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Japan's Initial Experience with Technical Development Cooperation in Basic Education: A Case in Ghana

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Abstract

This article describes several features of an in-service teacher training (INSET) project for science and mathematics teachers in basic education (grades 4 - 9) in Ghana. This project is an example of Japan's initial experience with technical development cooperation in basic education. Some of the major features of the project are as follows.

1) As a new comer in technical cooperation in basic education Japan was very careful about where to intervene and finally chose science and mathematics education in the belief that these subjects are relatively culture and value free and because Japan has a well-developed education system in this area.
2) INSET was chosen believing that Japan has a well established INSET system and because visible results are expected to come about more quickly than by intervening in pre-service training.
3) In providing INSET a 'cluster' rather than a 'cascade model' was adopted.
4) Project goals were clearly specified and quantified.
5) In order to sustain the achievements by the project, a strong emphasis was placed on capacity building of Ghanaian INSET providers through training in Japan and the institutionalization of INSET in order to create a system to utilize these human resources and spread INSET nationwide.

Although over the last ten years Japan has been supporting seven major technical cooperation projects for basic education exclusively in science and mathematics education, it is too early to judge whether it has been successful as the impact of these projects on students is yet to be determined.

Introduction

Until the mid 1990s, Japan's bilateral development cooperation in education had concentrated on higher education and technical/vocational education. Cooperation in the area of basic education tended to be limited to the so-called 'hardware' type of projects such as the construction of school buildings and the provision of school equipment. Technical cooperation for basic education appeared on the scene of Japan's Official Development Assistance (ODA) in education following the international commitment to 'Education for All' expressed at the World Conference on this theme in 1990. This technical cooperation in

basic education focuses on the content and organization of education such as curriculum development, science and mathematics education, school management, teacher training and educational administration. In the last ten years the Japan International Cooperation Agency (JICA), which is the Japan's bilateral technical cooperation agency, has embarked upon seven major projects in this area. Some of the projects have already been completed or have entered their second phase. The projects are listed and described in Table 1.

Table 1. Major Technical Cooperation Projects in Basic Education Supported by JICA

Title	Country	Duration	Brief Description
The Package Cooperation for the Development of Elementary and Secondary Science and Mathematics Education	Philippines	June 1994-May 1999	Capacity building of a core of in-service teacher training (INSET) institutions in science and mathematics education
Mini-Project-Type: The Technical Cooperation for the Development of Creativity Lessons for Primary Education	Egypt	December 1997 – November 2000, now expanded to a new larger project	Development of teachers' guides in science and mathematics
The Project on Strengthening of Mathematics and Science in Secondary Education	Kenya	July 1998 – June 2003, now in the second phase	Capacity building of INSET providers and institutionalization of an INSET system for science and mathematics teachers
Mini-Project-Type: The Mpumalanga Secondary Science Initiative Project	South Africa	November 1999 – March 2003, now in the second phase	Capacity building of INSET providers and institutionalization of an INSET system for science and mathematics teachers in one province
Improvement of Educational Achievement in Science, Technology and Mathematics in Basic Education	Ghana	March 2000 – February 2005	Capacity building of INSET providers in three selected districts and establishing a model of structured INSET
The Project for Development of Science and Mathematics Teaching for Primary and Secondary Education	Indonesia	October 1998 – September 2003	Capacity building of three major teacher training (PRESET) universities
The Secondary School Teacher Training Project in Science and Mathematics	Cambodia	August 2000 – October 2004	Capacity building of a higher teacher training institution in science and mathematics

Source: Kuroda (2004)

It is notable that all of these projects are concerned with science and mathematics education and focus on teachers. In the international community of development cooperation, Japan is a new comer in the field of technical cooperation for basic education. Therefore in embarking upon such new undertakings Japan was very careful about where to intervene and finally chose teacher training in science and mathematics as a focal area for technical cooperation at the basic education level. There are several reasons for this choice. Firstly there seems to be a kind of unspoken consensus or belief among the Japanese, particularly those involved in development cooperation, that Japan has a well developed and successful science and mathematics education system as exemplified by high scores of Japanese students in several international surveys. There is also confidence in the well established Japanese system of teacher training. In fact there have been an increasing number of requests from developing countries for cooperation in these areas and Japanese expertise has been increasingly utilized in projects such as those in Honduras and Bangladesh. Another rationale cited for the emphasis on science and mathematics is that they are relatively culture and value free, and thus foreign interventions in these subjects may not be perceived as an invasion of sovereignty of the country concerned. Both these rationales are debatable (Sawamura 1999), but nevertheless JICA has taken a decisive first step toward educational cooperation for strengthening science and mathematics education through teacher training (pre-service teacher training, PRESET, and INSET).

