Summary of Synthesis Study of
'Evaluation in Science and Mathematics Education Projects'

1. BACKGROUND AND OBJECTIVES OF EVALUATION STUDY

1.1 Background and Objectives of Evaluation

As part of the effort towards improvements in the quality of basic education, JICA has implemented 12 technical cooperation projects in the primary and secondary science and mathematics education sector so far (as of the end of April 2004). However, a systematic evaluation of the education projects has not been conducted yet, thus the review and classification of past and ongoing education projects are strongly required. Within this context, JICA conducted a synthesis evaluation study on technical cooperation projects in primary and secondary science and mathematics education with the following two objectives.

a. Review and classify the past and ongoing 12 projects by JICA on primary and secondary science and mathematics education

b. Analyze project planning and modification processes as well as the components of cooperation to isolate contributing and inhibiting factors of the projects and to draw lessons learned for the improvement of future project formulation and implementation processes

1.2 Evaluation Study Team and Evaluation Study Process

1) Evaluation Study Period

The evaluation study was conducted from July 2003 to February 2004. Field studies were conducted in Kenya and the Philippines for 35 days from November 8, 2003 to December 12, 2003.

2) Evaluation Study Team

The evaluation study was organized and supervised by the then Office of Evaluation and Post Project Monitoring, Planning and Evaluation Department of JICA (currently the Office of Evaluation, Planning, and Coordination Department). The Evaluation Study Committee was established to implement the study, consisting of JICA educational task team representatives and two external evaluation advisors (Kazuo Kuroda from Graduate School of Asia-Pacific Studies, Waseda University, and Takashi Hamano from the Center for the Study of International Cooperation in Education, Hiroshima University). Based on the strategies presented by the Evaluation Study Committee, one external advisor in the committee, a person in charge in the JICA Secretariat Office, and two consultants from Global Link Management were involved in all the evaluations.

1.3 Projects of the Evaluation Study

Twelve JICA projects were selected for the evaluation study (Table 1). Out of the 12 projects, field studies were conducted on two projects each in Kenya and the Philippines so that lessons common in projects could be extracted.

Table 1 : Projects of the Evaluation Study

Region	Country	Project Title	Abbreviation	Project Period
Asia	Philippines	The Package Cooperation for the Development of Elementary and Secondary Science and Mathematics Education	Package Cooperation	1994/6-1999/5
		Strengthening of Continuing School-based Training Program for Elementary and Secondary Science and Mathematics Teachers	SBTP	2002/4-2005/4
	Indonesia	Project for Science and Mathematics Teaching for Primary and Secondary Education	IMSTEP	1998/10-2003/9
	Cambodia	Secondary School Teacher Training Project in Science and Mathematics	STEPSAM	2000/8-2004/9
Africa	Egypt	Development of Creativity Lessons for Primary Education	DCL	1997/12-2000/11
		Improvement of Science and Mathematics Education in Primary Schools in Egypt	ISME	2003/4-2006/3
	Kenya	Strengthening of Mathematics and Science in Secondary Education	SMASSE I	1998/7-2003/6
		Strengthening of Mathematics and Science in Secondary Education	SMASSE II	2003/7-2008/6
	South Africa	Mpumalanga Secondary Science Initiative	MSSI I	1999/11-2003/3
		Mpumalanga Secondary Science Initiative Phase II	MSSI II	2003/4-2006/4
	Ghana	Improvement of Educational Achievement in Science, Technology and Mathematics in Basic Education	STM	2000/3-2005/2
Latin America	Honduras	Improvement of Teaching Methods in Mathematics	PROMETAM	2003/4-2006/3

1.4 Framework of the Study

The evaluation questions of the evaluation study were designated in line with the above-mentioned objectives as follows:

1) Summary and classification of projects

Under what social and educational situation was each project implemented? What elements or criteria could be used to classify the projects?

2) Contributing and inhibiting factors

What were the contributing and inhibiting factors affecting the impacts of primary and secondary science and mathematics education projects?

3) Lessons learned

What lessons were learned and extracted from these primary and secondary science and mathematics projects?

