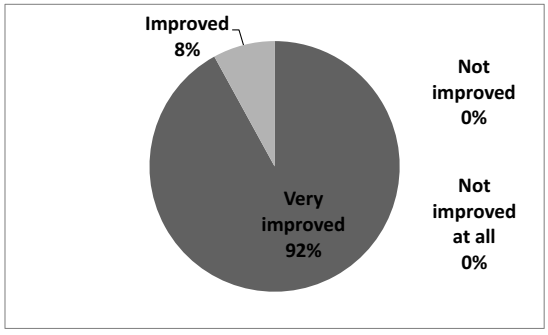
Figure 5: Participants' Confidence in Teaching Science and Mathematics Before and After Participation in Local INSET



Source: Beneficiary survey (sample numbers: 50)

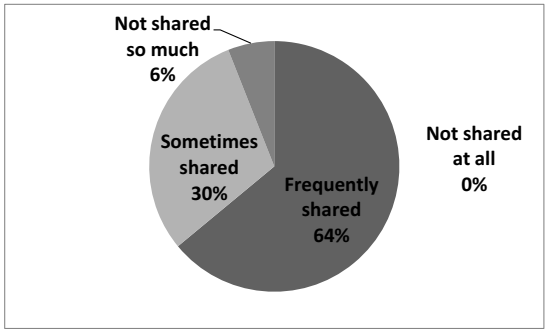
Figure 6: Participants' Preparation of Lesson Plans for Science and Mathematics Before and After Participation in Local INSET

More than 90% of participants responded that their teaching skills were 'Much improved' with the rest responding 'Improved' after participation. There were no responses of 'Not improved' and 'Not improved at all' (Figure 7). Furthermore, more than 90% of participants responded that they shared the contents of Local INSET with their fellow teachers (Figure 8).



Source: Beneficiary survey (sample numbers: 50)

Figure 7: Improvement in Teaching Skills after Participation in Local INSET

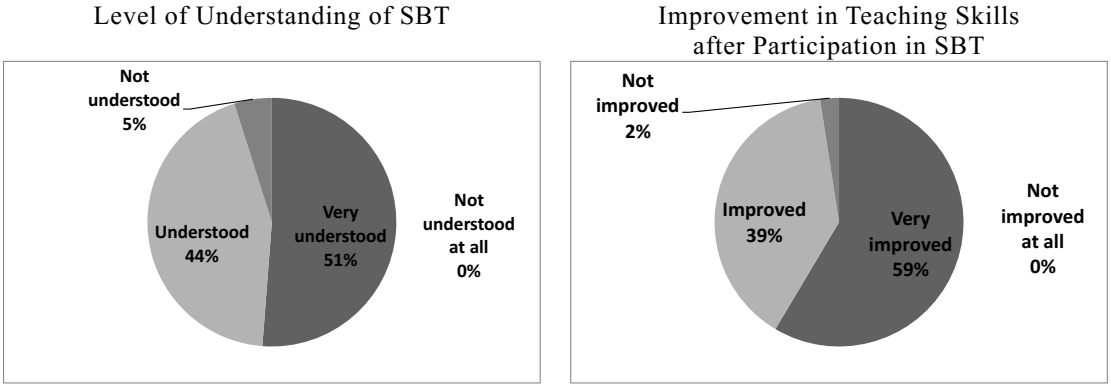


Source: Beneficiary survey (sample numbers: 50)

Figure 8: Frequency of the Sharing the Contents of Local INSET with Fellows

(2) Survey Results for Non-participants

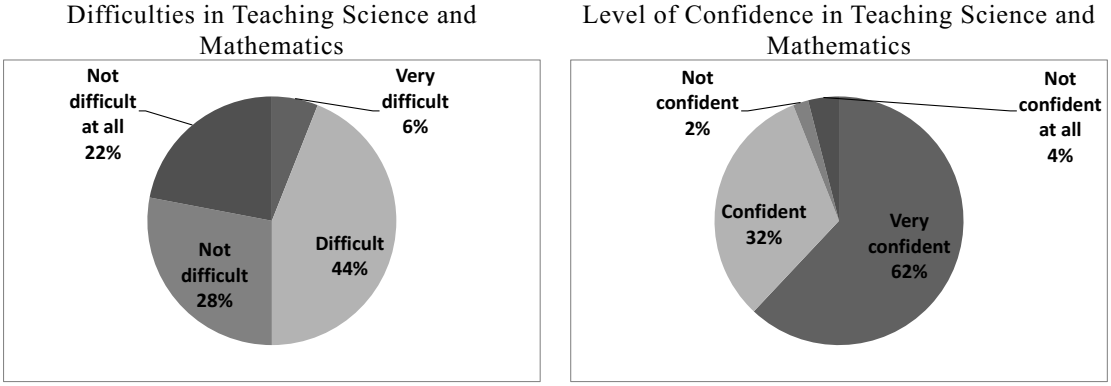
Forty one out of fifty non-participants participated in SBT as shown in Table 8. Out of these, 90% responded that they understood SBT and that their teaching skills had improved after participation in SBT (Figure 9).



Source: Beneficiary survey (sample numbers: 41)

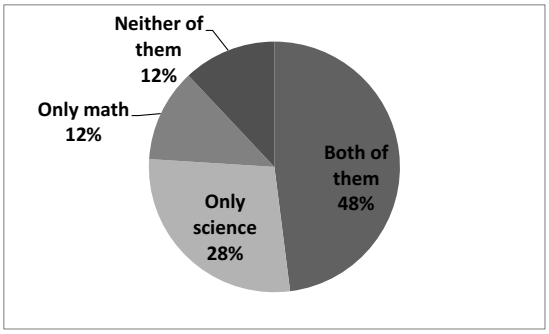
Figure 9: Non-participants' Level of Understanding of SBT and Improvement in Teaching Skills after Participation in SBT

Figure 10 and Figure 11 show the current difficulties and level of confidence in teaching science and mathematics as well as the preparation of lesson plans for non-participants. Compared to participants after participation, more teachers responded that they had difficulty and little confidence in teaching science and mathematics and that they did not make lesson plans.



Source: Beneficiary survey (sample numbers: 50)

Figure 10: Non-participants' Difficulties and Level of Confidence in Teaching Science and Mathematics



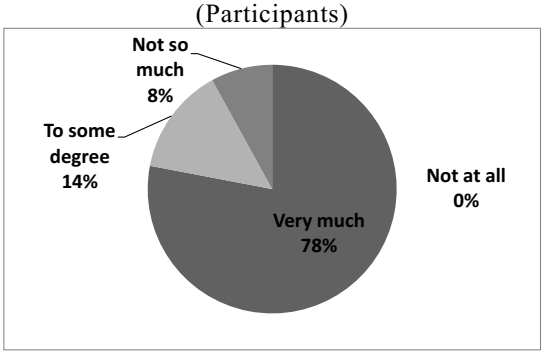
Source: Beneficiary survey (sample numbers: 50)

Figure 11: Non-participants' Preparation of Lesson Plans for Science and Mathematics

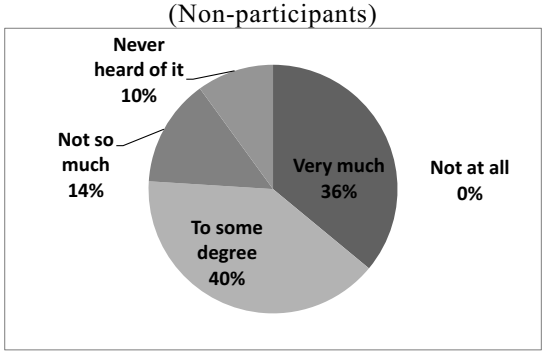
(3) Practice of ASEI-PDSI by Participants and Non-participants

Figure 12 shows the level of practice of ASEI-PDSI in science and mathematics lessons per each item of ASEI for participants and non-participants[12]. Of the participants who responded, 80%-90% said they practiced the four items of ASEI 'Very much' or 'To some degree.' Furthermore, 70%-80% of non-participants responded 'Very much' or 'To some degree', although their practice levels are rather lower than the levels of participants. Practice by 70%-80% of non-participants could be regarded as an effect of SBT.

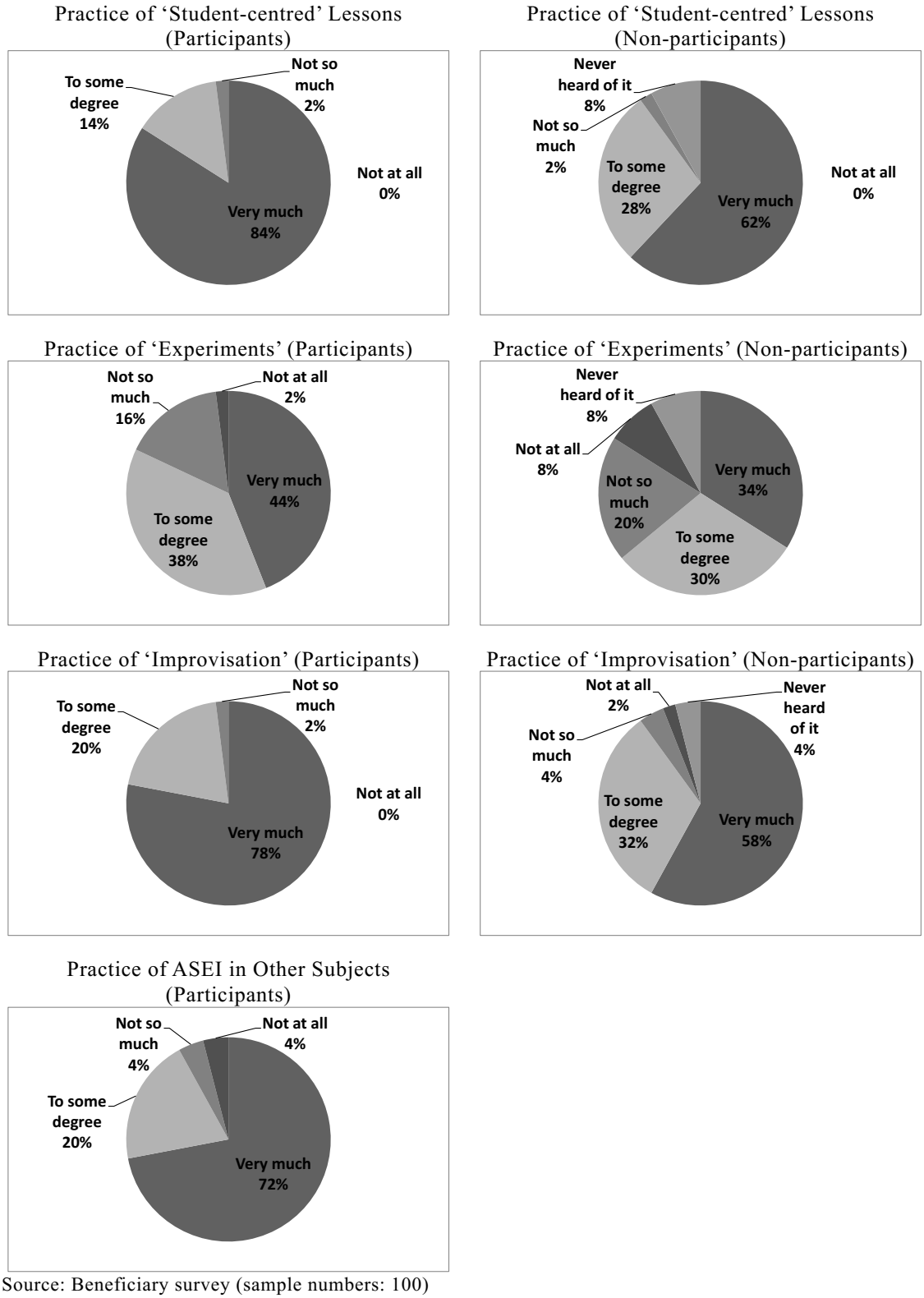
Practice of 'Activity-focused' Lessons (Participants)



Practice of 'Activity-focused' Lessons (Non-participants)



[12] PDSI of ASEI-PDSI indicates the implementation cycle of lessons and is not applicable to the judgement on practicing or not practicing, so the level of practice is shown with each item of ASEI.



Source: Beneficiary survey (sample numbers: 100)

Figure 12: Participants' and Non-participants' Practice of ASEI in Teaching Science and Mathematics

(4) Results of Interviews with Headmasters and Supervisors

According to the interviews with headmasters of 36 schools, out of 50 schools visited for the beneficiary survey, 35 out of the 36 had implemented SBT for SMASE INSET and 29 schools had done so more than once per term at least (the reason for one school having not implemented SBT was that the school is limited in size and number of teachers). Furthermore, 35 out of 36 headmasters regularly monitored lessons as well as checking the practice of ASEI by teachers. In response to a question on whether teachers' teaching skills were improved by SMASE, most of the headmasters recognized an improvement in teaching skills, with 29 of them responding 'improved very much,' 5 of them responding 'improved to some degree' and 1 of them responding 'not improved much.'

In addition, according to an interview with 10 supervisors belonging to the 5 states (2 supervisors for each state), all the supervisors responded they had known about SMASE INSET as well as the contents of ASEI-PDSI. Regarding the practice of ASEI-PDSI by teachers, they responded that while the practice level varied from teacher to teacher, the majority of teachers who had participated in Local INSET or SBT conducted lessons based on ASEI-PDSI. They also provided examples of some teachers conducting better lessons than trainers did. Teachers also actively practiced the ASEI-PDSI approach in lessons for other subjects besides mathematics and science. The reason for teachers not practicing is that practice is not mandatory (no regulations for promotion or pay for practice) and that it is difficult to encourage practice on the part of individual teachers who are indifferent to ASEI-PDSI. Another opinion from the supervisors was that full-level practice of ASEI-PDSI cannot be realized soon after participation in SMASE INSET but comes only gradually with a series of experiences in lessons. Therefore, it is difficult to clearly evaluate whether or not it is practiced and it is important to evaluate the level of practice with a long-term perspective.

(5) Specific Examples of Qualitative Effects of the Project

Specific examples of changes among teachers and pupils as well as issues surrounding the practice of ASEI-PDSI are shown as the qualitative effects of the project, which were obtained from the ex-post evaluation.

Specific Examples of Changes and Issues surrounding the Practice of ASEI-PDSI

Examples of Changes among Teachers

- Teachers have had attitudinal changes in teaching, using activity-oriented and learner-centred approaches. Their lesson plans as well as teaching skills have also been improved.
- Some teachers have developed better confidence in teaching mathematics and science and have become able to handle even some topics that were perceived to be difficult.
- They have encouraged pupils to actively participate in lessons by asking them for feedback and not to keep speaking in their lessons.
- They have learned the learner-centred approach at teacher's colleges, but learned only the concept. The practical approach has been learned through participation in training.
- They have newly learned the utilization of improvisation (development of teaching materials) with resources from local materials.
- They have applied the ASEI-PDSI approach in other subjects such as social studies.

Examples of Changes among Pupils

- Pupils' attendance rates have increased.
- Pupils have become more interested in learning.
- Pupils' understanding of mathematics and science has increased, showing positive responses to lessons.
- Pupils have developed curiosity about topics of mathematics and science with the participatory approach.
- It is reported that pupils' examination scores in science and mathematics at school have increased.
- Pupils have actively and positively participated in lessons without showing hesitation.
- Pupils have reduced feelings of dislike of mathematics.
- Group working has helped pupils to understand lessons more quickly.