This article describes several features of the initial undertakings in educational cooperation by JICA, taking a project in Ghana as an example, and tries to extract some lessons learned from this valuable experience. Since the author of this article is the chairperson of the Japanese supporting committee for the project, the article necessarily takes on the nature of a subjective reflection on the project[1]. However an attempt is made to introduce a more objective view in the article by comparing this Ghanaian project with other similar projects in Table 1.

Overview of the Project: Main Features

Origin of the Project

Since independence in 1957 and supported by favorable economic growth, Ghana had successfully developed its education system. A key piece of legislation driving this process was the Fundamental Law of Education in 1961 prescribing free compulsory primary and secondary education. By the 1970s, Ghana could be said to have had the best education system in West Africa. However in the late 1970s and early 80s, Ghanaian education started deteriorating due to the sudden decline of the Ghanaian economy and to political instability. This economic and political crisis resulted in the intervention of International Monetary Fund (IMF) and the World Bank forcing Ghana to adopt the strategy of 'structural adjustment'

[1] While this article deals with JICA's projects, it does not represent any official views of JICA but the author's personal views.

in 1983. Within this IMF/World Bank strategy for the economic recovery of Ghana, education sector reform was started in 1996 by introducing a ten-year program of 'Free Compulsory Universal Basic Education' (FCUBE). This program aimed at establishing a nine-year compulsory basic education system (composed of six-year primary and three-year junior secondary schools) by 2005. In order to establish this system, three goals were set: 1) to improve the quality of teaching and learning, 2) to strengthen management to improve efficiency and 3) to improve access and participation.

As one of the international contributors to African development, the government of Japan, whose ODA has historically concentrated in Asia, expressed its intention to support educational development in Africa at the General Conference of UNCTAD[2] in April 1996. At this conference Ghana was particularly mentioned as a country where the OECD/DAC[3] new development strategy could be successfully implemented. Against the backdrop of this positive stance by the Japanese government, several exploratory studies and informal consultations and negotiations with the Ghanaian authorities were conducted from 1997 to 1999 in order to arrive at a mutually agreed upon project in the education sector. Eventually in October 1999 both sides agreed to embark upon an INSET project in science and mathematics education at the upper primary and lower secondary level as part of the endeavor to improve the quality of education stated in FCUBE. This project, which is entitled 'Improvement of Educational Achievement in Science, Technology and Mathematics in Basic Education (STM)[4] in the Republic of Ghana', was started in March 2000 and is scheduled to end in February 2005.

On the Japanese side, as mentioned above, it was fully recognized that this was one of the very first technical cooperation efforts in basic education and that Africa, unlike Asia, was not a familiar region for them. Therefore they approached the project with due caution as reflected in a JICA exploratory report (1997, p. 42),

> .... Japan has not necessarily had enough experience in technical cooperation in basic education and therefore must be very careful not to simply transfer Japanese know-how and experience in science and mathematics education without due consideration given to specific educational and other conditions of relevant countries. Further it should also be kept in mind that numerical goal indicators are difficult to set for basic education and it takes some time and needs great efforts to see visible achievements. Moreover it should be noted that even science and mathematics education cannot escape from cultural, historical and linguistic influences. ....

[2] The United Nations Conference on Trade and Development
[3] The Development Assistance Committee (DAC) of the Organization for Economic Development and Cooperation (OECD)
[4] 'Technology' in this project is interpreted not as a specific subject but application of science and mathematics. Therefore in practice this project deals with science and mathematics education.

Project Goals

As indicated in the title of the project, its overall or long-term goal is to improve students' educational achievement in STM at the upper primary and junior secondary level in selected geographical areas. At the beginning "students' educational achievement" was understood to include a wider range of achievements; not only knowledge about science and mathematics, but also areas such as its application in daily life and student motivation to learn these subjects.. But as the project was implemented, about a year later in March 2001, the term was modified to knowledge only, which is easier to measure. At the same time verifiable indicators, which measure the degree of the achievement of the goals, were specified and quantified. Pupils were expected to show specified improved results on tests of their knowledge and understanding. For example, 45% of upper primary level pupils were expected to attain the score that was achieved by 35% of this group in the baseline tests.

The long-term goal of learner achievement was to be realized by improving teachers' capacity to deliver STM, which is the immediate goal of the project. This teacher-directed goal was also made more specific in March 2001. By this time the project had developed check lists for assessing teachers' capacity in terms of lesson plan preparation and classroom activities. The goal for teachers' capacity was set as follows; the percentage of the teachers who reach the target score of 3 or higher, on a measurement scale of 1 (poor) - 5 (excellent), are not less than 60% for science and 70% for mathematics respectively,

This tendency toward a more specified and quantified description of project goals and purposes is not necessarily due to changes in contextual factors in Ghana, but rather reflects an increasing concern on the part of Japan/JICA about accountability and efficiency issues in ODA and thus about 'objective' project evaluation. In spite of JICA's careful approach to the evaluation of technical cooperation projects in basic education, as cited in the 1997 JICA report, this is probably the first JICA project in education that has espoused very quantified and measurable indicators, even for long-term goals.