1.5 Evaluation Study Methodology

Based on the three evaluation questions, the projects were classified according to the approaches taken and were then analyzed using logic models. Document reviews, question surveys and interviews with relevant individuals in Japan were adopted for in-country study. The activities conducted during the field studies include document collection, questionnaire surveys and interviews with relevant field staff, and site visits.

2 SUMMARY AND CLASSIFICATION OF PROJECTS

2.1 Classification of Projects by Characteristics

The first project in the primary and secondary science and mathematics education sector was the Package Cooperation launched in the Philippines in 1994. Since then, other projects in the sector were implemented in succession. The efforts expanded notably from the late 1990s to 2000s, resulting in seven projects in Africa, four in Asia, and one in Latin America from a geographical point of view. Table 2 shows the results of classification of the 12 projects according to other characteristics.

Table 2 : Classification of the 12 Projects

Duration of projects	One seven-year project, four five-year projects, and seven three-year projects: the number of three-year projects has been on the increase.
Cooperation modality	Five project-type technical cooperation projects including the Package Cooperation, two projects in the form of dispatch of expert team, and five technical cooperation projects
Primary or Secondary Education	Three projects are at the primary education level, five at the secondary education level, and four at both primary and secondary education levels.
Science or Mathematics:	One project focuses on mathematics and the remaining 11 projects on both science and mathematics.
PRESET or INSET	Ten projects conducted training for teachers in service (INSET) and two projects conducted both INSET and training for pre-service teachers (PRESET).

2.2 Summary and Classification of Projects by Approach

Groups of activities in the projects were divided into 11 approaches including development of teaching materials, training for in-service teachers, monitoring, and evaluation. It was revealed that all 12 projects include teacher training as a core component. Accordingly, this evaluation made the classification of projects based on two criteria: beneficiaries of training and teacher training system. As a result, the 12 projects in primary and secondary science and mathematics education were classified into the following four types (Table 3).

Table 3 : Project Classification by Teacher Training Approach

Type 1	Approach of INSET by cascade system. The experts and counterparts of the projects directly train teacher trainers using their expertise in the subjects.	Philippines: Package Cooperation Kenya: SMASSE I Kenya: SMASSE II South Africa: MSSI I
Type 2	In this type, teachers are provided with direct training in a cluster (a group of schools in an area) or through in-school training for teachers (cluster system). The experts and	Philippines: SBTP Ghana: STM South Africa: MSSI II

	counterparts of the Projects support the training and offer advice on management, but do not provide direct guidance on the content of the subjects.	
Type 3	The approach of the development and dissemination of teaching guides. The projects classified as Type 3 simultaneously provide in-service teachers with training in using the guides.	Egypt: DCL Egypt: ISME Honduras: PROMETAM
Type 4	This is the approach of training for university faculty, in which trained university trainers conduct direct training or offer lessons for in-service teachers and university students. This approach is conducted mainly at universities.	Indonesia: IMSTEP Cambodia: STEPSAM

2.3 Five Factors Determining the Success of the Projects

When the types mentioned above and evaluation results were cross-examined, a direct correlation was not necessarily evident. It was then concluded that factors directly influencing the evaluation results would not be the selection of the project type, but rather would be how much each project makes use of the characteristics of the selected type and how much ingenuity is exercised in each project to that end.

The projects were cross-examined based on the above classification and summary, and contributing and inhibiting factors that influence the efficiency of each project were extracted. The following are five elements that were considered factors determining the success of primary and secondary science and mathematics projects. (Table 4).