Issues in Practicing ASEI-PDSI

- Lesson preparation (such as making lesson plans) takes more time. Lesson hours are shorter due to more talking by pupils in lessons.
- Laboratories and materials of science is still lacking. Teaching aids have not always been available.
- Group work is difficult due to the bad physical conditions of the classrooms (the classrooms are too small, there are too many pupils etc.)
- There are some cases that it is not easy to practice the approach in lessons for the lower grades of primary school.
- It is difficult to fully practice the approach having only participated in SBT due to not full understanding ASEI-PDSI.

Source: Beneficiary survey (sample numbers: 100), interviews with headteachers and supervisors in the five states for the beneficiary survey

In light of the above, the levels of achievement of the two indicators set for the Overall Goal were favourable at the time of the ex-post evaluation. In particular, it was confirmed that more than 80% of primary school teachers who had participated in Local INSET practiced ASEI-PDSI in mathematics and science lessons while more than 70% of teachers who had not participated practiced it. These had participated in SBT and learned from their peers. This is based on the results from the limited area of the five states where the beneficiary survey was conducted. However, in sum, the general level of teaching skills of primary school teachers has improved and the level of achievement of the Overall Goal as of the time of the ex-post evaluation was favourable.

3.2.2.2 Other Positive and Negative Impacts

While the Super Goal of the project was "upgrading the capability of primary school pupils in mathematics and science education in the country," a measurement of the academic performance of primary school pupils in mathematics and science had not been conducted in Nigeria as of the ex-post evaluation. There are no exit examinations for public primary schools or entrance examinations for public secondary schools in Nigeria and it was impossible to collect verifiable data on changes in academic performance in mathematics and science in the ex-post evaluation. According to interviews with SUBEB, State Trainers and supervisors in the five states where the beneficiary survey was conducted, it was reported that some pupils in their states had accomplished good results in subject contests in mathematics and science at national level. However, it is not clear whether this was an effect of this project or not.

In addition, according to the interviews above, it was also reported that some State Trainers were lecturers at teachers' colleges in some states where they had explained part of SMASE ISNET to their fellow lecturers as well as directly teaching the contents of training to their students.

There were no reports of any serious negative impacts during the project period or after the project completion, and it is unlikely that any negative impact of the project will emerge in the future.

This project largely achieved Project Purpose 1: enhancement of the ability of primary school teachers to conduct student centred lessons in mathematics and science in the pilot states as well as Project Purpose 2: enhancement of the ability of State Trainers as INSET providers in primary mathematics and science education in the non-pilot states. In addition, the level of achievement of the Overall Goal is also favourable since

SMASE INSET has been continuously implemented by the Nigerian side since project completion. It has been confirmed that, in the areas where Local INSET were implemented, more than 70% of primary school teachers practiced ASEI-PDSI in their mathematics and science lessons and the general level of their teaching skills had improved whether or not they had participated in Local INSET so that the planned effects had been observed. Therefore, effectiveness and impact of the project are high.

3.3 Efficiency (Rating: ②)

3.3.1 Inputs

Inputs	Plan	Actual
(1) Experts	0 Long-Term 5 Short-Term (-)	0 Long-Term 10 Short-Term (87 MM)
(2) Trainees received	No description	27 persons
(3) Equipment	Computer, Copy machine, etc.	PC, Copy machine, Projector, Printer, etc.
(4) (Others)	No description	Approx. 75 million yen
Japanese Side Total Project Cost	497 million yen	520 million yen
Nigerian Side Total Project Cost	Approx. 2 billion NGN (1.2 billion yen at the exchange rate at the time of planning)	Approx. 430 million NGN (as of the terminal evaluation, 260 million yen at the exchange rate at the time of evaluation)

* MM stands for man month.

3.3.1.1 Elements of Inputs

The project inputs including the dispatch of experts, training and the provision of equipment from the Japanese side were as planned. While the number of experts dispatched was ten compared with the planned five, no additional input of experts was made since more than one expert was in charge of the same assignment (their assignment periods were, however, added due to the extension of the project period).

The total project cost on the Nigerian side was unclear as so many implementing agencies were engaged in the project as well as SMASE INSET having been continuously implemented in Nigeria even after project completion. It was therefore quite difficult for the respective agencies to clearly distinguish the cost they had spent by the end of the project and the cost they spent after project completion. On the other hand, the approximate cost calculated at the terminal evaluation in February 2013 was 430 million NGN, which was considerably lower than the planned budget of 2 billion NGN.

While it was planned that 90% of the total cost for INSET implementation was to be

borne by the Nigerian side, it was not disbursed as planned, as described above. Due to this, the accumulated total number of participants in Local INSET in the pilot states was 43,000, compared to the three times of 70,000 participants (210,000 for the accumulated total number) in the original plan. Similarly, the accumulated total number of participants in National INSET for the non-pilot states was 413, compared to the three times of about 400 participants (1,200 for the accumulated total number) in the original plan. Thus, the actual outputs of the project were less than the planned outputs, which was caused by the decrease in inputs (spending) on the Nigerian side[13].

3.3.1.2 Project Cost

As described above, the project cost rather exceeded the plan with an actual cost of 520 million yen as against a planned cost of 497 million yen. This additional cost was caused by an additional period of dispatch of experts due to the 7-month extension of the project period.

Therefore, the project cost was higher than planned.

3.3.1.3 Project Period

The actual project period exceeded the plan with an actual period of 43 months as against the planned period of 36 months. The extended project period was caused by the significant delay in the INSET schedule. It was impossible to implement National or Local INSET as planned due to the insufficient allocation of INSET funds. While it was planned that training materials for Cycles 1, 2 and 3 would be revised based on the implementation results of the respective Cycles, the revision was also delayed due to the delay in the INSET schedule.

Therefore, the project period was longer than planned.

Both the project cost and the project period exceeded the plan. Therefore, efficiency of the project is fair.

3.4 Sustainability (Rating: ②)

As shown in Figure 2 in "1.1 Background," it was planned that State and Local INSET in the non-pilot states would be implemented by Nigeria on its own accord after the project completion. Neither National INSET for the non-pilot states nor Local INSET in the pilot states, however, had been completed up to Cycle 3 by project completion. It was decided that these INSET would be continuously implemented up to Cycle 3 in addition

[13] Calculation based on the actual cost from the Nigerian side and the number of INSET participants as of the terminal evaluation. The rate of the actual cost to the planned cost is 21% whereas the rate of the number of participants to the planned number is 15% for Local INSET as well as 28% for National INSET.

to the State and Local INSET in the non-pilot states. Furthermore, estimating based on progress at the time of project completion, it was predicted by those involved that it would take approximately 10 years after project completion to complete all the remaining INSET.

The series of SMASE INSET was planned to be completed not only by this project. In addition, it was estimated at the time of the ex-post evaluation that this would take 7-8 years more to complete. The sustainability of the project effects should be therefore examined in this ex-post evaluation mainly from the perspective of whether SMASE INSET have been continuously implemented by Nigeria's own accord after project completion and whether Local INSET in the respective states is to be implemented up to Cycle 3. The ex-post evaluation mainly reviewed whether there were any special problems in the policy and institutional, organizational, technical and financial aspects which are necessary to continuously implement SMASE INSET in Nigeria.

3.4.1 Related Policy and Institutional Aspects for the Sustainability of Project Effects

The national development plan "Nigeria Vision 2020" as well as education sector policies such as the "National Policy on Education" and the "National Teacher Education Policy" are still effective as of the ex-post evaluation. Furthermore, the federal government continuously and strongly supports the implementation of SMASE INSET, which has been actually continuously implemented in Nigeria since project completion as described above.

Nigeria has a federal system and both the federal and state governments are responsible for educational administration in the country. The central (federal) government agencies among the project implementing agencies include FME, NTI, NCCE and UBEC and the respective SUBEBs are placed under UBEC while LGEA are placed in each LGA.

At the time of the ex-post evaluation, the introduction of SMASE INSET into teacher-training courses and levels of lower and upper secondary education was being considered among the implementing agencies at the central level. However, priority was given to the completion of current SMASE INSET as it is estimated that it will take 7-8 years more to complete SMASE INSET for primary school teachers throughout the country.

The state government policies on SMASE INSET differ from state to state; some states have a positive stance on implementing SMASE INSET and others are less positive. Nigeria experienced changes of government in 2015 and the state governor as well as the top of SUBEB were changed in some states. This meant that some states which were positive about SMASE INSET became negative and vice versa. The only

state which has not implemented SMASE INSET by policy is Lagos State. All other states have continued implementation after project completion since the federal government has a policy on the implementation in every state as well as SMASE INSET itself has been implemented by funds disbursed from UBEC to each state.

3.4.2 Organizational Aspects for the Sustainability of Project Effects

The implementation system of SMASE INSET has not changed since project completion and National, State and Local INSET have been implemented with almost the same system as that at the time of project implementation.

At the central level, members of the National Coordinating Unit (NCU) which consists of the central implementing agencies have been continuously engaged in SMASE INSET. Currently 20 officers are engaged in SMASE INSET in FME which leads NCU and the SMASE Coordinator of FME, who has been in charge since the time of the Phase 1 Project, has been continuously in charge of the general management of SMASE INSET, holding regular meetings with NCU members and listening to their opinions. There is no special organizational problem at the central level and no special management problems have been reported from the NCU members to FME.

At the state level, SUBEB officers (one officer called the “SMASE Desk Officer” and other officers in charge) have been mainly engaged in SMASE INSET and they have managed (implemented and monitored) State and Local INSET in the states (except for Lagos State). According to the “SMASE Nigeria INSET Guidelines” which show the administrative structure and procedures of SMASE INSET and which were made during project implementation, it is planned that Local INSET in the respective states will be managed by Zonal Implementation Committees and Zonal Coordinating Units to be established in each ‘Zone’ consisting of some LGAs. However, while it was planned that all primary school teachers in the country would participate in Local INSET, a decrease in the number of participants in Local INSET due to insufficient INSET funds has made it unnecessary to manage Local INSET per Zone and the SUBEB officers in charge have managed Local INSET in the same way as State INSET. According to the SMASE Desk Officers in the pilot states, FCT and Kogi, no special management problems in the management of State and Local INSETs have been identified.

SBT introduced during project implementation has also been introduced in the Guidelines above. Primary schools, however, are not obliged to implement SBT and the frequency and method of implementation of SBT are not specified. This has resulted in no information on the number of schools in practice nor on the situation of the practice of SBT in the respective states. According to the SMASE Desk Officers, while SBT has

been practiced in most schools in the pilot states and FCT, there is no information on the number of schools practicing SBT in Kogi State.

3.4.3 Technical Aspects for the Sustainability of Project Effects

According to the officers in charge of SMASE INSET in FME, UBEC, the pilot states, FCT and Kogi, as well as National and State Trainers and Core Teachers, there has been no special technical problem in implementing (planning, managing, monitoring and evaluating) SMASE INSET. While there is a certain level of difference in skills among the respective National and State Trainers and Core Teachers; e.g. some Core Teachers facilitate Local INSET more effectively than National and State Trainers do, trainers at the national, state and local levels have sustained the general technical level necessary for INSET trainers.

In addition, those involved in SMASE INSET have participated in the JICA Knowledge Co-Creation Program (Group and Region Focus) including courses such as "Improving Teaching Methods for Science and Mathematics in Primary Education" even after project completion. According to FME, the participants in the program courses were selected from a wide range of candidates, including primary teachers, based on recommendations from the respective SUBEBs. Furthermore, participation in the program courses has greatly contributed to motivating people concerned with SMASE INSET in addition to learning the program contents.

3.4.4 Financial Aspects for the Sustainability of Project Effects

Most budgets for the implementation of SMASE INSET were disbursed from the Teacher Professional Development Intervention Fund (hereinafter called the "TPD Fund") by UBEC during and even after project implementation[14]. The TPD Fund is a fund for the capacity development of teachers to be almost uniformly allocated from UBEC to all the states in the country every year. While the amount allocated to each state slightly differs depending on the size of each state, around 150 million Naira (approximately 80 million JPY) has been allocated to each sate every year.

While it was planned that the budgets for implementing State and Local INSET in the respective states would be borne mainly by the states themselves, some states, such as Kaduna, fell behind in implementation due to the failure in fully secured SMASE INSET fund[15]. Following this, a regulation on prioritizing in SMASE INSET was added to the Guidelines for Teacher Professional Development Programmes made by UBEC during the project period in 2012, which regulates how to use the TPD Fund for the

[14] Disbursed from the states' own educational budget for some states, their rates are small.
[15] Refer to Footnote 6.

states. Furthermore, the Guidelines were revised after project completion in 2014 and a new regulation added so that the SUBEB should include SMASE INSET in their action plans to be submitted to UBEC when applying for the fund. With this new regulation, UBEC has the policy not to disburse the fund to a state where SMASE INSET is not included in its action plans (except for Lagos)[16]. Table 9 and Table 10 show the total amount of TPD Fund disbursed from UBEC to all SUBEBs as well as the amounts of the Fund received and spent for SMASE INSET in the pilot states, FCT and Kogi in the last five years.

Table 9: Total Amount of TPD Fund Allocated from UBEC to All SUBEBs

Unit: Thousand NGN

2012	2013	2014	2015	2016
5,180,000	6,290,000	5,957,000	4,440,000	6,290,000

Source: Questionnaire response from UBEC

Table 10: Amounts of TPD Fund Received and Expended for SMASE INSET in the Pilot, FCT and Kogi States

Unit: Thousand NGN

States	Items	2011	2012	2013	2014	2015
Kaduna	TPD Fund received	161,000	161,000	161,000	161,000	120,000
	Expenditure on SMASE	60,000	30,000	30,000	25,000	20,000
Niger	TPD Fund received	150,000	140,000	170,000	160,000	120,000
	Expenditure on SMASE	76,572	46,000	59,165	47,186	8,657
Plateau	TPD Fund received	150,000	140,000	170,000	161,000	120,000
	Expenditure on SMASE	95,557	-	47,440	-	46,334
FCT	TPD Fund received	150,000	170,000	170,000	161,000	120,000
	Expenditure on SMASE	300[Note 2]	29,973	29,221	27,637	13,884
Kogi	TPD Fund received	NA[Note 3]	140,000	170,000	161,000	120,000
	Expenditure on SMASE	7,500	15,000	14,000	20,000	20,000

Source: Questionnaire responses from the respective SUBEBs

Note 1: The amounts above are based on the results of questionnaire responses from the respective SUBEB, so some of amounts are based on an approximate calculation. '-' in the table means that no INSET was conducted that year.

Note 2: State INSET has been implemented in FCT from 2012, so the expenditure on SMASE INSET in 2011 was only for the attendance fees for National INSET and the implementation cost for workshops.

Note 3: The amount of TPD Fund received in Kogi in 2011 was not available. The expenditure on SMASE INSET was disbursed from the state budget.

As seen above, the respective states implemented SMASE INSET (dispatch of State Trainers to National INSET[17] as well as implementation of State and Local INSET)

[16] The TPD Fund is the capacity development fund for all teachers including primary and lower secondary education teachers, and is not all available for SMASE INSET in the respective states. For example, the "Education Sector Support Programme in Nigeria (ESSPIN)" (2008-2017) funded by DFID has been conducted to develop effective planning, financing and delivery systems that will improve the quality of primary education in Enugu, Jigawa, Kaduna, Kano, Kwara and Lagos where TPD fund has been used for activities for ESSPIN as well as for SMASE INSET.

[17] The respective SUBEB have paid the participation fee for National INSET to NTI where National INSET is implemented.

using the TPD Fund even after project completion. All the states, however, have insufficient INSET budget for all of the primary school teachers in the states and have had to decrease the number of participants. Besides, according to the SMASE Desk Officers of the five states, while the monitoring cost for SMASE INSET has been budgeted as part of overall INSET budget, monitoring cost has not been secured as they have prioritized the implementation cost for INSET.