Project Design

While this project is concerned with science and mathematics education, it is also a teacher training project. In fact the major component of this project is providing training (more specifically INSET) for upper primary and junior secondary school (JSS) teachers in science and mathematics. The project is therefore aimed at improving teachers' capacity for delivering STM by providing them with INSET, which in turn is conducive to improved students' achievement.

In designing the project, however, there was not much discussion about why intervention in teacher training would be an effective and efficient way for improving students' educational achievement. No questions were raised as to whether intervention in areas other than teacher training, such as school management or curriculum and textbook development, could be more effective in improving students' achievement. One of the reasons for having chosen teacher training was unique to the Ghanaian context. When this project was being designed, there had already been many projects in education in Ghana conducted by international

development partners. Teacher training in science and mathematics was one of a few areas left for educational cooperation by Japan. The Ghanaian side therefore made requests to JICA for teacher education. In addition the Japanese project developers believed from their own experience that the key to educational development is having good teachers.

Hence discussion focused on which is more effective, PRESET or INSET. Finally it was agreed upon by both sides to intervene in INSET. The reasons for this decision were:

1) it would take more time to see visible improvement in students' educational achievement through PRESET than INSET,
2) as school-based PRESET[5] was about to be introduced INSET could provide good training opportunities for senior school teachers who would supervise as a mentor the new school-based PRESET of prospective teachers and
3) if teacher training colleges[6] (TTCs) provide INSET in addition to PRESET, closer relationships between TTCs and teachers/schools may be created and thus PRESET at TTCs would also be improved by reflecting more realistically the needs at the school/classroom level.

Another notable feature of this initiative is that it is not a nation-wide or provincial-wide project, but a small-scale pilot project in three districts. Of these three, a district called Akuapem North in Eastern Region was selected as the first project site to develop an initial structured INSET. This INSET model would then be replicated, tested and modified in the other two districts (Adansi West in Ashanti Region and Tamale municipality in Northern Region)[7]. Through these processes it is expected to establish a suitable model of INSET, and ideally this model could be diffused nationwide by the Ghanaian education authorities. It should be noted that this model of INSET is designed and organized on the initiative of the district education authorities, and is an appropriate development in the light of the decentralization of educational administration in Ghana. This approach to INSET is often called a cluster model (JICA 2004a) in that INSET is directly provided for classroom teachers in a certain geographical area. This model differs from the so called 'cascade model' whereby the content of INSET workshops conducted at the central level is diffused to regions and to districts and eventually to schools with multiplier effects.

School-based INSET is another important component in the design of this project. The initial design did not include this aspect at all. As the project was implemented, it became obvious that a high attrition rate of teachers had negative effects on the achievement of its goals. If those teachers who have undergone INSET provided by the project leave the system, it is a waste of valuable resources. This is not an issue about INSET as such, but one which pertains to a more general policy concerning teacher employment. However in order to alleviate this problem, in addition to INSET at the district level, the project has introduced

[5] In the new PRESET system in Ghana, the last year training of the three-year teacher training is to be conducted at school not at teacher training college.
[6] In Ghana 38 teacher training colleges are providing PRESET for primary and JSS teachers.
[7] Just to give an idea of the size of the project, some 1,000 teachers have been provided with INSET in the first project site and altogether about 950 in the other two sites by September 2004. (JICA 2004b)

school-based INSET as an important component. Teachers can share the knowledge and skills delivered through INSET with the colleagues at school making them institutional rather than individual properties.

The last but not least important feature of this project is that it also aims to develop technical and managerial capacity on the Ghanaian side to organize a structured INSET program. This implies that after the project, INSET can be organized by Ghanaians without Japanese assistance. Since the preparatory stage of the project, there has been a strong concern about its sustainability on both sides. In this kind of pilot approach, it often happens that as long as the project is ongoing, a good model is created and maintained, but once it ends everything disappears in a very short period of time. Therefore since its inception the project has fully recognized that it is extremely important to build capacity to sustain its results.

Project Implementation

Three groups of Ghanaian institutions/personnel have been involved in implementing the project. The first group consists of the central ministry's staff overseeing the planning and implementation of the project together with Japanese counterparts, namely the Director General of the Ghana Education Service[8] (GES) and the Director of its Teacher Education Division. Under their supervision, full-time counterparts have been designated to work exclusively for the project. They are a program coordinator and two specialists each in science and mathematics, recruited from among tutors of TTCs. Although this is not a project covering the entire nation, but only the three districts, the central government organized the team, because according to the Ghanaian policy this project was designated as a national one assigned to GES.