Table 4 : Five Elements Determining Success of Primary and Secondary Science and Mathematics Projects

1) Planning	One of the important factors lies at the planning stage of a project, which is not just confined to the primary and secondary science and mathematics sector. In-depth needs analysis, the construction of logic keeping cause-and-effect in mind, and the selection of inputs are factors that are especially significant in influencing the efficiency of projects.
2) Means to expand outcome	The teacher training system employed under the primary and secondary science and mathematics projects were classified into two groups: cascade and cluster (training within school district) systems. Whether a project is being implemented based on various characteristics or not influences the impact.
3) Collaboration	In recent years, many projects included collaboration with Japan Overseas Cooperation Volunteers, other ODA schemes, local universities, and other donors. The collaboration with related agencies inside and outside the project is a factor that especially influences efficiency.
4) Institutionalization	Governmental support for the projects leads to securing financing at both the central and local levels. Governmental assistance such as establishment of funds and authorization of training on weekdays particularly affects sustainability.
5) Monitoring and evaluation	How to monitor and evaluate the reality of teacher training and the capability of teachers and students is a universal issue in the primary and secondary science and mathematics projects. A timely modification of project planning through monitoring and evaluation greatly contributes to the achievement of project purposes.

The five elements discussed here are considered important factors determining the success of primary and secondary science and mathematics projects. In the following chapters, analysis is performed on these important five factors. Four cases in the field studies are to be introduced in its course, followed by eight other projects. Then a synthetic study will be conducted in order to draw common lessons from the projects.

3 LESSONS LEARNED AND RECOMMENDATIONS

As already discussed in the paper, the five important factors are thought to influence the success of technical cooperation projects in primary and secondary science and mathematics education. Here, attempts are made to draw common lessons from the projects in relation to these five important factors. Meanwhile, in this summary, major elements of the lessons learned are extracted and described.

3.1 Lessons Learned about Planning

The evaluation study confirmed that contributing and inhibiting factors of projects are deeply associated with the planning process in many cases. This section shows analytical results on whether the achievement of objectives has been thoroughly thought out at the time the projects were formulated and how input elements have influenced the achievement of the objectives. Although the following lessons have been drawn from the primary and secondary science and mathematics education projects subject to the evaluation study, these lessons can be applied to projects other than those in the educational field.

- **In the planning stage, it is necessary to construct a logic model and formulate a logical framework (PDM) after sufficient deliberation on cause-and-effect linkages.**

  The analysis of all the projects using a logic model (visual representation of the cause-and-effect linkages between project inputs and the goals) in the evaluation study found that nearly half of the projects need to be reconsidered in terms of logical construction, from the project purpose to the overall goal. While the logical framework (PDM) employed in projects is generally an effective tool for project management, it sometimes encounters difficulties in precisely describing complicated cause-and-effect linkages of the projects. Constructing a logic model at the planning stage leads not only to a deliberate consideration of the cause-and-effect linkages of projects and but also to uniform understanding of the detailed structure of the project by persons concerned. In particular, since educational projects may involve a complicated cause-and-effect relationship, using a logic model helps pinpoint potential risks of projects (as to which objectives seem hard to achieve).
- **The quality and scale of inputs have a great influence on sustainability and impact. Therefore, planning of project inputs needs careful consideration with comparison to similar projects.**

  In the Package Cooperation in the Philippines, in spite of considerably large-scale inputs, the sustainability of the training system began to disappear as soon as the project was terminated. On the other hand, SBTP that followed the Package Cooperation realized a training system without major costs while demonstrating sustainability and geographical expansion. One possible reason for this was that the training system of SBTP was designed with the intention of reducing Japanese inputs and establishing a training system that could be easily managed by local people alone. While large-scale inputs may result in an accelerated expansion of activities in the short-term, the danger of inhibiting long-term sustainability and impact needs to be kept in mind. To calculate the adequate scale of inputs at the planning stage of projects, it may help to identify similar projects in and out of implementing agencies and to compare the necessary costs and outputs.
- **While formulation of projects utilizing existing resources is effective in terms of efficiency and sustainability, it is necessary to deliberately consider whether the**

utilization is in line with the objective of the projects.

It is effective to formulate a project plan with considerations to the existing resources in the country as well as to the outcomes and experiences of past projects. However, a clear overall project plan must first be in place when priority is given to the utilization of existing resources. Without an appropriate project plan, the project objectives may be distorted through the mere utilization of resources and implementation of inputs. As a matter of fact, in the Package Cooperation in the Philippines, too much emphasis was placed on the utilization of the Science Teacher Training Center constructed through grant aid and the real objective of the project, establishment of a training system, was not clearly defined. In the utilization of resources, careful consideration should be made so that the inputs are consistent with project purposes.