Meanwhile, the necessary budget for supervisors to monitor teachers' lessons in their schools has been budgeted in the regular budget of the state or LGA where they belong. According to 10 supervisors in the five states, however, there have been insufficient monitoring budgets together with difficulties in frequently visiting the schools in their charge. It has also been difficult for them to precisely check the practice of ASEI-PDSI using an original checklist as well as to carefully supervise teachers since they have originally monitored teachers' lessons based on the checklist used in their states or LGA.

Furthermore, according to10 State Trainers in the five states, a request was made to decrease the gap period between National and State INSET since a gap of almost one year had arisen from the time they participated in Cycle 1 of National INSET to the time they facilitated for Cycle 1 of State INSET and they were liable to forget the details of contents. This was mainly caused by a gap in the disbursement of the TPD Fund; it takes around two years for the respective SUBEB from the time of applying for their TPD Fund to UBEC to the time of receiving it, which has resulted in their being unable to implement State INSET immediately after National INSET. This delayed disbursement of budget, however, is quite usual in Nigeria and the disbursement of a regular budget is frequently delayed in ministries and agencies. This issue is not easy solved due to it being a common issue for government agencies in Nigeria.

Thus there is a financial problem in the continuous implementation of SMASE INSET.

Some minor problems have been observed in terms of the financial aspects. Therefore, the sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objectives of this project were 1) to enhance the ability of primary school teachers of mathematics and science in the three pilot states by conducting INSET on teaching methods for student centred lessons and 2) to enhance the ability of State Trainers as INSET providers in primary mathematics and science education while establishing a system to implement INSET in other states across the country. Through the achievement

of the objectives, the project aimed to raise the general level of teaching skills of primary school teachers in mathematics and science education in the country and to improve the future capability of primary school pupils in mathematics and science education.

This project was consistent with the development plan and development needs of Nigeria, as well as with Japan's ODA policy in view of quality improvement of education. Therefore, the project relevance is high. The project contributed to enhancing both the abilities of primary school teachers of mathematics and science in the three pilot states and State Trainers as INSET providers in primary mathematics and science education in other states. In addition, it is also confirmed that the general level of teaching skills of primary school teachers in mathematics and science education had been enhanced in the area where INSET was introduced as of the time of the ex-post evaluation. The project therefore has produced its desired effects including those effects which were expected for the future, the result being that its effectiveness and impact are high. On the other hand, both the project cost and the project period exceeded the plan due to insufficient and delayed allocation of INSET funds which frustrated the planned implementation of INSET schedule. Thus the efficiency of the project is fair. The sustainability of project effects is also fair since the funds for INSET implementation and monitoring were still insufficient due to its implementation nationwide. However, no special problem has been identified in the institutional, organizational and technical aspects.

In light of the above, this project is evaluated to be satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

(1) While the implementation budget for National, State and Local INSET is secured from the TPD Fund by UBEC to a certain extent, the respective SUBEB basically have to disburse the monitoring costs for SMASE INSET from their regular budget. Some SUBEB have difficulty in fully monitoring INSET implemented in their states and in obtaining information on the progress and effects of INSET due to the insufficient monitoring budget. The Guidelines for Teacher Professional Development Programmes stipulates that SMASE INSET should be included in action plans for the TPD Fund. It is recommended that FME issue a circular notice to encourage the respective state governments to allocate a budget for the monitoring of SMASE INSET from their state budgets in order for the respective SUBEBs to request their state governments for the monitoring budget in their state regular budgets.

(2) While SMASE INSET has been continuously implemented since project completion in Nigeria, the measurement of academic performance in mathematics and science by primary school pupils has yet to be conducted, although this is set as an indicator for the project super goal. Only three years have passed since project completion and it is estimated that completion of SMASE INSET will take 7-8 years as of the ex-post evaluation. This leads to prioritization in INSET implementation to the measurement of project impact. It is desirable that changes in academic performance in mathematics and science by primary school pupils are measured in the future in order to obtain the specified information on the effects of INSET. It is recommended that the members of the National Coordinating Unit consider how and when they should measure the changes in the academic performance of primary school pupils in mathematics and science and make future plans for the measurement.

(3) SBT was introduced in the project in addition to the cascade-system INSET and it was found at the beneficiary survey conducted by the ex-post evaluation that 80% of primary school teachers who had not participated in Local INSET had participated in SBT for SMASE INSET in the three pilot states, FCT and Kogi. Furthermore, it was confirmed that participation in SBT only had similar effects to participation in SMASE INSET. The frequency and method of SBT, however, have not been uniform and the quality of SBT differs from school to school. To improve the general quality of SBT as well as to maintain the level among schools, it is recommended that the respective SUBEB and LGEA promote the implementation of SBT at primary schools in their states and that LGA also encourage supervisors to add guidance on matters such as the frequency and method of SBT, as well as advice on the content of training etc. in their monitoring activities at schools.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

(1) <u>Introducing alternative means in cases where there are difficulties in the planned implementation of project activities due to financial constraints</u>

Although in the original project plan basically all primary school teachers should have participated in SMASE INSET where the implementation of SBT was not included, it was found half way through the project that it was financially impossible to pay for all the teachers. As a countermeasure for some teachers being unable to participate in

INSET, SBT was introduced where some participants shared what they learned in INSET with their peers. To promote this sensitization, workshops for those involved in SMASE INSET were held as part of the project activities and all primary school headteachers and supervisors in the pilot states were invited to these workshops and encouraged to implement SBT for SMASE INSET in their schools and states. As a result, it was confirmed at the ex-post evaluation that SBT had been implemented in almost all schools where there were participants in SMASE INSET in the pilot states and that the implementation in the non-pilot states such as FCT had been encouraged by UBEB, headteachers and supervisors. Thus, even if there is a financial constraint which means only a limited number of teachers are able to participate in INSET, it is possible to solve this constraint by introducing alternative means of low-cost training such as SBT, which enabling the dissemination of the training contents to more and more teachers.

(2) Necessity of careful and thorough examination and consideration in setting the project scope

The project site was the whole of Nigeria and the Overall Goal was to upgrade the teaching skills of all primary school teachers in the country through participation in SMASE INSET. Nigeria, however, is the most populated country in Africa and the number of schools and teachers at the primary education level is huge. They exist in every LGA, even where schools at the secondary and higher education levels do not. Furthermore, Nigeria has not a centralized but a decentralized system with a federal governing structure. Implementing nationwide training in a single uniform way in such a country is difficult for the central government agencies as they experience problems in obtaining information on the situation of the implementation of training and consolidating the management of it. It is also quite difficult to firmly establish training systems and contents through the wide and shallow implementation. In addition, as described in the lesson learned above, the cost of implementing INSET is huge with primary school teachers across the country. It can be thus seen that to implement unified INSET for primary school teachers in the whole country is equal to a national program and the size of the project site and the number of target persons were too much for a single technical cooperation project of usual size. It is therefore important that the project scope is carefully examined at the project planning with thorough consideration of the conditions of the recipient country including the target number, the affordable cost burden, the governance system, etc.

Republic of Niger

FY2016 Ex-Post Evaluation of Technical Cooperation Project[1]

"The Project on Strengthening of Mathematics and Science in Secondary Education in Niger Phase 2 (SMASSE-NIGER Phase 2)"

External Evaluator: Yutaka Yamaguchi, International Development Associates Ltd.

0. Summary

The project implemented training to strengthen the capacity of teachers in mathematics and science in secondary education principally by means of In-Service Training (hereinafter referred to as "INSET") which introduced an approach to teaching methods (called the ASEI-PDSI approach[2]) and developed teaching materials.

From the time of ex-ante evaluation to ex-post evaluation, the improvement in the quality of education has been consistently proposed as a policy goal in Nigerien development policies. In addition, it had become an important issue to improve the quality of education by offering INSET to the increasing number of contract teachers. Further, the project is in accordance with the development policy of Japan at the time of planning, therefore its relevance is high. In connection with the project purpose "The capacities of mathematics and science teachers are strengthened through quality INSET", achievement of the targeted indicators for the implementation of ASEI-PDSI was confirmed and its effectiveness proved to be high. With regard to the overall goal "The ability of Base II and Middle Education Cycle students in mathematics and science is improved", the results of the beneficiary survey were employed as an alternative indicator, since the ratio of successful applicants for First Cycle Studies Certificate in Secondary Education (hereinafter referred to as "BEPC"[3]) proved to be inappropriate as an indicator to measure the level of academic achievement of students. The results of the beneficiary survey confirmed that there existed changes in the attitudes of students in the mathematics and science classes. The favorable changes in attitudes of students in class are considered to lead to an improvement in the academic achievement of students, which proves the positive impacts of the project. However, it was also confirmed that there exist many external harmful factors which produce negative influences on the achievement of the overall goal. These external harmful factors include a rapid increase in the number of

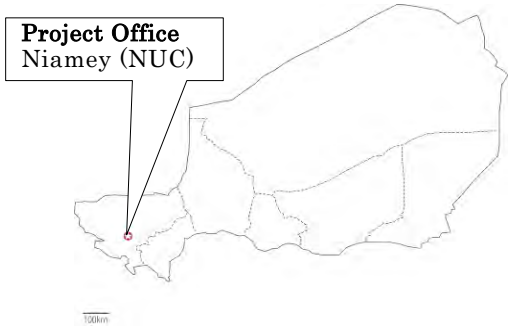
[1] In order to objectively measure the extent of improvement in science and mathematics classes at the time of ex-post evaluation, this ex-post evaluation also carried out in depth analysis by a Japanese researcher who had wide experience of direct and indirect involvement in the science and mathematics education improvement projects implemented by JICA in Asia and African countries. Selection of the researcher was done by the external evaluator, and subsequently agreed by JICA.

[2] Abbreviation of "Activity, Student-centered, Experiment, Improvisation-Plan, Do, See, Improve", the catch words for the approaches that the project pursues, which represents the directions for the improvement of the lessons and the methodologies for them, through the active participation by the students, enhancing practical knowledge and promoting scientific and logical thinking in the class. Please refer "3.2.1.2 Achievement of Project Purpose" for further information.

[3] Brevet d'Etude du Premier Cycle (BEPC)

students, lack of basic academic ability in primary education, some issues related to education in French, an increase in the number of contract teachers, and reduction in teaching hours due to strikes carried out by teachers and school boycotts by students. Considering these factors, the level of its effectiveness and impact is fair. The efficiency of the project is judged to be high, which is cost-efficient having its cost lower than planned and finished within its planned project period. Furthermore, the sustainability of the project is high. In order to continue INSET, the project owns necessary conditions in policy and institution background, in addition to that, which also secured necessary conditions in organizational, technical and financial aspects of the implementation agency. In light of the above, this project is evaluated to be highly satisfactory.

1. Project Description



Project Location (Niamey Urban Community and 7 regions)

Lesson on one of the mathematics and sciences subjects in a school of the first cycle of secondary education (Base II)

1.1 Background

In October 2003, the government of Niger issued the "Ten-Year Education Development Program (PDDE)" in relation to the expansion of primary education and aimed to achieve "Education for all (EFA)" by 2015 through the implementation of this program. In response to this, many development partners collaborated in primary education to expand it. However, support by development partners was limited in secondary education and which did not show much development.

According to the document for the preparatory study of the project, there existed approximately 470 public secondary schools and 6,200 teachers, 2,262 of which were in mathematics and science, at those schools in 2006. However, approximately 80 % of them were contract teachers, and most of them had not received teacher training or professional education in a Faculty of Education in university education. In addition, it cannot be said that the quality of education was high in secondary education. In most of secondary education, education that places emphasis on letting students memorize what is written on

the blackboard was prevalent, in which the level of understanding by students was not taken into consideration very much.

Therefore, it was indicated as an imminent issue to strengthen the capacity of core human resources and teachers in mathematics and science by INSET and other measures, in order to improve the quality of secondary education which places a basis for development of human resources playing important roles in the future of Niger.

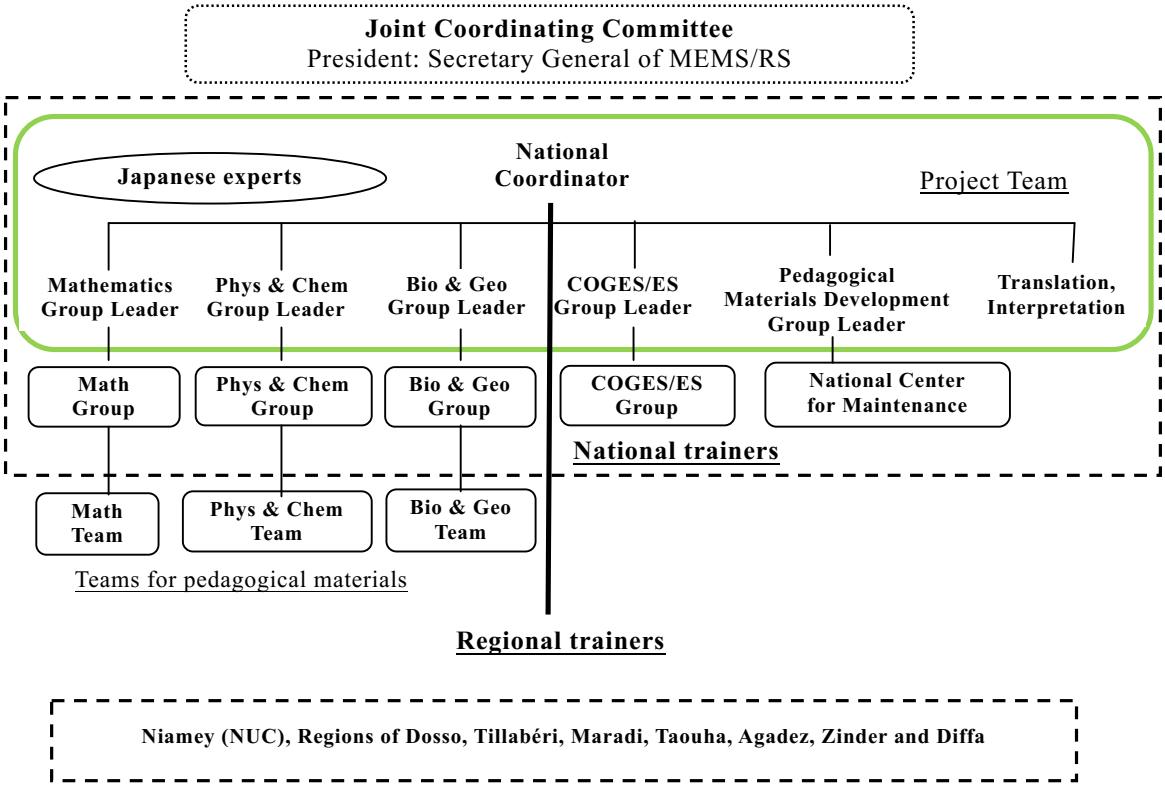
With this background, Japan International Cooperation Agency (JICA) implemented a technical cooperation project "Strengthening of Mathematics and Science in Secondary Education in Niger (SMASSE-Niger)" (hereinafter referred to as "Phase 1") for three years from October 2006 to October 2009. The Phase 1 project conducted INSET in the three Regions of Niamey, Tillabéri and Dosso. After that, the government of Niger recognized the effects of the Phase 1 and requested the Japanese government to cooperate in a successive project to extend the implementation of the INSET to all of the eight Regions of the country and establishing a system of INSET.