District education offices, represented by the district directors of education in the project sites, are the second important stakeholders in this project. The core activity of the project is the organization of INSET in the three pilot districts. At its conclusion, the district education offices are expected to take over the entire responsibility for INSET from the ad hoc project team. The degree of their motivation depends on the extent to which they understand the significance of INSET for the improvement of Ghanaian education. Since this project was initiated from the center, and not formulated at the district level, it took time and effort by the Ghanaian and Japanese partners to reach a mutual understanding about the project.

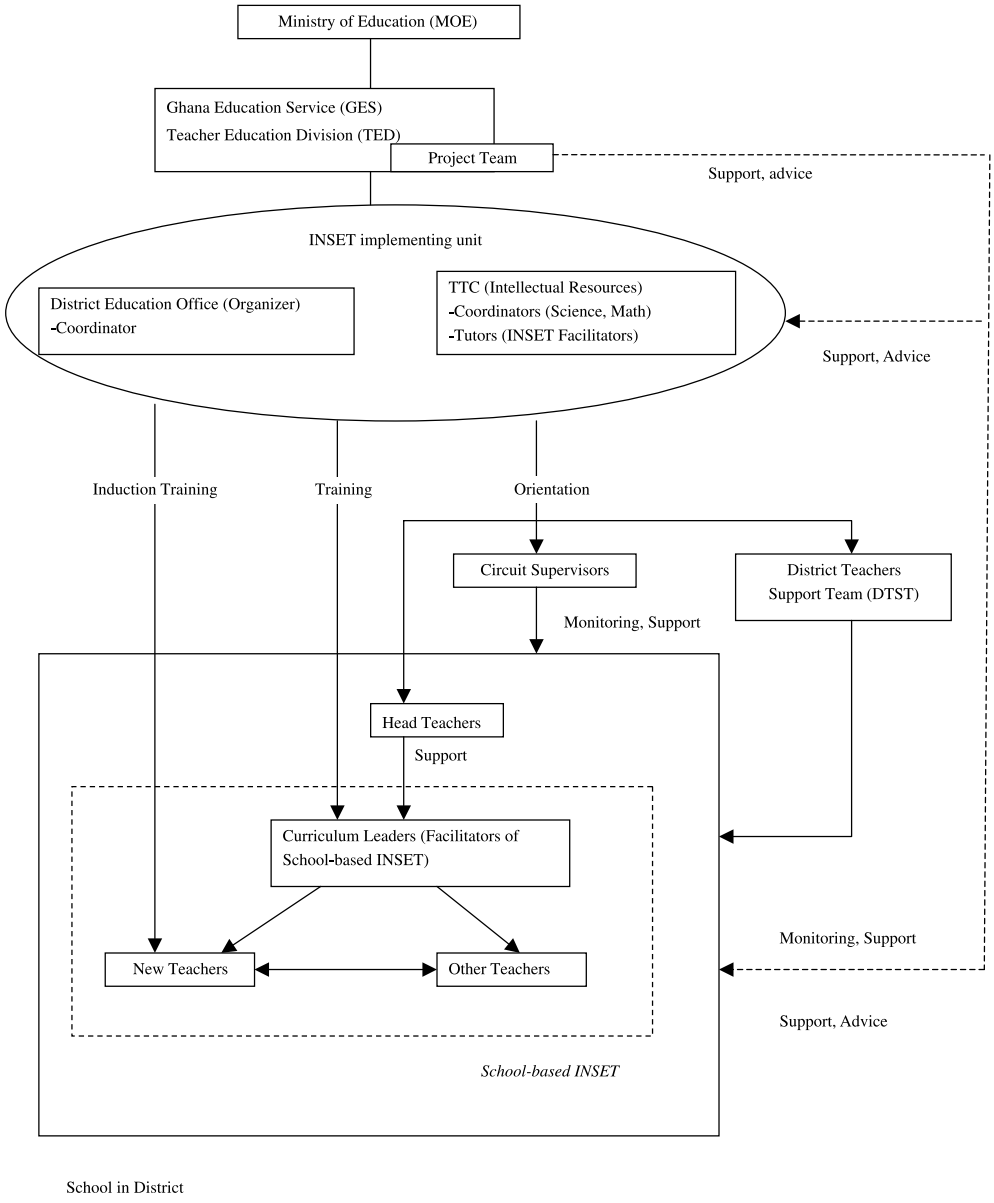
In practice science and mathematics tutors of three TTCs in the project districts (Presbyterian TTC in Akwapin North, Akrokeri TTC in Adansi West and Bagabaga TTC in Tamale) have played an important role as well. It is they who have provided substantive input for INSET as pedagogical and subject specialists. While according to the agreed project document, one science tutor and one mathematics tutor from each of the three TTCs were supposed to be involved, practically all the science and mathematics tutors of the three colleges have been contributing to INSET as resource persons. This participation may be

[8] There are two central administrative bodies dealing with education in Ghana, the Ministry of Education, Youth and Sports being a policy formulating organ and the Ghana Education Service (GES) an implementing organ.

because they were invited to Japan for JICA training in science and mathematics education and became highly motivated to assist in implementing the project.