3.2 Lessons Learned about Expansion of Outcome

Classifying technical cooperation projects in primary and secondary science and mathematics education was one of the major objectives of the evaluation study. The teacher training systems employed in many projects were classified either as "cascade" (the transmission of lectures from central to local bodies) or "cluster" (direct training to groups of schools). Here, the synthesis study has analyzed the characteristics of each system and have compiled its results.

- **In teacher training using the cascade system, it is effective to minimize the number of cascade layers and conceptualize what is delivered in the training in simple keywords.**

  In teacher training using the cascade system the delivered content has a tendency to diminish in proportion to the number of cascade layers. In the Package Cooperation in the Philippines, training courses were conducted in three stages, namely, national, regional, and district levels. It was observed that the effects of the training were diminished from the national level to the district level due to no allowance for training at the local level. In the training system of SMASSE in Kenya, the three stages established in the initial project plan were reduced to two, a modification that enhanced the effectiveness of the training. In the cascade system, information delivered from one person to another diminishes. Delivery of fundamental concepts, rather than of complicated issues, avoids the diminishing of the content, and thus contributes to its effectiveness. In SMASSE in Kenya, the keyword of "ASEI/PDSI" was contrived to make the concept intended by the project easy to understand. On the other hand, if the keyword itself is presented without an underlying context, the message conveyed may be misunderstood. In the Package Cooperation in the Philippines, the keyword of PWA was adopted, but the keyword was misunderstood as meaning just conducting experiments in class. Unfortunately in this case, the misunderstood concept was disseminated through training. Though it is important to simplify a concept into a keyword in the cascade system, it is necessary to organize the concept and to carefully prepare for dissemination, for example, by producing manuals for training.

- **The expansion system centered on the cluster (direct) system is suitable to consolidate the outcome in a geographically limited area. In introducing cluster training, it is necessary to gain understanding and support from concerned stakeholders in the area.**

  Teacher training through cluster and school training systems has an advantage in delivering the effects of the training not only to teachers but also to schools as well as to the entire school district (cluster). In STM in Ghana, in response to the high turnover rate of teachers, the support to school training was strengthened. In SBTP in the Philippines, a training system where schools in the same cluster hold training in turn contributed to establishing a network among teachers in the cluster who teach the same subject. The dissemination system described above can be especially effective at the primary education level, because primary schools have closer relationships with local areas. In addition, obtaining more understanding from principals and school inspectors promotes the participation of teachers. In cluster and school training systems based in schools and local communities, holding a workshop for principals and school inspectors is important for gaining understanding and support at the school and community levels.

- **The above training system depends largely on the condition of the educational administration, level of education (primary/secondary), and geography. The training system should be designed with these factors in mind.**

When the two dissemination systems mentioned above are compared, the cascade training system is suitable for spreading skills “fast and wide to a large number of people”; whereas the cluster training system is appropriate for spreading skills “slowly to a small number of people in small areas.” Furthermore, in selecting teacher training by the cascade system or cluster system, it is important to consider the following three conditions: educational administration, the level of education, and geography. In terms of educational administration, the cascade system is adequate in a situation where administration capacity at both the central and local levels is high, while the cluster system is adequate where decentralization has been established. At a higher secondary education level, schools are located at a considerable distance and the cascade system is desirable, as it requires less occasion to get together. At the primary education level, on the other hand, education is conducted in close relationship with local communities and, therefore, cluster training is recommended, as those concerned can get together more often. From a geographical point of view, in areas where transportation systems are not well developed, it is difficult to continuously conduct cluster training. Thus, a large-scale cascade training held during vacation time is suitable. Conditions to help effectuate each training system are compiled and listed in Table 5 below.