1.2 Project Outline

Overall Goal		The ability of Base II and Middle Education Cycles students in Mathematics and Science is improved.
Project Purpose		The capacities of Mathematics and Science teachers are strengthened through quality INSET.
Output(s)	Output 1	The capacities of National Trainers are reinforced.
	Output 2	The National and Regional Training Structure is established.
	Output 3	The supporting system for the INSET Project is strengthened.
Total cost (Japanese Side)		226 million yen
Period of Cooperation		March 2010 to September 2013
Implementing Agency		Ministry of Secondary Education (MES); Ministry of Secondary and Higher Education, Research and Technology (MESS/R/T) at the time of ex-ante evaluation was renamed to Ministry of Higher Education and Scientific Research (MEMS/RS) during the project implementation period, which was changed into the MES in August 2013.
Other Relevant Agencies / organizations		-
Supporting Agency/Organization in Japan		-

Related Projects	Technical cooperation: "Strengthening of Mathematics and Science in Secondary Education in Niger" Phase 1 (2006 - 2009), (SMASSE-Niger), "School for All: The project on Support to Educational Development through Community Participation" (hereinafter referred to as "School for All Project Phase 1") (2012 - 2016), "School For All: The Project on Support to Educational Development Through Community Participation Phase 2" (hereinafter referred to as "School for All Project Phase 2") (2016-2020), Follow-up Cooperation for Strengthening of Mathematics and Science in Secondary Education in Niger Phase 2" (Follow-up Cooperation for the project, hereinafter referred to as "Follow-up Cooperation") (2014) Grant Aid: The Project for Construction of Secondary School in Niger (Grant Agreement signed in 2013)

The following is the organizational chart of the project.



Note: COGESS/ES stands for "School Management Committee/ Secondary Education"
Source: Prepared based on Report of the Terminal Evaluation of the Project (JICA).

Figure 1: Implementation System of the Project

The Niger education system has six years of primary education, four years for the first cycle of secondary education (also called Base II), and three years for the second cycle of secondary education (also called Middle Education). The Phase 1 was concerned with the first cycle of secondary education. The project for this ex-post evaluation was concerned with both the first and the second cycles of secondary education. The Group Leaders of the project principally played a leading role in developing training texts/programs and new pedagogical materials for INSET, and conducted training in mathematics, physics/chemistry and biology/geology. For the purpose of developing pedagogical materials, a team for pedagogical materials for each subject was organized. National Inspectors were assigned to the posts of Group Leaders for the three subjects in mathematics and science, who had expert knowledge on these subjects and a wealth of teaching experiences. As indicated in Figure 1, INSET was conducted in a cascade method which was composed of centralized training conducted by national trainers who trained the regional trainers. Subsequently, the regional trainers conducted training at the regional level.

1.3 Outline of the Terminal Evaluation

1.3.1 Achievement Status of Project Purpose at the Terminal Evaluation

Regarding the achievement of the project purpose, teachers' attitudes were evaluated from indicators of PDSI, and students' activities were evaluated by using indicators of ASEI. Teachers' attitudes obtaining a score of 2.3 which was higher than its targeted score of 2.0, which showed an improvement. Students' attitudes toward mathematics and science subjects obtained a score of 2.0 which was also higher than its targeted score of 1.5. Therefore, the project purpose was judged as being achieved.

1.3.2 Achievement Status of Overall Goal at the Terminal Evaluation (Including other impacts.)

Although the ratios of successful applicants for BEPC showed a tendency to improve from 2010 to 2012, the ratios fluctuated depending on certain years in the previous years and it was difficult to analyze only the results in mathematics and science subjects separated from other subjects, as the ratios of successful applicants were made public only as aggregated results of all of the subjects. While many positive impacts were observed throughout the project, there existed negative factors in the examination of the achievement of the overall goal, such as a reduction in school hours caused by strikes carried out by teachers and deteriorating learning environments due to an increased number of students per class.

1.3.3 Recommendations from the Terminal Evaluation

At the time of the Terminal Evaluation, the following five recommendations were made. The recommendations from (1) to (4) were submitted to the Ministry of Higher Education and Scientific Research (MEMS/RS) and the recommendation (5) was submitted to the project team while they were active until the completion of the project.

(1) It is to be desired that the Ministry applies training methods and pedagogical techniques to other subjects.

(2) Establishment of a Department dedicated only to training of teachers, making good use of the human resources developed by the project.

(3) Extension of the pedagogical materials and their promotion

(4) Establishment of a system of teacher training and conducting teacher training continuously

(5) Reflecting experiences of the project on its operation plan in order to realize policies related to education quality

2. Outline of the Evaluation Study

2.1 External Evaluator

Yutaka Yamaguchi, International Development Associates Ltd.

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: August, 2016 – September, 2017

Duration of the Field Study: November 7, 2016 – November 25, 2016

February 17, 2017 – February 24, 2017

2.3 Constraints during the Evaluation Study

In the western part of Niger, armed groups invaded from the neighboring country, Mali. In addition, in the southeastern part of Niger, Boko Haram provoked armed conflicts extending terrorism and kidnappings. Furthermore, strikes carried out by teachers and school boycotts by students continued at a national level. Because of these conditions, surveys conducted by the interview method organized by the external evaluator and a subsequent beneficiary survey conducted by local consultants were only completed in Niamey. As to the situation outside of Niamey, those who had teaching experiences in other regions were interviewed in Niamey. Relevant documents on the implementation of regional training were collected.

3. Results of the Evaluation (Overall Rating: A[4])

3.1 Relevance (Rating: ③[5])

3.1.1 Consistency with the Development Plan

The project is highly consistent with the development plan. With regard to development policies in the education sector, improvement in education quality has been consistently proposed. This development policy for improved education quality contained in the "Ten-Year Education Development Program (PDDE)" also continued in the "Education and Training Sector Program 2014-2024 (PSEF)" which was approved just before the completion of the project. It can be said that PSEF places more emphasis on quality in secondary education than the former program. It is because concerns have begun to increase over the ominous repercussion of rapidly expanding quantity in primary education and the effects on the quantity and quality in secondary education. In PSEF, the direction to place more emphasis on mathematics and science education proceeds.

3.1.2 Consistency with the Development Needs

The project is highly consistent with the development needs. The number of contract teachers was increasing according to the data both in the annual report of the Ministry of Secondary and Higher Education, Research and Technology (MESS/R/T) at the time of ex-ante evaluation and the annual report of the Ministry of Secondary Education (MES) at the time of project completion. On the other hand, pre-service training (hereinafter referred to as PRESET) in universities could not cope with the rapidly increasing needs of teacher preparation. Therefore, improvement of teachers' quality by INSET became an important issue.

3.1.3 Consistency with Japan's ODA Policy

Consistency with Japan's cooperation policy is high. "ODA Country Factbook 2009 of Japan" indicates expansion in quantity and quality of basic education including the first cycle of secondary education as a priority area of Japanese cooperation toward Niger in 2009. Accordingly, the purpose of the project, "The capacities of mathematics and science teachers in secondary schools are strengthened through quality INSET", is in accordance with Japan's cooperation policy. The project was one of the various Japanese technical cooperation projects for the improvement of education in mathematics and science in Africa including Kenya by introducing teacher training, in which Japan had a comparative advantage.

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[4] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[5] ③: High, ②: Fair, ①: Low

In light of the above, this project was highly relevant to the country's development plan and development needs, as well as Japan's ODA policy. Therefore, its relevance was high.

3.2 Effectiveness and Impact[6] (Rating: ②)

3.2.1 Effectiveness

3.2.1.1 Project Output

National inspectors worked for the project played a principal role in producing training texts /modules, and in developing new pedagogical materials for INSET in the three subjects of mathematics and science, 1) Mathematics, 2) Physics and Chemistry and 3) Biology and Geology. Evaluation results given by trainees on training materials were good. Thus "Output 1. The capacities of National Trainers are reinforced" could be regarded as mostly achieved by the time of project completion.

"Output 2. The national and regional training structure is established" was achieved, although during the implementation period of the project, the execution of a part of the training was delayed due to an increase in the government's expenditure caused by the Northern Mali Conflict. INSET was conducted in a cascade method which was composed of national and regional training. The project team planned the training. A training system was established for the training. For regional trainers, national training was conducted at the National Center for Maintenance of Pedagogical Materials. The national training was conducted by national trainers whose capacity had been enhanced by the project. Then regional training was implemented by the regional trainers in training sites in each Region.

"Output 3. The supporting system for the INSET project is strengthened" was achieved in the main. As scheduled, the project strengthened the roles of school principals and the School Management Committees in Secondary Education (COGES/ES) for the purpose of supporting INSET in mathematics and science. Institutionalization of an INSET system did not finish within the period of the project. This is because the Ministry of Secondary Education was newly established and took time in its administrative restructuring, although the MEMS/RS had already started the examination of institutionalization of INSET since the closing seminar held before the completion of the project. Hence, a part of Output 3 left unaccomplished. After the end of the project, the MES finished and approved the Guidelines[7] for INSET system.

3.2.1.2 Achievement of Project Purpose

During the project period, achievement was confirmed with both of the indicators of

[6] Sub-rating for Effectiveness is to be put with consideration of Impact.

[7] MES, "Guidelines for In-service and Pre-service Training in Niger" (2015)

the project purpose, Indicator a. Teachers' attitudes and practice of ASEI-PDSI and Indicator b. Students attitude toward the mathematics and science classes.

ASEI are the first letters of Activity (toward a class with activity-based learning), Student-centered (change a teacher-centered class to a learner-centered class), Experiment (from theoretical learning to a class that includes experiments and practicum) and Improvisation (a class with simple experiments using improvised materials), which was used as an indicator to evaluate students' attitudes in class in the evaluation of the project. PDSI are the first letters of Plan, Do, See and Improve, a cycle of daily improvement and impetus to change the way of managing a class, which was used as an indicator to evaluate attitudes of teachers in the evaluation of the project. In checking the details of each indicator, a general improvement was observed in both of the indicators, and in all of the indicators of PDSI and those of ASEI. Therefore, it can be said that the project purpose was achieved.

Table 1: Achievement of Project Purpose

Project Purpose	Indicator	Actual
The capacities of Mathematics and Science teachers are strengthened through quality INSET.	Indicator a: Teachers attitude and practice of ASEI-PDSI obtain no less than 2.0 as the mean of ASEI-PDSI indicators based on the Project's monitoring and evaluation (M & E).	According to the survey conducted in 2013, a score higher than the target score of 2.0 was obtained (out of 4 point). The project purpose was achieved. The score was 1.0 by the baseline survey conducted in 2010 at the beginning of the project.
	Indicator b: Students involvement in class obtains no less than 1.5 as the mean based on Project's M & E.	According to the survey conducted in 2013, a score of 2.0, which was higher than the target score of 1.5 was obtained (out of 4 point). The project purpose was achieved. The score was 0.6 by the baseline survey conducted in 2010 at the beginning of the project.

Source: Report of the Terminal Evaluation of the Project (JICA)

3.2.2 Impact

3.2.2.1 Achievement of Overall Goal

(1) The academic ability of the students of the first cycle of the secondary education is improved. (Overall Goal)

BEPC is an indicator for the overall goal as a national end-of-year examination. The ratios of successful applicants who sat for BEPC showed a tendency to improve from 2010 (before the project began) to 2013 (when the project completed), and after the completion the ratios continued to rapidly decrease and increase. In addition, it was impossible to analyze only the results in mathematics and science subjects separated from other subjects, as the results of BEPC were judged with the results of all the subjects combined.

Furthermore, rapid changes in the ratios of successful applicants of BEPC were unusually large. A clear explanation has not been given as to the changes in the ratios and students' academic achievement by the Ministries that conducted those BEPC examinations. Further, no national examination other than BEPC is conducted in the first cycle of secondary education. Meanwhile, the Division of Academic Achievement Follow-up (DSAS) was created to measure changes in academic achievement produced by training within the Department of Pre-service and In-service Training (DFIC) in 2016; however, the DSAS is still in the process of developing its organization and has not initiated its activities yet. Therefore, it was confirmed that the measurement of academic achievement using the ratios of successful applicants of BEPC was difficult, due to the factors mentioned above and the fact that the influences produced by external conditions were substantial as described below, which affect all the subjects of secondary education.

Table 2: Ratio of Successful Applicants for
First Cycle Studies Certificate in Secondary Education (BEPC)

2010	2011	2012	2013	2014	2015	2016
31.4%	35.9%	48.2%	46.8%	26.6%	45.9%	30.2%

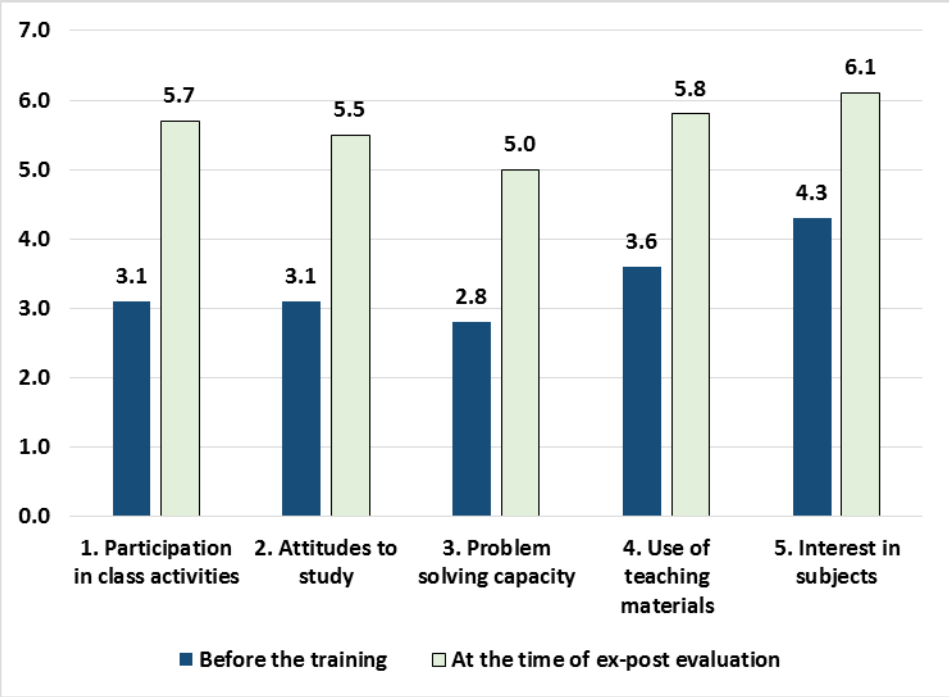
Source: Report of the Terminal Evaluation of the Project (JICA), Documents of DFIC, MES Statistical Yearbook (2017 provisional)

(2) Teachers' evaluation about changes in students' attitudes (alternative indicator)

Results of the questionnaire survey to teachers in the beneficiary survey[8] were employed as an alternative indicator to measure changes in academic achievement of students in relation to the overall goal. Questions were asked to compare before the training and at the time of ex-post evaluation about changes in the attitudes of students (these changes correspond to Indicator b. Changes in the attitudes of students toward science and mathematics) observed by teachers who had received the training from the project. This is because it is conceivable that improvements in the attitudes of students in the classes of mathematics and science are quite likely to lead to improvements in the academic achievements of students. Targeting only trained teachers has an

8 In December 2016, a questionnaire survey was conducted to 101 teachers in mathematics and science who had received training by the project. The public secondary schools where the teachers work were chosen at random out of all of the five school districts of Niamey. The 101 teachers were selected, considering the real distribution of teachers among the three subjects of mathematics and science. The composition of number of the teachers with their subjects in charge was as follows: Mathematics 40, Physics and Chemistry 30, Biology and Geology 29, Mathematics and Physics/Chemistry 1, all of the three subjects of Mathematics, Physics/Chemistry and Biology/Geology 1. The 101 teachers break down into 79 male (78%) and 22 female (22%) teachers. (The percentages of male and female teachers in secondary schools in Niger were 75% and 25% respectively. There has been little or no change in the percentages, since school year 2013-2014 when the project completed.)

advantage of preventing the negative influences of external conditions such as subjects other than mathematics and science or recent increase of contract teachers.