As indicated in Figure 1, the goal of the project is that by its end the district education offices in the project sites will be able to organize INSET on their own using technical and academic resources in the TTCs in their respective districts, with general advice and support from the project team. This INSET helps improve teachers' performance, which in turn will be conducive to improved achievement of students.

Figure 1. Organizational Structure for INSET Implementation



Expected Outcomes of the Project

According to the design, the project is expected to produce the following six concrete outcomes (JICA 2002), which lead to attaining the immediate goal of improved teachers' performance and eventually to realizing higher students' achievement in science and mathematics.

Outcome 1: The existing STM education at upper primary/JSS will be reviewed and the recommendations of that review will be reflected in the Project Design.

--- *This activity is to study the initial conditions of students and teachers (baseline survey) and to modify and develop the project design according to its results.*

Outcome 2: Structured INSET is established in Akuapin North District linked with School-based INSET.

--- *It is envisaged here to develop a model of INSET in the first project site.*

Outcome 3: INSET Program is replicated in other Project Areas.

--- *This activity is intended to test the model in the other two areas and to modify and further develop it.*

Outcome 4: Institutionalization of INSET is supported and policy for this move is developed.

--- *With a view to sustaining the achievements of the project in the future, even at this stage the project is to encourage and support the government's initiatives and endeavor toward institutionalizing INSET nationwide.*

Outcome 5: Creation of awareness and information-sharing on STM are promoted.

--- *It is aimed here to diffuse the results of the project among students, parents, teachers and the general public.*

Outcome 6: Monitoring and Evaluation of INSET are undertaken.

--- *This activity includes monitoring and evaluation of both individual INSET activities and the project itself.*

Role of Japanese Support

From JICA's perspective, this project has been run under a scheme called 'Project Type Technical Cooperation', which consists of three components, namely 1) dispatch of Japanese experts, 2) counterpart training in Japan and 3) provision of equipment. For this project approximately six experts from Japan have been stationed in Ghana throughout its duration. They are a chief advisor for the project, an administrative coordinator and two specialists each in science and mathematics. The first two persons play the role of supervising and coordinating the implementation of the project together with their counterparts. The four subject specialists (school teachers with a bachelor degree) provide substantive input when INSET is organized in cooperation with the local subject experts. All of these Japanese experts and their Ghanaian counterparts form the project team as is shown in Figure 1. In addition to these, experts have been dispatched for short-term visits two or three times a year. They are normally academic staff of Japanese universities who have more professional experience, knowledge and skills in science and mathematics education and thus technically advise the Japanese as well as Ghanaian experts.

Most of the Ghanaian members of the project team (administrators and subject experts) have undergone the so called counterpart training in Japan organized by three Japanese universities (Shinshu University, Miyazaki University and Hiroshima University). Ten subject experts and seventeen administrators have been trained under this scheme. This training has been an incentive to motivate the counterparts to get actively involved in the project and to improve their professional knowledge and skills. The provision of equipment is very modest, particularly because this project does not involve the construction of large facilities.

One of the characteristics of the project is to foster inter-project collaboration, including JICA initiatives other than the 'Project Type Technical Cooperation' as well as projects not funded by JICA. One example of this collaboration is that the project has combined a JICA country-focused group training course with the project. This course is one of the JICA general training courses for a group of people from a specific country that is normally organized separately without direct links with particular technical cooperation projects. But for this project, a country-focused training course on science and mathematics education has been organized specifically to train those Ghanaians who are involved in the project. This two-month long course, jointly designed and run by two Japanese universities (Fukuoka University of Education and Hiroshima University), targeted mainly science and mathematics tutors of the three TTCs. Forty science and mathematics tutors of the three TTCs and seven administrators have been trained under this scheme. Although not all of these TTC tutors are officially appointed members in the project, they are expected to make a considerable technical contribution to the project as resource persons, and to date they have met this expectation. This collaborative arrangement was intended to build and improve the capacity of the Ghanaian side for sustainable implementation and development of INSET.

Another example of a wider utilization of various initiatives is to send Ghanaian educators to Japan or other countries as JICA long-term trainees. This is a relatively new JICA scheme to provide trainees with an opportunity to acquire a master's degree in education at universities in Japan or other countries. Thus far four have been sent to Japan and two to other countries, all of whom were recruited, selected and recommended by the project. Although these trainees are not Ghanaian counterparts per se or necessarily expected to be so, it is envisaged that they will play a leading role in sustaining the establishment and institutionalization of INSET in Ghana in the near future.