Table5 : Factors to be considered when choosing between Cascade System and Cluster System for a Teacher Training System

Factors to be Considered	Cascade System	Cluster System
Educational Administration	Since the top-down approach is used, it is better to have educational administrators possessing superior capabilities in the central government at the upper layer of the cascade and in the regional government at the lower layer.	In the case where cluster training is conducted in rural areas, local governments are required to have some level of administrative capability. Thus, it is appropriate to conduct it in a country where a degree of decentralization has been achieved. Also, in order to carry out in-school training sessions, schools have to be equipped with a degree of management ability.
Level of Education	High schools are located at a good distance from each other, and it makes it difficult for teachers to often gather in a single location, Therefore, the cascade system is effective at the high school level, (especially in the case where the enrollment rate is low).	Since primary and secondary schools are often deeply rooted in the local community, the needs vary depending on the region. Therefore, it is significant for neighboring schools to form a cluster. When a project targets primary and secondary schools, cluster training is effective, since it enables the teachers of the local schools to congregate in a nearby school.
Geographical	When access to the other schools is	Cluster training is suitable when a

Conditions	hindered due to underdeveloped infrastructure, etc., as in the case in Kenya, it is difficult to frequently gather at one site. The rate of participation increases if a center with accommodation facilities is built to provide the teachers with opportunities to receive intensive training.	transportation network is well developed and access to neighboring schools is relatively easy, thus facilitating day trips and the rotation system, even in an island country such as the Philippines.

3.3 Lessons Learned about Collaboration

Science and mathematics education projects in recent years seek collaboration not only with other ODA schemes such as Japan Overseas Cooperation Volunteers (JOCV), but also with local universities and other donors. The type of collaboration has no small effect on the occurrence of outcomes. In this section, the current state of collaboration between the evaluated projects and related organizations are reviewed and analyzed. The evaluation study chose collaborative partners who were considered particularly significant in the field of educational projects, and examined how collaboration with these partners related to the contributing and inhibiting factors of the projects.

- **Collaboration with local universities or academic institutions is effective in terms of the quality control of training, sustainability, and incentives for teachers. In promoting collaboration, it is necessary to clarify the organizational relationships surrounding each institution.**

  Collaboration with local universities helps to spread local knowledge and experiences, control the quality of training, achieve sustainability, and promote participation in training. Under SBTP in the Philippines, propelled by the collaboration with universities, new evaluation theories that have been widely accepted locally are adopted in an attempt to quantitatively assess how lessons have been changed. Under MSSI in South Africa, a university provides a training course on teacher qualification at a discounted rate and this enhances the motivation to participate in training. In pursuing collaboration with universities, it is essential to clarify responsibilities as well as organizational relationships surrounding concerned institutions in order to avoid the diffusion of ownership. Several cases have been reported in which the involvement of the Ministry of Education, which should assume the leadership, has become less pronounced due to the participation of universities. Moreover, a key contributing factor to future sustainability is to emphasize the concept of reciprocity and equality when collaboration with universities is deployed.

- **Collaboration with Japan Overseas Cooperation Volunteers (JOCV) Program can be a great contributing factor. A precondition for collaborating with the JOCV Program is to formulate a full agreement between experts and volunteers on the direction and activities of the projects.**

  Among the projects of this evaluation study, the JOCV program was frequently chosen as a partner for collaboration. Collaboration with the JOCV program took two forms: organized collaboration and flexible collaboration. Under organized collaboration, the JOCV program was officially designated as a component of the project and a certain level of output was expected from this arrangement. Under flexible collaboration, the JOCV program was positioned externally to the project but was requested as needed by the project to collaborate through activities such as monitoring. It is made clear that the appropriate collaboration is chosen to suit the objectives of each project, while taking advantage of its own strength. However, JOCV posts in science and mathematics education were generally difficult to fill due to a shortage of eligible candidates. To counter this constraint, senior JOCVs and short-tem emergency JOCVs were assigned under SBTP in the Philippines to secure a required number of experienced volunteers for achieving the project's outputs. In collaborating with the JOCV program, it is important to confirm the intention of volunteers and to fulfill two objectives at the same time: civil participation, which is the aim of the JOCV program, and the achievement of outputs sought by projects. It is especially important to confirm the intention of JOCVs from the recruitment stage and not to impede activities desired by JOCVs themselves.