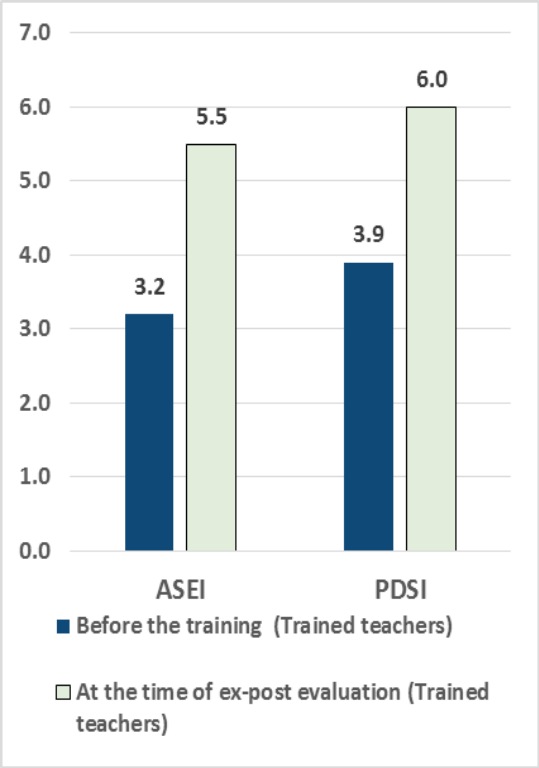
Source: Beneficiary survey conducted by the ex-post evaluation
Note: Teachers evaluated their students' attitudes applying the seven-grade evaluation system

Figure 2: Students' Attitudes, Evaluation by Trained Teachers in Mathematics and Science

According to the results of this beneficiary survey, teachers evaluated that there existed improvement in students' attitudes in classes of mathematics and science, comparing before the training and at the time of ex-post evaluation (when the beneficiary survey was conducted in December 2016) (Figure 2). Favorable changes were reported in all of the five points of view: "Participation in class activities", "Attitudes to study", "Problem solving capacity", "Use of teaching materials" and "Interest in subjects". The same tendency was confirmed for both male and female teachers. The first four points of views[9] were about the changes in students' activities expected to be produced as a result of changes in teachers' attitudes through the class evaluation and monitoring conducted by the project. The last point of view, "Interest in subjects", was often indicated as an effect of training in the report of the Mid-Term Review of this project and also in the interviews to teachers in the ex-post evaluation.

[9] These four points of views for evaluations were used to observe changes in students' attitudes with a "Class Evaluation Sheet" prepared by the project for class evaluation and monitoring based upon the ASEI-PDSI approach.

Accordingly, these changes can be regarded as effects of change in teachers' attitudes (teaching capacity) (PDSI indicator), which are likely to lead to improvement in academic achievement of students namely impacts of the project. Thus, it was confirmed that there were changes in students' activities which will lead to improvement in their academic activities, with the beneficiary survey to teachers who had received the training using the alternative indicators.



Source: Beneficiary survey conducted by the ex-post evaluation
Note: Teachers evaluated their own activities and their students' activities from the points of view of ASEI-PDSI, applying the seven-grade evaluation system. Sample size: 101 trained teachers and ten untrained teachers in mathematics and science

Figure 3: Evaluation of Lessons by ASEI-PDSI
Comparison between
before and at the time of evaluation

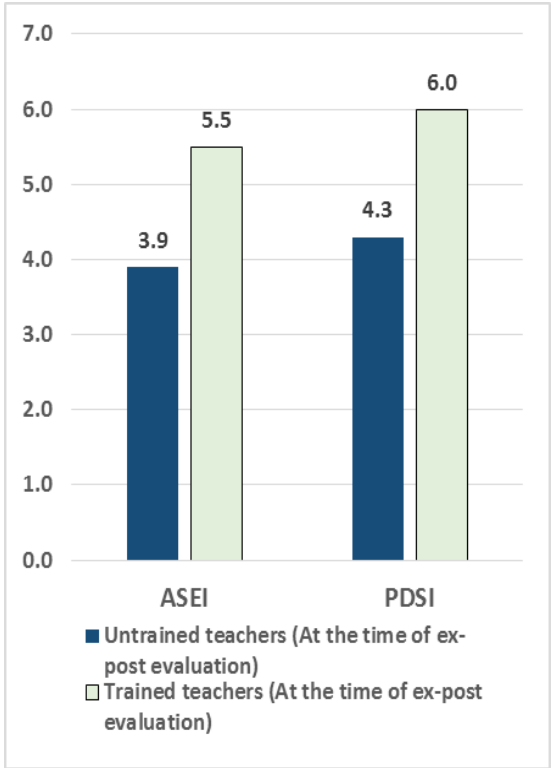


Figure 4: Evaluation of Lessons by ASEI-PDSI
Comparison between
untrained and trained teachers

Likewise, an improvement was observed in both ASEI indicators to evaluate students' attitudes toward mathematics and science class and PDSI indicators to evaluate teachers' activities, according to the results of teachers' self-assessment of their class using ASEI-PDSI indicators, comparing before and after the training. Furthermore, differences were noted even when we compare the above results with the assessment of students' attitudes in lessons by untrained teachers by themselves, which

was lower than that of trained teachers, though the sample size was small[10]. These tendencies were equally observed, when the survey results were analyzed by gender. In light of the above, it can be presumed that there was an improvement in the teaching capacity of the teachers trained by the project.

(3) Situation of INSET after the project completion

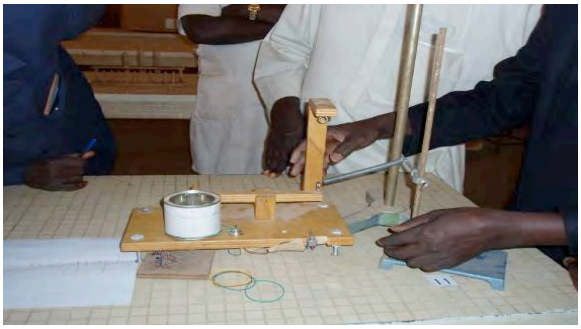
After the completion of the project, the system of national and regional training has become well-established and the training continues. Through the system, delayed regional training were implemented; training contents were extended by lesson studies at the school level and the capacity of newly contracted teachers was improved, all of which contributed to the overall goal, "the improvement of the ability of secondary school students in mathematics and science" by strengthening the teaching capacity of mathematics and science teachers. Various types of training started to be implemented in addition to SMASSE type training implemented by the project (mathematics and science INSET based upon the ASEI-PDSI approach). Principally, three types of training are being conducted under the oversight of the DFIC: 1) SMASSE type training in mathematics and science, 2) Lesson studies by Pedagogic Units, and 3) PRESET for contract teachers. All of these activities of the DFIC were confirmed by interview and questionnaire surveys.

In December 2014, continuing the training system of the project, the DFIC conducted SMASSE type regional training for 612 teachers with funds from the national budget, the implementation of which was scheduled during the term of the project. Although the number of the participants was less than the planned number of 900, the DFIC conducted additional training for 972 teachers supported by United Nations Children's Fund (UNICEF) in 2016. Audio-visual training materials such as videos of model lessons were used in the above training which was conducted after the completion of the project, which was useful for an effective implementation of training. In addition, the DFIC plans to conduct similar training in mathematics and science. The plan has been included in the annual action plan of PSEF for 2017 (PAA2017).

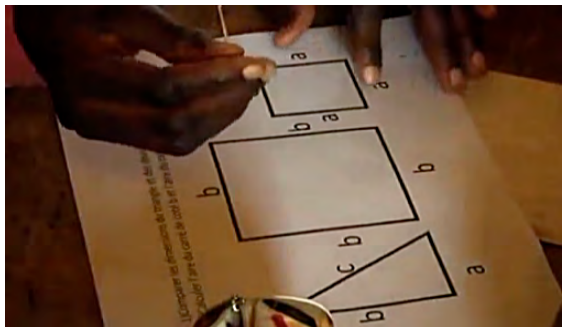
The activities of Pedagogic Units (groups of teachers who teach the same subject) were stagnated and inactive since long before the beginning of the project and were

[10] In December 2016, a questionnaire survey was conducted to ten teachers in mathematics and science who had not received training by the project. The six public secondary schools where the teachers work were chosen at random out of the 3rd and the 4th districts of the five school districts of Niamey. The two districts were also selected at random. A questionnaire survey based upon ASEI-PDSI evaluation points identical to that of trained teachers was conducted to the ten teachers who had not received training of the project. The ten teachers were selected, considering the real distribution of teachers among the three subjects of mathematics and science. The composition of number of the teachers and their subjects in charge are as follows: Mathematics 4, Physics and Chemistry 3, Biology and Geology 3. The ten teachers break down into seven male and three female teachers.

limited mainly to adjustments of lesson schedules and normal communication among teachers, according to interview survey results. The project and its Follow-up cooperation promoted arrangements for an In-School INSET using Pedagogic Units as a system of INSET at the school level[11]. Furthermore, a system was created to conduct training by multiple Pedagogic Units in supporting each other, combining several neighboring schools into a cluster. With this system, an integrated system of training was established utilizing Pedagogic Units in addition to training in the cascade method by the project. This organization is able to provide significant direction for improvement, although it is not an easy task to promote the activities of Pedagogic Units. Financial support from the Quality Education Support Project (PAEQ 2014-2018) of the World Bank was also allocated to training by the DFIC to promote Pedagogic Units' activities in 2016.



A teaching material for a laboratory experiment in geoscience developed by the project (seismograph)



A teaching material used in model lessons in mathematics

PRESET has high needs. By school year 2015-2016[12], the number of contract teachers increased by 109% compared with the time of ex-ante evaluation, increasing to as many as 10,351. The DFIC is in charge of PRESET for the increasing number of newly contracted teachers in secondary education. PRESET for contract teachers had been conducted and suspended before the beginning of the project according to the

[11] Already existed teachers' groups of the same subject are currently called as Pedagogic Units by Subjects. Implementation of lesson studies were added to the functions of them. Implementation of In-School INSET become clearly a part of their functions. In addition, Pedagogical Units were also created organizing teachers of multiple neighboring schools in natural science and humanities to identify training needs and conduct lesson studies on specific issues. The foundation of these are defined by Ministry Decree No. 00186 of April 30, 2015 on the creation and the roles of Pedagogical Units by Subjects (UPD), Pedagogical Units for Scientific Subjects (UPS) and Pedagogical Units for Literature and Human Sciences (UPL/SH). Lesson studies by Pedagogical Units were initiated by the project. Then the Follow-up cooperation promoted the development of the system. The arrangements for the establishment of a system progressed, however it seems that it still takes time to begin to conduct their practical activities sufficiently.

[12] School years in Niger begins in September or in October and ends in June or in July, the dates of which differ slightly depending on year. In this report, a school year which begins in 2015 and ends in 2016 is described as 2015-2016.

DFIC, and restarted in the last school year of the project of 2013-2014[13]. Then until the time of ex-post evaluation, the DFIC has been implementing the training continuously supported by the World Bank's PAEQ. Regional inspectors work as trainers for PRESET for contract teachers, in mathematics and science with many of them being former regional trainers of the project. The contents of the present PRESET include preparation of lesson plans based upon ASEI-PDSI.

(4) Negative external factors for the overall goal

Following are possible major negative factors which prevent the outputs and the project purpose from producing continuing effects on the overall goal indicators: (a) Deterioration in learning environments by a rapidly increasing number of students, (b) Lack of basic academic ability in primary education, (c) Problems caused by difficulty in learning French which is a prerequisite for academic ability, (d) Increasing the number of contract teachers, (e) Reduction in teaching hours due to strikes carried out by teachers and school boycotts by students.

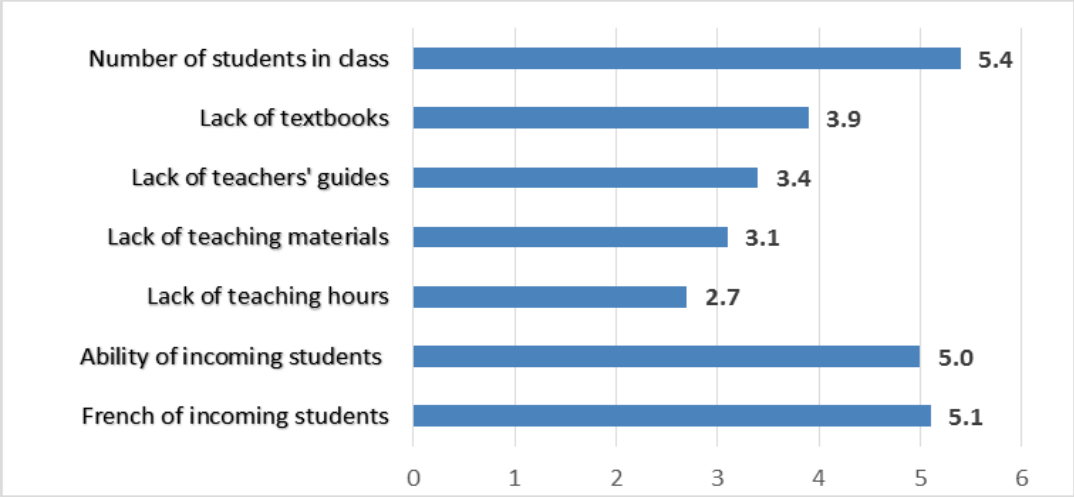
Learning environments seem to have deteriorated due to an increased number of students per teacher in public secondary education, which is demonstrated in the estimated average number of students in a class with regard to changes in the student-teacher ratio. According to MES statistics, the number of students in the first cycle of secondary education increased by approximately 126% in six years, from 253,643 in 2009-2010 at the beginning of the project to 571,117 in 2015-2016 (Average annual growth rate approximately 13%). The number of students in the second cycle of secondary education increased by approximately 176% in six years from 33,134 in 2009-2010 at the beginning of the project to 91,532 in 2015-2016 (average annual growth rate approximately 16%)[14]. The rapid increase in the number of students in secondary education was caused by a rapid increase in the number of incoming students from primary education. In PSEF, a plan was proposed to decrease the ratio of incoming students to secondary school from primary school in order to restrict increasing number of students from primary education. This measure was planned to cope with an expected rapid increase of students in secondary education caused by the expansion in primary education and to maintain quality of incoming students. However, the ratio did not reduce for incoming students from primary education in the first cycle of secondary education in school year 2013-2014. Furthermore, the Ministry of

[13] Pre-service training for contract teachers has not been implemented by the project. However, it can be said that the development of a training system by the project contributed to the smooth restart of them. Example of such development include the establishment of DFIC, a system for national/regional training and training of trainers for inspectors.

[14] The change in the number of students are according to annual reports of MESS/R/T (2009) and MES (2016 and 2017).

National Education abolished the examination for the Certificate of the end of studies in primary school (CFEPD), which contributed to the rapid increase in incoming students.

Lack of basic academic ability in primary education was clearly demonstrated in recent tests conducted by the World Bank and the Analysis Programme of the CONFEMEN Education Systems (PASEC) in 2014, which compared the academic ability in West African countries. In the results of the tests, Nigerien student's performance of French and Mathematics in primary schools was of one of the lowest levels in the region. The PASEC indicated a lack of understanding of the students' instruction language- French, as one of the possible causes of low performance in basis educational ability[15].



Source: Beneficiary survey conducted by the ex-post evaluation
Note: About the seven problems indicated above, the teachers were asked to evaluate the importance of their problems in conducting lessons in the class, applying the seven-grade evaluation system: the least important as 1 and the most important as 7. The numbers in the Figure 5 show the average values of the evaluation.