Other than JICA's programs, initiatives such as scholarships from the Japanese Ministry of Education to invite foreign students to Japan, scientific research funds from the same Ministry and the visiting professorship scheme of Hiroshima University, have also been extensively utilized. From all of these, immediate or short-term effects on the project are not necessarily expected. However, these activities have been conducted with a view toward creating a long-term basis for educational development in Ghana and for promoting educational exchanges between Japan and Ghana.

What Has Been Achieved by the Project?

This project is scheduled to terminate at the end of February 2005. It is JICA's usual practice to conduct a final evaluation six months before the completion of a project. For this project, the evaluation was done from 24 September to 10 October 2004 by a joint evaluation team composed of Ghanaian and Japanese representatives. Since the members of the team are those persons who have been involved in the project in one way or another, including the author, it is not an external evaluation, but a kind of self-evaluation or self-reflection. The following are the author's personal observations on the results of this project based on the experience of this evaluation exercise.

Has a Structured INSET Model Been Developed?

A more or less structured INSET model at the district level has been developed by organizing INSET fifteen times in the first site and trying and testing this initial model sixteen times in the other two sites. This model has the following features and components (JICA 2004b).

1) It comprises two phases each of which entails a three-day workshop.
2) The INSET workshops are organized during school days so that teachers can immediately apply what they have learned through INSET.
3) It provides self-learning materials for students to compensate for the absence of the teachers during INSET.
4) The number of participants in each session of INSET is limited to 30 to ensure quality interaction.
5) Pre- and post-monitoring of participants in the INSET workshops are conducted.
6) It develops curriculum based workshops on the teaching of challenging topics in science and mathematics.
7) The workshops emphasize a child-centered and activity-oriented approach to teaching.

These trials have finally resulted in an INSET manual, issued in October 2004, covering technical and administrative aspects.

School-based INSET is a new project component added at a later stage. The project has just started INSET for curriculum leaders of schools who are expected to organize school-based INSET. Interviews with these curriculum leaders have revealed that they have actually started facilitating school-based INSET with the support of the principal, but at the same time they have been faced with many challenges to overcome including funding issues. Therefore a mode of school-based INSET that could be replicated has not been fully developed and its effectiveness is yet to be tested.

Have Teachers Changed and Has Improved Teachers' Performance Contributed to Progress in Students' Achievement?

The primary concern of the project is to determine how teachers have changed as a result of the INSET. In order to measure the improvement of teachers' performance against

the indicators set by the project, a sample survey was conducted, comparing teachers' performance between pre- and post-INSET in terms of lesson plan preparation and classroom activities. For each subject a group of three subject specialists in the project team investigated the lesson plan and observed the classroom activities of the teachers surveyed. The survey has found very impressive improvement as indicated in Table 2. As far as the progress in teachers' performance is concerned, there is no doubt that the project has been successful.

Table 2. Percentages of Teachers Who Reach the Target Score or Higher before and after INSET

Lesson plan preparation	Science		Mathematics	
	Pre	Post	Pre	Post
Upper Primary	9.4%	55.8%	9.2%	62.8%
JSS	16.8%	62.2%	2.5%	83.2%
Classroom Activities	Science		Mathematics	
	Pre	Post	Pre	Post
Upper Primary	14.9%	55.0%	25.0%	67.9%
JSS	26.5%	61.8%	28.4%	86.3%

Source: JICA (2004b)

However the goals of the project have not been fully achieved because upper primary teachers have not attained the targets of 60% for science and 70% for mathematics respectively. In the light of the remarkable progress in teachers' performance, this finding should not be interpreted as failure of the project, but may be because the project has set too ambitious targets.

In contrast to the drastic improvement of teachers' performance, the progress in students' performance is not clear. While the mean scores of achievement tests have slightly increased

Table 3. Mean Scores of Achievement Tests

	Science		**Mathematics**	
	Baseline	Final Evaluation	Baseline	Final Evaluation
Upper Primary	36.0*	36.7	35.5	36.2
JSS	38.2	39.5	33.7	34.7

Note:*Full mark is 100.
Source: JICA (2004b)

for upper primary and JSS students in both subjects (Table 3), when it comes to the percentages of students who have obtained the target score, upper primary students in mathematics and JSS students in science have not reached the goals set for the project (Table 4). But in any case the differences between the goal and attained percentages are not statistically significant. There may be many reasons for these results, including:

1) it may take a longer time for improved teachers' performance to impact student achievement,

2) improvement of teacher capacity is not high enough to be conducive to improved student achievement, and

3) there are a number of factors contributing to student academic performance such as school management, school environment, textbooks and teaching materials. Teacher capacity is only one of them.