- **Collaboration with other donors can be effective if the objective of the collaboration is clearly defined. In addition, donors with past experiences in similar projects can be an important source for information exchange.**

  In this evaluation study, two projects, STM in Ghana and PROMETAM in Honduras, were analyzed for lessons learned on collaboration. These two projects approached the issue of collaboration in a similar manner. When these projects encountered issues to be addressed in forming collaborations with other institutions, they raised and discussed such issues among other donor agencies. The evaluation study, through a questionnaire survey, found that donor collaboration did not take place under other projects due to a lack of recognition for the need or problems to be solved in establishing collaboration. When one ventures to pursue collaboration in such projects, one may end up with mere rhetoric: "a collaboration for a collaboration." In order to avoid the involvement of unnecessary related organizations, it is crucial to address tasks to be accomplished and to share common recognition of them when collaboration with other donors is sought. Under SMASSE in Kenya and MSSI in South Africa, information exchange with other donors took place during the project planning stage and this helped to avoid duplication of cooperation as well as in receiving useful advice. It was observed that information exchange with other donors is especially essential at the planning stage of new projects.

3.4 Lessons Learned about Institutionalization

Governmental assistance and institutionalization, such as holding training on weekdays and making it obligatory to participate in training, can have a huge impact. In this section, some common points found in projects that have received institutionalization or administrative support are reviewed, and some points to be considered when seeking institutionalization are analyzed.

- **To gain governmental assistance and achieve institutionalization in promoting teacher training and project outcome, activities to gain understanding from the partner countries and ingenuity to facilitate institutionalization are, of course, important. Having mentioned that, the synthesis study believes the most important factor is to gain support from teachers and students, who are the end beneficiaries.**

  Institutionalization of the teacher training system is effective not only for future impact or sustainability, but also for the groundwork for further participation of teachers in training. Some efforts in the past were helpful to gain governmental support for each project: for example, efforts to make educational administrators aware of outcomes of the project of SMASSE in Kenya, and consideration and ingenuity of SBTP in the Philippines to develop a low-budget training system. On the other hand, the evaluation study revealed that the very reason for institutionalization was the strong support for the training and its outcome from the teachers and students. A training course for fostering "self-realization" of teachers in the culture of "self-help efforts" in the SBTP in the Philippines has gained strong support from teachers, and such support must have lead to the institutionalization of training on weekdays and the establishment of foundations. Furthermore, the PROMETAM in Honduras made a strong appeal to relevant parties by compiling data pertaining to the rate of satisfaction of teachers with the training, the degree of understanding of subjects, frequency of the use of teaching materials, etc. As the saying goes, “example is better than precept.” This has led to the dissemination of teaching materials throughout the country.

Decisions on institutionalization and governmental support rest in the hands of the local authorities, and they always place the emphasis on end beneficiaries. A short avenue to institutionalization may be to gain solid support from teachers and students by upgrading the quality of the training and outcome.

- **Governmental assistance can be obtained more smoothly for a training system built upon an existing system, rather than for a newly established system.**

  Under SBTP in the Philippines, a school training system that was conducted by the Philippine side was strengthened and expanded by Japanese input and was established as a cluster system. At present, SBTP is the only training system authorized to be held on weekdays and supported by the government. This could be attributed to the fact that the school training system was already prevalent and recognized by authorities to a certain degree. As this example shows, cooperation and/or assistance to existing training systems facilitates the establishment of a system in the short term and, as a result, sustainability through institutionalization.

- **In countries where effective collaboration among donors is under way, coordination among donors promotes institutionalization.**

  If there were no other donor implementing projects in the same sector in the country of the project, the possibility of institutionalization becomes higher in comparison. In Kenya, donor coordination in the education sector was not very advanced and there were no other donors implementing projects in the area of secondary science and mathematics education. Consequently, the importance of SMASSE in Kenya became comparatively high and this led to the institutionalization of the project. In countries where donor coordination is advanced, enhancing the Japanese presence in the framework of donor coordination can promote institutionalization. In the case of Honduras, Japan was recognized among donors as being competitive in mathematics education, and this contributed to the official adoption of materials developed by the project. Therefore, it can be said that the enhancement of donor coordination is a contributing factor for institutionalization in countries where donor coordination in the education sector is already under way.