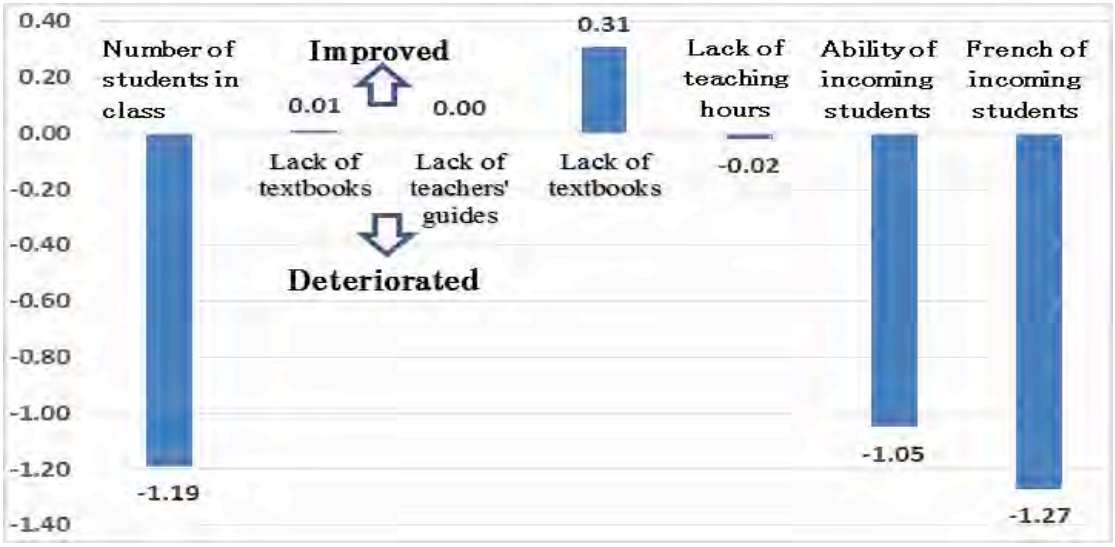
Figure 5: Importance of Problems in the Class

The beneficiary survey confirmed that the following were three important problems perceived by teachers which were becoming more serious after the completion of the project. The three problems are namely: (a) Deterioration in learning environments by rapidly increasing number of students, (b) Lack of academic ability in primary education and (c) Problems caused by difficulties in learning French which is a

[15] Reports by the PASEC: "PASEC2014 Education System Performance in Francophone Sub-Saharan Africa, Competencies and Learning Factors in Primary Education (2015)" and "PASEC 2014 Performances du système Éducatif nigérien Compétences et facteurs de réussite au primaire (2016)"

prerequisite for academic ability[16]. In the beneficiary survey, considering the situations mentioned in this section, the evaluator asked 101 teachers in mathematics and science trained by the project about the importance of seven issues which the evaluator considered problematic in conducting lessons. Then, the survey also asked questions about changes in the importance of those issues compared with 2013 when the project was completed and at the time of ex-post evaluation (Figures 5 and 6).

The results of the survey confirmed that the above three issues of "Number of students in a class", "Academic ability of incoming students" and "French ability of incoming students" are perceived as being more important by teachers in conducting lessons. Furthermore, they had a tendency to answer that these issues had deteriorated compared to 2013 when the project finished and at the time of ex-post evaluation.



Source: Beneficiary survey conducted by the ex-post evaluation
Note: About the seven problems indicated above, the teachers were asked about the changes in the problems in conducting lessons in the class, whether the problems showed improvement or deterioration compared with the year 2013: Deteriorated -2, Deteriorated a little -1, No change 0, Improved a little 1, Improved 2. The numbers in the Figure 6 show the average values of the evaluation.

Figure 6: Changes in Problems in the Class

The increase in number of contract teachers is also an external factor which affects the indicators of the overall goal. The problem of the increasing number of students was dealt with continuously by replenishment of contract teachers without any

[16] In Niger, national languages such as Hausa and Zarma are used in daily life, while French is used as medium of instruction in school education. Students learn French through school education (in some secondary school students learn both French and Arabic as languages of instruction). Introduction of education using national languages has been delayed, applying it only to some experimental schools. From 2016, introduction of textbooks has initiated in the first two years of primary schools from for the purpose of using national languages as medium of instruction.

PRESET, since the system for PRESET was not functioning sufficiently. The number of contract teachers rapidly increased from 4,955 in 2008-2009 to 10,351 in 2014-2-2015, although the ratio of contract teachers' numbers to the total number of teachers decreased from approximately 80% to 63% in the same period. The employment of so many contract teachers without any PRESET meant an increase in the percentage of untrained teachers in the total number of teachers in mathematics and science, for all subsequent training conducted by the DFIC in those subjects. Consequently, it can be considered that this situation may have produced negative influences on the efforts to improve academic ability in mathematics and science.

Table 3: Distribution of Secondary Teachers in Public Schools according to Their Status

Unit: person

	Civil Servants	Contract Teachers	Volunteer Teachers	Others	Total
2008-2009	933	4,955	322	58	6,268
Ratio (%)	14.9%	79.1%	5.1%	0.9%	100%
2015-2016	4,715	10,351	100	11	15,177
Ratio (%)	31.1%	68.4%	0.7%	0.0%	100%

Source: Statistical Yearbook MESS/R/T (2009) and MES (2017 provisional)

School hours decreased because of more frequent strikes carried out by teachers and school boycotts by students, however there exists no statistical documentation on this issue. The increased frequency of the strikes and the boycotts was noticeable. In fact there was only one week without any such incident from the beginning of the school year until the third week of November 2016 when the first ex-post evaluation mission ended, even though the second cycle of secondary education had started in the middle of September and the first cycle had started in the beginning of October in 2016-2017, according to the interview results with inspectors, pedagogic counselors and teachers. Various teachers' unions in Niger possess nation-wide communication and cooperative organizations, through which strikes are often conducted on a nation-wide scale. Accordingly, the strikes usually exert a nation-wide influence.

From the below, the overall goal is regarded as achieved using an alternative indicator. Meanwhile, it is confirmed that there does not exist any examination in mathematics and science to measure the achievement of academic ability including BEPC. In addition, there are significant external factors that provide negative impacts on academic achievement. Therefore, it is difficult to measure precisely the level of achievement of the overall goal.

Table 4 Achievement of Overall Goal

Overall Goal	Indicator	Actual
The ability of Base II and Middle Education Cycles students in Mathematics and Science is improved.	Indicator a: Performance in the End of Year Exams improves.	It is confirmed that the ratios of successful applicants of BEPC is not suitable as an indicator for the overall goal. The rapid changes in the ratios were unusually large.
	Indicator b: Performance of students in Mathematics and Science through the evaluation of learning achievements test improves.	No national examination other than BEPC is conducted in the first cycle of secondary education.
	Alternative indicator: Attitudes of students in the lesson are improved, according to the evaluation by trained teachers in mathematics and science.	The teachers evaluated that there existed improvements in the attitudes of students in the lessons of mathematics and sciences, compared with before the training and at present. Positive changes were reported in the results of teachers' self-assessment of their class of mathematics and science.

Source: Prepared based on Report of the Terminal Evaluation of the Project (JICA), answers to questionnaire survey for the implementing agency, and results of interviews and the beneficiary survey at the time of ex-post evaluation

3.2.2.2 Other Positive and Negative Impacts

It has also become easier to implement training for subjects other than mathematics and science, due to the institutionalization of INSET to which the project has contributed. By surveys undertaken through interviews and the collection of information on DFIC's activities, it was confirmed that training in other subjects was initiated using as a reference the project's model for national and regional training. The DFIC was established based upon a recommendation of the project and is in charge of training in all the subjects of secondary education. All the subjects are dealt with in the lesson studies training by Pedagogic Units and the PRESET for contract teachers.

The new training system covers not only INSET but also PRESET according to the Guidelines, the preparation of which the project initiated and the DFIC completed after the end of the project. The Guidelines made clear that the related organizations and their roles demonstrate an integrated system of training including both INSET and PRESET. The Higher Normal School (ENS), a teacher training school for secondary education, has not been able to cope sufficiently with the increasing needs of PRESET even after the completion of the project, although the roles of each organization related to training were clearly defined in the Guidelines[17].

[17] The number of students in all the courses in ENS was only 895 in 2012-2013 and 1,054 in 2014-2015 (Statistical annuals of Niger 2016). It cannot be said that ENS is complying with rapidly increasing demands for teacher training. Not only training for teachers, the courses being conducted in ENS include training for higher officers in the management of secondary schools such as school principals, Pedagogic Advisors and Inspectors.

Not only In-School INSET, the roles of Pedagogic Units include other varieties of activities such as arrangements for lesson scheduling, selection of teaching materials and preparation of lesson plans. The activities of Pedagogic Units are supported by the project and the Follow-up cooperation and the roles of which are well defined in the Guidelines and a Ministerial decree. Their contents are incorporated into the training modules to make them known to teachers, school principals and inspectors to improve the performance of Pedagogic Units. This was confirmed through the surveys conducted on training texts, modules and other related documents of the DFIC.

The project's pedagogical materials played a pioneering role in francophone African countries. The pedagogical materials are digitalized on PDF or DVD, which has an advantage of making their use and technical transfer easier as examples[18].

Furthermore, recently the number of private secondary schools has been increasing in Niger, and these schools have been playing a more important role accordingly. In private schools, contract teachers including freelance teachers are in the majority (approximately 93% according to the Annual report of the MES of 2017). In order to have a better reputation, many private schools would like to employ better teachers from public schools on freelance contracts. Consequently, many teachers trained by the project also teach in private schools. Therefore, it can be considered that the project actually has had influences on private schools as well.

In light of the above, this project has to some extent achieved the project purpose and overall goal, and the effectiveness and impact of the project are fair. For the project purpose "The capacities of mathematics and science teachers are strengthened through quality INSET" was achieved. The overall goal can be evaluated as partially achieved, since impacts were observed with alternative indicators measuring changes in students' activities which are expected to lead to an improvement in the academic achievement of students. Furthermore, substantial quantity of INSET was implemented after the end of the project. In addition, other positive impacts were also confirmed. However, improvements in the academic activities were not able to be confirmed due to the fact that BEPC was found to be inappropriate as an indicator. Finally, also confirmed were significant influences produced by negative external factors which prevent the sound development of the above impacts.

[18] JICA projects for mathematics and science education implemented in francophone countries such as Burkina Faso and Senegal targeted for primary education. The Niger's project is the first in French speaking countries and took a pioneering role in producing audio-visual pedagogical materials, which seem to have served as reference in producing pedagogical materials in other countries.

3.3 Efficiency (Rating: ③)

3.3.1 Inputs

3.3.1.1 Elements of Inputs

In general, considering the outputs produced, the elements of inputs of the project were considered to be appropriate. With regard to long-term experts, one expert was dispatched for INSET/project management, and the other for education in mathematics and science education. Short-term experts were dispatched in support of the production of audio-visual training materials to make up for a deficiency of technicians in that field in Niger. The Niger side allocated seven project team members including national inspectors in mathematics and science and the head of the National Center for Maintenance of Pedagogical Materials, and they worked almost exclusively with the project. In addition, the project provided third-country training by "Strengthening of Mathematics and Science Education - Western, Eastern, Central and Southern Africa" (SMASE-WECSA), which is a Kenya-based mechanism for regional cooperation in mathematics and science. Further training in Japan and training for statistics in Senegal were also implemented by the project.

Table 5: Planned and Actual Inputs

Inputs	Plan	Actual
(1) Experts	Long-Term: 2 Short-Term: if necessary	Long-Term: 2 Short-Term: 4
(2) Trainees received	Not mentioned	Training in Japan: 7 Third-country Training: 28 (20 in Kenya, 5 in Senegal and 3 in France)
(3) Equipment	12 million yen (a vehicle for monitoring, office equipment and others)	10 million yen (a vehicle for monitoring, office equipment and others)
Japanese Side Total Project Cost	250 million yen including expenses for local cost (91 million yen)	226 million yen which including expenses for local cost (66 million yen)
Nigerien Side Total Project Cost	259 million CFA francs including expenses for training and monitoring activities from the second year of the project	91 million CFA francs including expenses for central/regional training and monitoring activities

Source: Ex-ante project evaluation sheet, Basic design study report and documents provided by JICA

3.3.1.2 Project Cost

The project cost was lower than planned. The project produced planned outputs with a relatively small cost. The reasons why the project could produce outputs with a small cost are as follows: 1) The project made good use of technical inputs in the Phase 1 project such as third-country experts and training in a third-country provided by the SMASE-WECSA; and 2) The Niger side assigned many counterparts including inspectors and pedagogic advisers who had expert knowledge on subjects and a wealth of experiences in advising teachers, and they could adapt the transferred technologies into the Niger situation. Consequently, inputs from the Japanese side were kept low and the total cost did not become a large amount. Cost for equipment and expenses for local expenditure were also lower than planned.

3.3.1.3 Project Period

The project period was as planned. The planned period was three and a half years from January 2010 to June 2013. A review of the plan of operation became necessary due to the coup d'état carried out on February 18, 2013. After the coup d'état, an agreement was reached on a modified plan of operation. The period was changed into three and a half years from March 2010 to September 2013.

In light of the above, the project cost was lower than planned and the project period was as planned. Therefore, its efficiency is high.

3.4 Sustainability (Rating: ③)

3.4.1 Related Policy and Institutional Aspects for the Sustainability of Project Effects

In June 2013, PSEF was approved by the government of Niger as a concrete sector development plan. Further, the Technical and Financial Partners (PTF) for Niger decided to support PSEF in July 2013. The PTF offers support consistent with the Global Partnership for Education, and the World Bank which is the supervising organization for the common fund. In addition to primary education, secondary education started to receive assistance from many development partners with the above cooperation from PTF. “Means to improve quality of learning” is one of the three principal cooperation areas of PTF in supporting PSEF, in which the improvement of the capacity of teachers and personnel related to the management of schools are included. The sustainability of the project is enhanced, due to the start of the cooperation for INSET in secondary education.

The DFIC was established in the MES based upon the suggestions provided by the project, which prepares guidelines/manuals and conducts INSET in accordance with

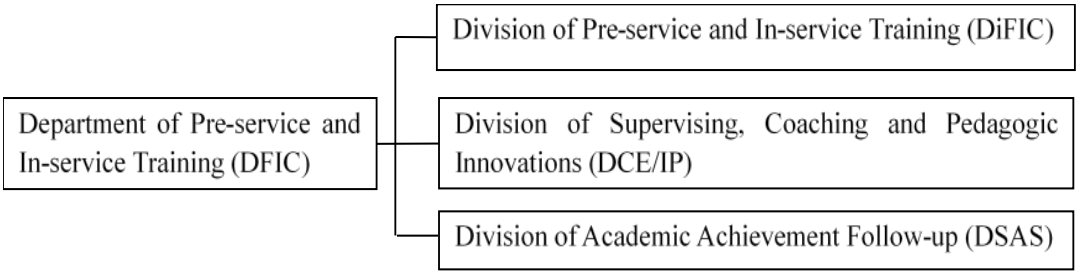
the “Education and Training Sector Program 2014-2024”. The Guidelines were approved by the Ministry of Secondary Education and an administrative and regulatory mechanism was established.

3.4.2 Organizational Aspects for the Sustainability of Project Effects

There had been a complicated relationship between the Ministry of National Education and the MEMS/RS. In 2011, administration of the first cycle of secondary education was transferred to the Ministry of National Education, meanwhile the MEMS/RS continued its INSET. However, this problem was solved, when the establishment of the MES was decided in August 2013 just before the completion of the project and subsequently the restructuring of the MES progressed succeeding both the administration of the first cycle of secondary education and its INSET. After the completion of the project, the organizational and personnel restructuring progressed, which were defined clearly in a Ministry decree.