In any case this is an issue to be further examined.

Table 4. Percentage of Students Who Have Achieved the Target Scores or Above

	Science		Mathematics	
	Goal	Final Evaluation	Goal	Final Evaluation
Upper Primary	45%	47.1%	45%	42.1%
JSS	40%	37.2%	40%	40.7%

Source: JICA (2004b)

Has Capacity for Organizing INSET Been Developed?

As many as eighty-five Ghanaians, including sixty science and mathematics experts and twenty-five administrators, have been trained through the country-focused group training course of JICA and other initiatives. It can be said, therefore, that a critical mass of human resources has accumulated on the Ghanaian side to organize and promote INSET, at least in the three districts.

However a crucial question to be asked here is whether these human resources have been utilized to promote INSET, or whether they have been scattered here and there losing links with the project. As far as the administrators are concerned, at the central level many of them are still in important positions to support and promote INSET in science and mathematics. Even those transferred maintain posts influential in decision making concerning policies for teachers including INSET and science and mathematics education. At the district level, interviews with those trained in Japan, including the three directors of the district education offices, indicate that they have made efforts to support the project and will sustain the good practices of the project.

As for the technical capacity for organizing INSET, those TTC tutors trained in Japan have gradually built adequate knowledge and skills and are now almost able to provide INSET in science and mathematics to teachers on their own without the project team being

directly involved in its organization. In addition they have been playing a very important role as leading experts in science and mathematic education in Ghana. For example, they have functioned as resource persons at a national workshop for science and mathematics tutors from other TTCs and as invited facilitators of INSET in other districts.

Institutionalization of INSET and Sustainability

As far as capacity building is concerned, an initial group of Ghanaian people, who are expected to sustain the gains of the project, seems to have been formed. Another factor to ensure the sustainability would be to create a system or institutional setting to effectively utilize and organize these human resources and to spread INSET nationwide. Various efforts have been made on the Ghanaian side to this end. For example at the policy level, the government of Ghana has fully recognized the role of teachers as key to quality education and expressed good intentions to support them. More concretely a policy proposal for the institutionalization of INSET has officially been approved by GES. This policy enables all teachers, regardless of their qualification or place of work, to receive periodic INSET throughout their teaching career. At the district level as well, officials in the three project districts have formulated strategies to sustain the project by incorporating STM activities in their educational action plan.

Although all these initiatives and endeavors taken by the Ghanaian side are extremely important for the sustainable development of INSET in science and mathematics in Ghana, they are still in the planning stage. In order to make the idea reality, more detailed implementation strategies, including the structure of INSET provision, costs, and incentives, need to be worked out at the respective levels of the educational system.

Discussion

Highlighted below are several issues and lessons from this initial experience of technical cooperation in basic education in Ghana. The first question, which is a very basic one, is whether science and mathematics education is an area where Japan is able to intervene and is likely to be successful or not. One of the reasons Japan chose science and mathematics for educational cooperation was that these subjects are relatively culture and value free. Although this premise is debatable, the JICA projects in this area, including the one in Ghana, have so far been welcomed by the counterpart countries without creating cultural or value problems. Many developing countries seem to believe rather naively that highly technologically advanced Japan must have good science and mathematics education. Perhaps because of this belief, an increasing number of requests for help in science and mathematics education have been made to Japan. But this increasing demand for technical cooperation in science and mathematics education is one thing and whether Japan's cooperation in this area is really useful and effective is another. In fact none of the seven projects listed in Table 1 has yet shown significant changes at the level of students. Although there have been several reports that the projects have contributed to improving teachers' capacity, like the case in

Ghana, long-term student attainment, as measured by improvement of achievement test scores, increased interest in these subjects or frequent application of scientific and mathematics knowledge in daily life, have yet to be demonstrated. It may therefore need some more time until one can judge if Japan's approach to technical cooperation in science and mathematics education has been a successful one or not.

In this connection, there seems to be a dilemma on the Japanese side as to how to set overall project goals and measure them in the area of basic education. While an increasing concern about accountability for ODA in Japan tends to demand short-term, more visible and measurable projects' results of JICA on one hand, on the other hand it is hard to show significant immediate achievements in basic education, particularly at the student level. This Ghanaian project is perhaps the first case where quantified overall goals were set and the final evaluation of the project has revealed that there has been no significant change in students' achievement. In spite of this fact, however, in order to develop Japan's initiatives in technical cooperation for basic education, it would be important for JICA to be patient enough to wait for another several years to make the final judgment about its success or failure.