3.5 Lessons Learned about Monitoring and Evaluation

Education projects are modified through trial and error, using the results of the evaluation of the reality of teacher training and monitoring of teachers and students. The section reviewed the method used to evaluate ongoing projects and how the monitoring and evaluation systems had been established.

- **Monitoring results bring about important information useful to the improvement of projects. Mid-term evaluation, if conducted appropriately, contributes considerably to the improvement of project planning.**

  Although preliminary studies may be carefully conducted at the planning stages, it is impossible to grasp all the necessary information before the start of the project. Therefore, almost all projects need modification after they start. The quality of modification depends on regular monitoring activities. Under IMSTEP in Indonesia, a pilot activity was introduced in the middle of the project period and this successfully enhanced the project’s effectiveness at the school level. This initiative was evaluated as a tangible output of monitoring activities. A mid-term evaluation is a good opportunity to find potential inhibiting factors that may be overlooked under daily monitoring activities. Under STM in Ghana, the mid-term evaluation revealed that the high turnover rate of teachers could be an inhibiting factor. Based on this evaluation result, the project plan was modified and support for school training was strengthened to generate impacts on entire schools as well as on individual teachers. Although mid-term evaluations tend to be conducted in a more simplified manner than ex-ante and terminal evaluations, it is desirable to enhance the role of mid-term evaluation as it greatly contributes to the efficiency and impact of the projects.

- **Establishing an independent monitoring and evaluation group in a project management system can clearly define the responsibility of evaluation tasks.**

  In SMASSE in Kenya, a task force in charge of monitoring and evaluation operations was formed, and a system to conduct periodical monitoring was established. It was an attempt to allocate staff (even though a small number) who mainly assume evaluation tasks by establishing an evaluation group within the project. This method is also effective as a means of identifying where responsibility for evaluation lies. On the other hand, in MSSI in South Africa, a reporting obligation was imposed on every layer of the cascade system from top to bottom with the premise that evaluation is the accumulation of monitoring information. In this way, a system was established to provide constant feedback. Both projects established and applied an evaluation system unique to their own respective projects. In many JICA projects not confined to education, JICA undertakes periodical monitoring for the mid-term and terminal evaluations. However, it must be noted that local entities take initiatives in evaluation and monitoring in the projects in Kenya and South Africa by submitting the results of their own evaluation and monitoring to be used for the JICA's periodical evaluations. Implementation of such evaluation and monitoring would tailor the content of evaluation to correspond with the needs and reality of the projects, which in turn facilitates the achievement of the objectives with more effective feedback.

- **In the evaluation of primary and secondary science and mathematics education projects, an attempt for adopting a method to objectively evaluate the teaching capacity of teachers and the improvement of classes was launched. It is desirable to accumulate evaluation results on the capacity of students and to establish an evaluation method based on such results in the future**.

  The evaluation method adopted for primary and secondary science and mathematics education projects mainly focused on interviews and questionnaire surveys targeting teachers who have participated in training. Recent impact evaluations include comparisons of effects seen on participants before and after training as well as effects seen on training participants and non-participants. In addition, quantitative analyses applying academic theories were also conducted. The evaluation of students, however, has not been conducted in some projects of this evaluation study. The improvement of student capacity depends on local community and individual characteristics to a great extent； thus, it is difficult to establish appropriate indicators to measure the effects. In the mid-term evaluation of STM in Ghana, interviews were conducted not only with students but also with parents. In addition, there was an attempt to perform a multi-aspect evaluation. Although the evaluation results of STM may not be sufficient to find direct cause-and-effect linkages within the project, the accumulation of data will contribute to the development and improvement of a method to evaluate the capacity of students.