The Department of Pre-service and In-service Training (DFIC) prepares policies of INSET and implements INSET, which belongs to the General Department of Training, Examination and Selective Tests (DGFEC). The director of the DFIC is in charge of definition, making and implementation of national policies and strategies, and supervision of monitoring/evaluation[19]. In addition to the director and deputy director, the DFIC is composed of three Divisions: 1) the Division of Pre-service and In-service Training (DiFIC), 2) the Division of Supervising, Coaching and Pedagogic Innovations (DCE/IP) and 3) the Division of Academic Achievement Follow-up (DSAS). The DiFIC plans and administrates the implementation of INSET, which produced many results described in “3.2.2 Impacts” since the establishment of the DFIC in 2014. The Coaching and Pedagogic Innovations (DCE/IP) examines the training contents, and the DSAS is in charge of the impacts of training on academic achievement. The details of work contents of the DCE/IP and the DSAS are still in the process of being defined. The DFIC has been actively expanding training, which started to require further improvement in the training contents of subjects other than mathematics and science. The DFIC plans to increase the number of the staff of the DCP/IP, so that at least one staff can be assigned to each subject, according to the interview results of the ex-post evaluation.

[19] Decree No. 00115 of July 10th 2014 about organizations of the central services of the Ministry of Secondary Education and definitions of their responsibilities



Source: Decree No. 00115 of MES 2014

Figure 7: Organization Chart of the DFIC

In the training at the regional level, many trainers are inspectors of the Regional Pedagogic Inspection Offices (IPR) and pedagogic advisors of the Department Office of Secondary Education (DDES). In many cases, the DFIC is in charge of training for these reginal trainers at the central level. The DFIC guides, administrates, trains the trainers and evaluates the training. Needs surveys and implementation of training in the region are conducted at the levels of the deconcentrated services and schools. At the regional level, the Division for Training is established in each Regional Office of Secondary Education (DRES). At the Departmental level, which is under the regional level, a person in charge of training is assigned to each DDES. The MES deconcentrated the responsibilities to the regions, making the directors of the DRES responsible for the implementation of teacher training at the regional level from 2015. The director of the DRES selects places for training and assigns trainers and supervisors. The Regional Pedagogic Inspection Offices (IPR) plan training activities and implement in-service training for teachers and pedagogic advisers, in the areas where they are in charge[20].

At the school level, Pedagogic Units by Subject (UPD) conduct lesson studies as In-School training. Teachers who have a wealth of teaching experiences are selected and assigned to the leaders of the Pedagogic Units by school principals who act as coordinators of the UPD. Further, Pedagogical Units for Literature and Human Sciences (UPL/SH) and Pedagogical Units for Scientific Subjects (UPS) were organized combining several neighboring schools into a cluster. In addition, the MES issued a decree on the COGES/ES in June 2016, and subsequently “School for All Project Phase 2” started in December of the same year. “School for All Project Phase 2” covers secondary education for its cooperation. The project intends to strengthen the roles and the capacities of the school management by the COGES/ES, which can be expected to contribute to an improvement in the quality of education, including

[20] Decree No. 0082 of February 23th, 2015 about organization of deconcentrated services of the Ministry of Secondary Education and definitions of their responsibilities

mathematics and science. For example, in order to share the expenses of schools, the COGES/ES collects funds from the parents, and these funds can be used to improve quality of education in mathematics and science. The results of the questionnaire surveys conducted by the ex-post evaluation for the school principals confirmed that the funds were used to share expenses that contribute to quality of education, as applied to the costs of copying documents, purchasing of teaching materials and others[21].

3.4.3 Technical Aspects for the Sustainability of Project Effects

It can be said that technical transfer and knowledge sharing within the DFIC are enabled, this is because the counterparts of the project serve as core members of the DFIC providing guidance to other members. The manuals and modules of the project are also shared among the members. These human resources inherit the technical knowledge of the project and maintain the following capacities: (a) capacity to produce training materials, (b) capacities to manage training in mathematics and science, and (c) capacity to produce training manuals. They produce TOR of training programs and conduct many training sessions after the end of the project. The evaluator's visit to the DFIC revealed that the documents produced and the equipment provided by the project are continuously used. The results of the interview survey found that the National Center for Maintenance of Pedagogical Materials continues to participate in the training in mathematics and science, which took an important role in the development of teaching materials and in the preparation of experiments in training during the project. The counterparts and members of the Teams for pedagogical materials remain in the National Center and continue in assisting the training of the DFIC, which was confirmed at the time of ex-post evaluation. Furthermore, national and regional trainers of the project participate as trainers in the training in mathematics and science, which have been continuously implemented after the end of the project. Consequently, their technical capacities are maintained.

According to the questionnaire and interview survey results regarding the DFIC, many national and regional trainers serve as trainers in the sessions for mathematics and science in other types of training such as PRESET, and they make good use of their past experiences as trainers in the project. Support to Pedagogic Units was not included in the plan at the time of ex-ante evaluation. This support, when started, was expected

[21] In the beneficiary survey of December 2016, a questionnaire survey was conducted to at randomly selected 20 school principals of public secondary schools of Niamey city. The survey was conducted to obtain information on the support to education in mathematics and science using share of expenses collected from parents who were members of the COGES/ES. The following are the results obtained from the targeted 20 schools regarding the use of share of expenses: 19 schools for "cost for copying various related documents including mathematics and science", 13 schools for "small amount of expenses for teaching and experiment materials in science", nine schools for "transport fees of laboratory equipment" and four schools for "rehabilitation of laboratories".

to play a complementary role for the regional training, and subsequently it continued receiving the Follow-up cooperation. While the number of less inexperienced contract teachers is rapidly increasing, it cannot be said that the Pedagogic Units' capacity to conduct training has reached a satisfactory level.

3.4.4 Financial Aspects for the Sustainability of Project Effects

Support to the PSEF by the Technical and Financial Partners (PTF) for Niger was decided in July 2013, by the signing of an endorsement letter to guarantee the support and agreeing on the creation of the common fund (2014-2018). With these arrangements, secondary education also became a target of the common fund. Accordingly, the funds from development partners are being allocated to INSET, in addition to the national budget[22]. With the above document, the PTF plans to support the PSEF until 2024, therefore continued financial support is expected to be secured. Relatively stable financial support can be expected from the common funds, meanwhile the national budget can be sometimes affected by expenditures related to security issues[23]. The situation has changed significantly compared with the project period from when the cooperation from other development partners than JICA was limited for INSET in secondary education.

Table 6 indicates the budget distribution of the MES in the budget of 2016. Salary and wages for contract teachers approximately account for 64% of the total budget. The personnel expenses occupy a major share of the budget. A budget allocation for INSET is secured as described below in the part of annual budget plan (PAA) based upon PSEF, after the end of the project. The portion of expenditure is large for the training in mathematics and science. The budget for training is allocated from various types of budget items such as: 1) the budget for "Staff training expenses" to PRESET for contract teachers, 2) the budget for "Support for Pedagogic Units" to training for lesson

[22] Quality Education Support Project (PAEQ); a project with which the World Bank supervises and finances the funds by the Global Partnership for Education (GPE) as a grant aid. Funds from the French Development Agency (AFD) were also added to the funds. In addition to the PAEQ, there exists coordination among various development partners including international organizations through the framework of the PTF in order to support the implementation of the PSEF. The implementation period of the PAEQ is expected to be extended for one more year, according to interview results with development partners.

[23] Generally speaking there has not been a substantial change in the mechanism of the budget requests by the ministries and the budget spending by the Ministry of Economy and Finance from the period of the project implementation. Some measures to improve the spending of the budgets are included in the PSEF, such as a measure that enables the Ministries to start the procedures for procurements earlier. The PSEF indicates the target budget execution rates to achieve (regarding the procurement of goods and services) by the education-related Ministries, setting goals to increase to 85% in 2016 and to 100% in 2024. However, the situation is the same as the time of ex-ante evaluation in which the Ministry of Economy and Finance possesses a strong authority over the budget management of the other Ministries. The budget expenditures on security issues continue to restrain the budget. In 2013 when the project finished, acts of terrorism by al-Qaeda-linked groups and armed attacks by Boko Haram militants started to increase, in addition to the conflicts in Mali. Afterwards, armed conflicts with Boko Haram continue in some parts of the Region of Diffa.

studies by Pedagogic Units, and 3) the budget for “Development of scientific and technology education” to training for teachers in mathematics and science. Similarly, the training budget for curricular amendments is allocated from the budget of the “Curriculum development”. Additionally, a Grant Aid by JICA “The Project for Construction of Secondary School in Niamey city” plays an important role in dealing with the issues related to the rapidly increasing number of students in the first cycle of secondary education.

Table 6: Budget Distribution of the Ministry of Secondary Education (2016)

Unit: Million of CFA francs and %

	Amount	Ratio
1. Salary	10,032	28.8%
2. Operation costs	5,880	16.9%
3. Subventions and transfers	14,523	41.7%
(Wages for contract teachers)	(12,177)	(35.0%)
(Staff training Expenses)	(108)	(0.3%)
(Support for Pedagogic Units)	(102)	(0.3%)
4. Investment	4,371	12.6%
(Development of scientific and technology education)	(189)	(0.5%)
(Secondary school construction project of JICA)	(2,331)	(6.7%)
Total	34,806	100.0

Source: Annual plan of Activities for PSEF of MES

Table: 7 Financial Plan of Budget 2016

Unit: Million of CFA francs and %

	Amount	Ratio
1. National budget	32,475	64.3%
2. International cooperation	7,127	14.1%
GPE/AFD (Project PAEQ)	(3.685)	-
Luxembourg	(744)	-
JICA	(2,339)	-
UNICEF	(0.2)	-
UNFPA	(158)	-
Others	(201)	-
3. To be decided	10,915	21.6%
Total	50,517	100.0

Source: Annual plan of Activities for PSEF of MES

Table 7 indicates the financial resources of PSEF, including the budget of the MES, in the financial plan of budget 2016. An increased amount of the budget is committed by international development partners, compared with the period of the project implementation. The part “to be decided” will be financed by either the national budget

or in cooperation with development partners. For example, UNICEF financed 60 million CFA francs for the support of the training in mathematics and science similar to the project in November 2016, although UNICEF's original budget plan was only 0.2 million CFA francs at the stage of the budget plan. In addition to UNICEF, a project (GPE/AFD: Project PAEQ) supervised by the World Bank supports INSET. The part of JICA in Table 7 partially includes "School for All Project Phase 2" in addition to the construction of schools.

After the completion of the project, an Annual Plan of Activities (PAA) is prepared based upon PSEF, in which the budget for INSET is included. The budget for INSET is 1,056 million CFA francs in 2016 and 810 million CFA francs in 2017, according to the PSEF budget plan (all the budget for INSET, including the national budget, cooperation by development partners and resources not determined) Out of this total budget for INSET, INSET in mathematics and science accounts for 72 million CFA francs in 2016 (6.8% of the total INSET) and 50 million CFA francs in 2017 (6.2% of the total INSET) as indicated below. The expenditure by the Ministry of Economy and Finance for training in mathematics and science was delayed due to the financial crisis caused by the conflicts in Mali in 2013, when the project was finishing. Afterwards, there were training sessions in 2014 and 2015 financed by the national budget. Furthermore, UNICEF financed the training in November 2016. Additional training is also being planned for 2017 as scheduled in the annual plan.

Table 8: Budget for Training in Mathematics and Science Education

Unit: Thousand of CFA francs

	2014	2015	2016	2017
Training expenses	37,023	12,472	72,000	50,000

Source: Follow-up cooperation report (2014-2015), Annual plan of Activities for PSEF of MES (2016-2017)

In light of the above, no major problems have been observed in the policy background and the organizational, technical, financial aspects. Therefore, sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The project implemented training to strengthen the capacity of teachers in mathematics and science in secondary education principally by means of INSET which introduced the ASEI-PDSI approach and developed teaching materials.

From the time of ex-ante evaluation to ex-post evaluation, the improvement in the

quality of education has been consistently proposed as a policy goal in Nigerien development policies. In addition, it had become an important issue to improve the quality of education by offering INSET to the increasing number of contract teachers. Further, the project is in accordance with the development policy of Japan at the time of planning, therefore its relevance is high. In connection with the project purpose "The capacities of mathematics and science teachers are strengthened through quality INSET", achievement of the targeted indicators for the implementation of ASEI-PDSI was confirmed and its effectiveness proved to be high. With regard to the overall goal "The ability of Base II and Middle Education Cycle students in mathematics and science is improved", the results of the beneficiary survey were employed as an alternative indicator, since the ratio of successful applicants for BEPC proved to be inappropriate as an indicator to measure the level of academic achievement of students. The results of the beneficiary survey confirmed that there existed changes in the attitudes of students in the mathematics and science classes. The favorable changes in attitudes of students in class are considered to lead to an improvement in the academic achievement of students, which proves the positive impacts of the project. However, it was also confirmed that there exist many external harmful factors which produce negative influences on the achievement of the overall goal. These external harmful factors include a rapid increase in the number of students, lack of basic academic ability in primary education, some issues related to education in French, an increase in the number of contract teachers, and reduction in teaching hours due to strikes carried out by teachers and school boycotts by students. Considering these factors, the level of its effectiveness and impact is fair. The efficiency of the project is judged to be high, which is cost-efficient having its cost lower than planned and finished within its planned project period. Furthermore, the sustainability of the project is high. In order to continue INSET, the project owns necessary conditions in policy and institution background, in addition to that, which also secured necessary conditions in organizational, technical and financial aspects of the implementation agency. In light of the above, this project is evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

<u>Promotion of the implementation of In-School INSET by Pedagogical Units</u>

In order to improve the teaching capacity of untrained and inexperienced teachers in mathematics and science at the school level, it is efficient to use the system of Pedagogical Units by Subjects (UPD) and Pedagogical Units for Scientific Subjects (UPS) organized by combining several neighboring schools into a cluster system, which was developed by a Ministry decree of 2015. It is to be desired that the DFIC

and regional inspectors/pedagogic advisers continuously implement the training and develop the training contents so that teachers can use these systems further and conduct lesson studies using them.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

4.3.1 Encouragement for the implementation agency to assign appropriate counterparts at the stage of the project preparation

One of the principal reasons for the success of this project is that the Niger side assigned a large number of counterparts who had expert knowledge on the subjects and a wealth of experience in advising teachers. It was recognized as important to secure the participation of the appropriate counterparts who are the stakeholders of the project, by repeatedly organizing coordination meetings with the implementing agency in the project preparation stage.

For this reason, the project was implemented under the strong initiative of the Niger side. The counterparts absorbed the methods of implementing training and monitoring/evaluating in other countries including Kenya, and improved them by adapting them to the situation of Niger. National trainers conducted national training effectively contributing to the improvement of the capacity of regional trainers. This training could receive sufficient collaboration from the human resources of the implementing agency, although the number of training sessions was limited during the project period due to the delay in budget expenditure by the Ministry of Economy and Finance. Furthermore, the institutionalization of the INSET progressed and the implementation of the training continued even after the completion of the project. Therefore, it was proved that the securing the cooperation from appropriate human resources of the implementation organization contributed substantially to an effective implementation of the project and further development of the project effects.