The next question to be raised is whether the choice of teacher training particularly INSET for technical cooperation in basic education is appropriate or not. Several Japanese projects, including the Ghanaian one, seem to have been successful in creating and heightening the awareness of the importance of INSET that has been conducive to policy formulation on INSET. There is no doubt that INSET is important and effective in improving teachers' capacity that will in turn lead to higher students' achievement. From the Japanese perspective there might have been a good reason for intervening here because it has a well established INSET system that would be worthy of study by developing countries. However, as already suggested, there must be a variety of factors other than teachers' capacity contributing to students' achievement in science and mathematics. In designing the project, more consideration could have been given to these factors, so that the relative importance of INSET/teachers' capacity could have been revealed and thus a more comprehensive approach to science and mathematics education could have been conceived.

There also emerged a rather technical issue in the process of designing the project. That is which approach to INSET would be more pertinent to the Ghanaian context, a 'cascade model' or a 'cluster model'. The former apparently is intended to cover a wider geographical area from the beginning, nation or province wide, by organizing INSET for trainers of trainers at the center. Its content is then diffused to provinces, districts and eventually schools. Several disadvantages are cited for this model such as

1) because INSET is implemented at increasingly further removed levels, the content is likely to be diluted,
2) it is difficult to incorporate varied local needs and
3) since initiatives are taken at the central level, there tends to be less sense of responsibility for INSET at a local level.

On the other hand the cluster model may be able to provide INSET which meets local needs,

but it is a challenge to replicate this in other areas. Choosing the appropriate model depends on a number of conditions such as the capacity of educational administration, the number of teachers to be included and the availability of transportation. In the Ghanaian case, in the context of the decentralization of educational administration, the 'cluster model' was introduced with a view to providing more solid INSET (not a diluted version) and strengthening the INSET capacity of local education authorities.

Lastly it should be mentioned that there is a strong concern for sustainability that is shared by all the projects listed in Table 1. Behind this heavy emphasis on sustainability is the idea of 'self-help' that is the basic philosophy of Japan's ODA (Sawamura, 2004). This philosophy implies that Japan's development assistance should enable the partner country to become self-reliant in maintaining and further developing the achievements of a project. In order to ensure this, even at the very initial stage of a project great consideration should be given to sustainability. In the Ghanaian project, two major activities have been conducted to this effect. One of them is capacity-building of INSET providers/organizers at different levels. This has been done mainly through training in Japan, and by now a critical mass of human resources to organize and promote INSET has been created. The other thrust towards sustainability is to encourage the institutionalization of INSET. The idea here is to create a system or institutional setting to effectively utilize and organize the human resources and to spread the INSET model developed by the project nationwide. The conventional concept of technical cooperation focuses on knowledge and technology transfer to the partner country (Nagao, 2004), whereas the idea of institutionalization goes beyond this and envisages the design and development of a new local structure. This mode of operation is an emerging focus of JICA's projects in certain areas including education, which could be observed in the Kenyan and South African cases as well.

References

Japan International Cooperation Agency (2004a). Hyouka Kekka no Sougou Bunseki: Shotou Chuutoukyouiku/Risuuuka Bunya [Overall Review of Project Evaluations: Science and Mathematics Education at the Primary and Secondary Level].

Japan International Cooperation Agency (2004b). ANEX 2. Evaluation Grid. Minutes of Meeting between the Japanese Evaluation Team and the Authorities of the Government of Ghana on Japanese Technical Cooperation for Improvement of Educational Achievement in Science, Technology and Mathematics (STM) in Basic Education.

Japan International Cooperation Agency (2002). STM Project Project Design Matrix (3rd Version, December 2002).

Japan International Cooperation Agency (1997). Ga-na Kyouwkoku Kisokyouiku Kisochousadan Houkokusho [A Report of the Mission for Basic Study on Basic Education on the Republic of Ghana].

Kuroda, N. (2004). Risuuka Kyouiku Kyouinkenshuu tou ni kannsuru Kyouryoku Keiken mo Shuuyaku [Review of Japan's Experiences of International Cooperation in Teacher Training

in Science and Mathematics Education]. Center for the Study of International Cooperation in Education, Hiroshima University.

Nagao, M. (2004). Could Japan Be a Good Math & Science Teacher for South Africa? *Journal of International Cooperation in Education,* 7 (1), 53-70.

Sawamura, N. (2004). Japan's Philosophy of Self-Help Efforts in International Development Cooperation: Does It Work in Africa? *Journal of International Cooperation in Education,* 7 (1), 27-40.

Sawamura, N. (1999). Risuuka Kyouiku Bunya no Kokusai Kyouryoku to Nihon no Kyouryoku Shuhou ni kansuru Yobiteki Kousatu [A Preliminary Study on International Cooperation in Science and Mathematics Education and the Modalities of Japanese Cooperation]. *Journal of International Cooperation in Education,* 2 (2), 173-181.