4.3.2 Effective use of international cooperation among countries in regional groups

The counterparts of the project received the support from the SMASE-WECSA in the Phase 1 (experts from third-country, third-country training, teaching materials for lessons and so on). Then, they efficiently implemented the Phase 2, making good use of the experiences from the Phase 1 project. The project was able to be implemented by the Niger side with a limited number of input from Japanese experts and without using any third-country experts from Kenya. However, the counterparts, trainers and other

related personnel to the project actively participated in regional third-country training sessions in Kenya and Senegal. It was useful for the implementation of the project in Niger to know about the experiences in other African countries with which Niger had similar economic and social situations. Furthermore, the third-country training was cost and time efficient compared with training in Japan, which enabled an increased participation of project related personnel in the training. The project developed the teaching materials by improving those of Kenya, through adapting or localizing them to the curriculum and teaching conditions of Niger. Hence, the teaching materials can be adapted well to the conditions of Niger and can be utilized at the level of the school classroom. Thus, this regional cooperation enhanced the effectiveness and the efficiency of the project. Therefore, it is to be desirable to implement a project taking advantage of opportunities for regional cooperation, in the case that they are available.

4.3.3 Positive use of audio-visual training materials on model lessons in teacher training

The use of audio-visual training materials (videos) on model lessons was a very effective way to promote better understanding by teachers and trainers in training sessions, in order to improve the teaching practices of the teachers in the class, including the practices of lessons based upon ASEI-PDSI. The DFIC uses the audio-visual materials effectively, although it needs to pay good attention to the environments where the training materials are used (preparation of projectors and screens, appropriate use of a personal computer in small group training and so on). It was confirmed that the materials are an effective and sustainable means to implement training. The production and use of audio-visual materials are beneficial to transfer practical training contents such as improvements in the teachers' practices in class.

4.3.4 Positive use of In-School INSET utilizing lesson studies by Pedagogical Units

The project started lesson studies by Pedagogical Units, and then the Follow-up cooperation initiated the training to promote lesson studies. In-School INSET by lesson studies has been officially incorporated into an integrated training system by the MES. Lesson studies by Pedagogical Units have a function of extending further to the school level the effects of training produced by a top-down cascade model (a system of national and regional training). Lesson studies by Pedagogical Units are a good measure to cope with the current situation, being relatively cost efficient, when they are well established. In-School Training by lesson studies are considered to be suitable: 1) as a measure for a further extension of the training effects produced by a project which introduced a cascade model training, after the completion of the project, 2) as a measure to improve the teaching capacity of inexperienced teachers who are not

sufficiently trained, and 3) as a measure to implement training in schools in distant areas where the implementation of training is not easy. Lesson studies are a useful means to promote the provision of guidance by experienced (or already trained) teachers to their colleagues, which can be a help to mitigate the current difficult situation in which many untrained teachers are newly employed by contract to cope with an increasing number of students.

4.3.5 Benefits of anticipating the major future trends of the education sector, which may affect the overall goal

The expansion in quantity in primary education increased the problems in secondary education (especially the first cycle of secondary education) both in quantity and quality. The PASEC indicated the low academic ability of students in mathematics and French in primary schools in Niger, which clearly demonstrated anew the seriousness of the problems in the quality of primary education. At the same time, the number of incoming students from primary education to the first cycle of secondary education is rapidly increasing. Meanwhile, the number of students who take pre-service teacher training is small in higher education, although the number of students in secondary education has been rapidly increasing. The number of newly employed contract teachers has increased more than before. Those contract teachers did not receive professional education in a Faculty of Education or PRESET for teacher. These trends in primary and higher education produced external factors which had negative influences on the project, making the problems in secondary education larger than the time of ex-ante evaluation.

It has become difficult to set as an overall goal the strengthening of average academic ability of students, because such situations produce substantial external factors influencing significantly on the quality of teachers and academic ability of students. Therefore, it became clear that results of the national examination could not be used as an indicator for an overall goal to measure the improvement in academic ability, through this ex-post evaluation.

It is not easy to anticipate the growth of such problems caused by the external factors, at the stage of ex-ante evaluation, since there exist a lot of policy uncertainty. However, it was beneficial to be well aware of the trends of the education sector in general, and to recognize their influence on secondary education, paying more attention to the influence from the external factors to set an overall goal and its indicators, at the planning stage and during the project period. This will be useful as a reference for future planning in preparation of the operation plan of a project in the first cycle of secondary education.

JICA Evaluation Department

On Views of Experts

In this ex-post evaluation, opinion of academia was invited to capture more specialized and diverse views for the projects, in addition to the perspectives of the DAC five evaluation criteria to be conducted by the external evaluator. The external evaluator selected and enlisted the support of a leading figure in the field: Hideo Ikeda, Professor emeritus of Hiroshima University.

Prof. Ikeda, author of this report, specializes in the science and mathematics education, and lesson study. Over the last 20 years, the Laboratory of Science Education, Graduate School for International Development and Cooperation, Hiroshima University, with which the author had been affiliated, has directly and indirectly participated in the science education improvement projects implemented by JICA in Asia and African countries. For these reasons, the external evaluator asked him to conduct in depth analysis based on his expertise and experience.

Specifically, "Classroom analysis through video recordings" was conducted to supplement the ex-post evaluations of these project, namely, the "Strengthening of Mathematics and Science Education (SMASE)" (technical cooperation project for Kenya, 2009-2013), as well as the Niger "The Project on Strengthening of Mathematics and Science in Secondary Education in Niger Phase 2" (technical cooperation project for Niger, 2006-2009).

The purpose of the analysis is to objectively measure the extent of improvement in science and mathematics classes at the point of ex-post evaluation. Thereby the author tried gaining insights regarding the impact of in-service education and training (INSET) for primary and/or secondary education, which were implemented under the two projects mentioned above. Moreover, the expert shared his comments and suggestions for the further development and improvement of capacity of teachers, which are obtained through the analysis. The result of the analysis related to the Niger's project was appended to the evaluation report as attachments.

Appendix

Detailed analysis by an expert: "Classroom Analysis through Video Recordings"

(Excerpts of portions related to Niger)

Expert: Hideo Ikeda (Professor emeritus, Hiroshima University)

This detailed analysis was conducted to supplement the ex-post evaluations for this project and the "Strengthening of Mathematics and Science Education Project" in Kenya (2009-2013). *The following is a portion of the analysis related to this project.*

(1) Purpose of the analysis: To objectively and quantitatively evaluate the extent of improvement in science classes at the point of ex-post evaluation.

(2) Summary of the analysis:

Materials and method: Classroom video analyses were conducted. The questions posed by the teacher and the questions asked by the students during the class were classified and analyzed according to the revised Bloom's Taxonomy of Educational Objectives (1 point for *Remember*; 2 points for *Understand*; 3 points for *Apply*; 4 points for *Analyze*; 5 points for *Evaluate*; and 6 points for *Create*), and scored (based on an assumption that questions posed by teachers and asked by students can be classified into a gradient ranging from those cognitively most basic questions based on "recollection" to those most cognitively advanced questions based on "creation", higher points were assigned as the question approaches the "creation" category). Because the score rating for different categories described above is consistent with the idea of "making students think", which was emphasized in JICA's technical cooperation projects for basic education in African countries, this method is expected to ensure objective examinations of the level of classroom instructions. In the present analysis, the scores that concern us (tentatively referred to as "Blooms' Scores") are computed by multiplying the aforementioned score within each of the six cognitive categories by its frequency, then by dividing the sum of the multiplications by the total frequency. This method overcomes the challenge of analyzing classroom instructions quantitatively, and is, thus, expected to contribute to the improvement in the quality of teacher education[24].

Observation target: A total of four teachers consisting of two teachers who had attended training and another two who had not attended training were selected from three schools (two schools in the first cycle of secondary education and one school in the second cycle of secondary education). Their biology/geology classes were videotaped and analyzed[25].

Hypothesis: Those teachers who had attended INSET provide higher-quality instructions (higher Bloom's Scores) than those teachers who had not attended INSET.

[24] However, the Bloom's Score primarily measures the psychological and cognitive level of a pedagogical method, and is not concerned with the level of instructional content taught in the class. Since a quantitative classification of instructional content has not been developed, the content will be textually described in this report.

[25] All four teachers who were observed had attended lesson studies through in-school INSET after the completion of the project. It should be noted that videotaping was limited to four classes in Niamey because the deteriorating security as well as frequent teachers' strikes and student class boycott in the provinces made filming challenging. In order to facilitate comparisons using a small number of objects of observation, only biology classes were chosen within the biology/geology subject area.

(3) Results of classroom analysis in Niger

The variance in the Bloom's scores among the four teachers who were analyzed was small, with the high of 1.96 and the low of 1.22. Among these four teachers, two had received training from JICA and the other two had not. Those who had received training scored higher, with the teachers with training scoring 1.96 and 1.51 while the teachers without training scoring 1.30 and 1.22. Based on these results, the hypothesis (higher scores for teachers with training) appears to be supported in Niger. However, since the sample size is two in each group, the probability cannot be judged to be high.

The classes taught by the teachers who had received training exhibited signs of the effects of the training enabled by this project on the teachers. A list of qualitative observations of such effects is as follows. 1. The dimension of *Activity* in ASEI has taken root, as the first cycle of secondary education Grade 1 class "Classification of Vertebrates" incorporated individual and group student activities. However, the second cycle of secondary education Grade 3 class "Reflection" taught by a teacher who had also received training centered on question-response exchanges between the teacher and individual students, and largely lacked interactions among students. There were no group activities. 2. In terms of *stimulating students by posing questions that make them think* as a practice of *Student-Centered* in ASEI, the two teachers mentioned above seemed to be stimulating students' thinking by, among other things, making students consider causal relationships more thoroughly by posing questions in the *Analyze* and *Evaluate* categories, and prompting students to critically examine whether other students' responses were correct or incorrect. Bloom's Scores were most strongly linked to this *Student-Centered* dimension. 3. *Experiment and Observation* in ASEI is greatly influenced by the subject area and topic of each class. The class "Classification of Vertebrates" should, at minimum, use graphics and photographs to relate the name of each creature to its actual living form, and ideally introduce *Experiment and Observation*. By taking into account the living environment of students in Niger, the questions posed by the teachers and responses returned by the students suggested that the students were generally able to connect the names of mammals to their actual forms. As far as this class was concerned, however, students seemed to only know the names of individual reptiles and amphibians without recognizing their actual forms. The class on "Reflection" dealt with a topic in which it would be difficult to introduce *Experiment and Observation* in the first place. However, *Experiment and* Observation appears to have been adopted in this class because the teacher prepared study resources and conducted the lesson like a dry lab by comparing graphics. 4. *Improvisation* in ASEI facilitated improvement in teaching by encouraging teachers to innovatively use teaching materials, teaching aids, and experiment methods by adapting to diverse local and

school conditions. Measurement of this dimension was impractical in the present analysis as it would have required comparisons of the materials introduced in the textbook and training to those used in the class. However, given the reality that many of the students in the class “Classification of Vertebrates” did not have textbooks as mentioned above, the situation calls for some kind of measures. One flaw was that only the names of species and the names of the taxa to which species belong were mentioned in the class. In contrast, the teacher of the class on “Reflection” incorporated concrete improvisations such as showing diagrams to describe an experiment setting in a way that is easy to understand, suggesting that the idea of *Improvisation* has taken root.

The results of the analyses of the first cycle of secondary school Grade 4 class “Homeostasis and Regulation” and the second cycle of secondary school Grade 1 class “Asexual and Sexual Reproduction among Plants”, both taught by teachers who had not attended training, indicated following problems. 1. Both teachers rarely posed questions in the *Analyze* and *Evaluate* categories; thus, training should be implemented so that teachers acquire techniques for using questions to stimulate students. 2. The teaching materials lacked consistency and many aspects of them confused teachers themselves. Given that the two teachers tended to explain materials simply by following textbooks, (even though this problem primarily stem from faults in the syllabi and textbooks) it is necessary to reorganize teaching materials in a logical manner, and efforts should be made for more logical organization and precise selection of teaching materials when teaching materials are selected and their contents are organized for training.

Annex: Achievement of Project Results

Results	Indicator	Actual
1. The capacities of National Trainers are reinforced.	Indicator 1-1: More than 2 tryouts in pilot school of the pedagogical materials developed by the Team are implemented.	Mostly achieved. Two times of tryouts were mostly implemented for the target number of the development of 45 sets of pedagogical materials as expressed in the indicator.
	Indicator 1-2: By the end of the Project, 45 or more sets of training materials are developed and produced.	Achieved. The project developed 64 sets of training materials.
	Indicator 1-3: Level of satisfaction of Regional Trainers with the developed pedagogical materials (Survey)	Achieved. Level of satisfaction by Regional trainers was high. An evaluation score of 3.7 points on average was obtained out of 4.0 points.
	Indicator 1-4: More than 1 time per year of monitoring and evaluation in classrooms on the pedagogical materials developed by the Team is implemented.	Mostly achieved. National trainers participated actively in the development process and monitored the tryouts.
2. The National and Regional Training Structure are established.	Indicator 2-1: More than 270 Regional Trainers in total are trained in Niamey.	Partially achieved. National training was conducted in two times in 2011 and in 2012, however, which was not conducted in 2013 due to the budget expenditure constraint produced by the Northern Mali Conflict. This delayed national training was conducted in February 2015 by the DFIC which successively continues the training system of the project.
	Indicator 2-2: More than 900 teachers receive one regional training session per year.	Partially achieved. The regional training was conducted from 2010 to 2012, however which was not conducted after that as scheduled due to the delay in budget expenditure by the Ministry of Economy and Finance. The delayed regional training was conducted in December 2014 by the DFIC.
	Indicator 2-3: All planned trainings in the INSET Plan are conducted in time.	Partially achieved. The implementation of a part of the training was delayed in the Indicator 2-1 and 2-2. Additionally a seminar to share the common experiences in francophone countries was not conducted.
	Indicator 2-4: Based on the Project M&E tool, the quality of the INSET provided by the National and Regional Trainers is rated more than 3.0.	Achieved. A score of 3.3, which was higher than the target score, was achieved in questionnaire surveys regarding the quality of the training. The surveys were conducted for the participants of the training using a monitoring and evaluation tool developed by the project.
3. The supporting system for the INSET Project is strengthened.	Indicator 3-1: More than 500 stakeholders (mainly school principals and representatives of COGES/ES) participate in one sensitization workshop.	Achieved. Sensitization workshops were organized and in which 657 school principals and the members of COGES/ES participated.

	Indicator 3-2: More than 250 school principals receive one training session.	Achieved. The project conducted training workshops for school principals in 2010, in which 353 school principals participated.
	Indicator 3-3: More than 25% of school principals carry out monitoring of lessons.	Achieved. According the questionnaire surveys conducted in 2013, it was confirmed that 31% of school principals carried out monitoring of lessons recommended by the project.
	Indicator 3-4: More than 50% of COGES/ES develop at least an action plan per year to support the quality of Education.	Achieved. Nearly 90 % of the COGES/ES developed an action plan, according monitoring surveys conducted from 2011 to 2013.
	Indicator 3-5: Organization of a national workshop to share the internal evaluation result and to capitalize the project experiences	Achieved. A national workshop was organized at the closing seminar of the project. A draft of guidelines to institutionalize INSET was presented by the project team in the closing seminar organized in 2013. The draft, produced by the Niger side, proposed the establishment of a department dedicated only to the implementation of INSET.
	Indicator 3-6: INSET guide/manual is developed.	The development of the guideline was not completed by the end of the project. This is because the MES was newly created and the guidelines were produced in accordance with the restructuring of it. The manuals for INSET to strengthen education in mathematics and science were developed during the project period.
	Indicator 3-7: INSET guide/manual is evaluated and validated by MESS/R/T.	The guideline was not approved by the end of the project, which was approved after the restructuring of the MES finished in November 2015. The manuals for INSET to strengthen education in mathematics and science were approved during the project period and are continuously used.

Source: Prepared based on Report of the Terminal Evaluation of the project (JICA) and answers to questionnaire survey for the implementing agency.