

Could Japan Be a Good Math & Science Teacher for Africa?

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Abstract

This paper presents an ‘experience-sharing’ model of technical cooperation as a way to explain the increasing Japanese technical assistance to African countries for their math and science education development over the last several years. The distinguishing features of this model are the symmetric relationship between the technology supplier and recipient, the centrality of learning function and the importance of managing the cultural factor. The model contrasts with the usual technology transfer model of technical cooperation based on the supposed technological superiority of the supplying country, and takes account of the possible advantages offered by the Japanese assistance in math and science education as well as the revealed weaknesses associated with it. An illustration of the model is provided by Japan’s technical assistance to a secondary math and science teacher retraining project in South Africa.

Introduction

Japan is a ‘high tech’ country that manufactures and sells millions of cars, computers, VCRs, cameras and many other industrial products all over the world.¹ Her universities and technical schools turn out a constant and sizable stream of good engineers and skilled workers.² And Japanese children consistently achieve high rankings in international mathematics and science (hereafter M & S) surveys.³ Japan is also one of the world’s top donors of official development assistance (ODA) contributing the largest amount of bilateral educational aid.⁴ Would all this qualify Japan as a good, potential source of technical assistance for improving M & S education in developing countries with marked weaknesses in this area? Could Japan provide such assistance, for example, to the sub-Saharan African countries, where fewer

¹ In the year 1999, for example, Japan was the world’s top producer of passenger automobiles (8.1 million cars, accounting for 21% of world production), machine tools (US\$ 7.7 billion, 22 % of world production) and industrial robots (402,000 units, 54% of world production). Data taken from Ninomiya (2002).

² Around 25.7 % of Japanese university graduates earn an engineering, computer and other natural science degree. Among the countries with comparative size of university enrollment, only Korea (38.4 %) and Germany (32.5 %) surpass this proportion. Data taken from OECD (2002).

³ See, for example, TIMSS results (Martin et al. 2000; Mullis et al. 2000).

⁴ In the year 2000, Japan was not only the largest ODA contributor (US\$13.5 billion), accounting for around 25 % of total ODA of DAC member countries (ahead of USA with US\$9.9 billion) but was also the largest contributor of bilateral educational ODA (around US\$515 million, ahead of Germany with US\$495 million). Data taken from DAC (2002).

students enroll in science and technology-related studies at all levels of instruction and the quality of instruction is far from adequate owing to limited availability of financial, material, technical and human resources (Caillods et al. 1996)?

The question is a real one, since the Japanese Government not only received numerous requests for such assistance from sub-Saharan African countries in recent years, but has also decided to respond positively to some of these requests. The Japan International Cooperation Agency (JICA), the country's official agency for technical cooperation, started an M & S assistance project in Kenya in 1998 and in South Africa and Ghana in 1999, and also dispatched Japanese M & S experts to Tanzania in 2000 for exploration of a similar project possibility (See Panel 1). Their move was endorsed by the Japanese Government-supported Second Tokyo International Conference on African Development (TICAD II) in 1998, which declared that "capabilities in science and technology will be raised on the national as well as regional levels (in Africa)" (Ministry of Foreign Affairs 2001). At TICAD III, held in Tokyo in September 2003, the Japanese Government reaffirmed this intention, citing its expanded commitment to the development of basic education in Africa (Ministry of Foreign Affairs 2003). There is indeed a general shift in the Japanese Government's aid policy to place a greater emphasis on educational cooperation (Sawamura 2001). There is, therefore, a good possibility that assistance for M & S education should become a regular feature of Japanese cooperation efforts vis-à-vis African countries.

Panel 1 JICA's experience in M & S education assistance

1960s~	Dispatching of M & S volunteer teachers
1994~99	M & S teacher training project for the Philippines
1997~99	M & S teaching material project for Egypt
1998~	M & S teacher retraining project for Kenya
1998~	M & S teacher training project for Indonesia
1999~	M & S teacher retraining project for Ghana
1999~	M & S teacher retraining project for South Africa
2000~	Dispatching of Japanese M & S experts to Tanzania
2000~	M & S teacher training project for Cambodia

All these M & S education assistance projects have a 3 - 5 year term, with extension possibilities, and usually aim at strengthening the capacity of M & S teachers in primary and secondary schools through teacher retraining programs conducted in the selected countries with the aid of Japanese experts, as well as through training of teacher trainers and related staff in Japan. This pattern reflects the experience of the first technical assistance project to the Philippines. This project was originally a scheme to build up the national institute for M & S curriculum development and training, which later added a teacher retraining program (Magno 2004). Each new project took the Philippine experience as the broad frame of reference and worked out the strategies and measures for aid intervention differently.⁵

The author is actively participating in the M & S teacher retraining project for South Africa both as the Chair of JICA's committee to support this project and as a leader of the technical assistance team dispatched for a short-term assignments three times a year. This paper presents a new model of technical cooperation being tried in this project, termed 'experience-sharing model', which contrasts with the technology transfer model underlying most technical cooperation projects. The technology transfer model assumes the existence of a 'technology gap' between the technology supplying and receiving countries, and the transfer takes place to fill this gap. The experience-sharing model is applicable to situations in which there is no clearly definable 'technology gap', but the cooperation takes place as a process in which the 'recipient' country picks and adopts useful elements from the technological experience of the 'supplier' country. The experience-sharing model is generally relevant in the areas of social development, such as education and health, where traditional and cultural values have such significant influences that cooperation needs and requirements may not be clearly discerned as a 'gap'. This model was initially conceived by the Japanese team organized to elaborate JICA's cooperation scheme for M & S education assistance in South Africa.⁶ It made sense, since there already existed in South Africa an ample stock of knowledge, experience and know-how in the area of M & S education and the cooperation need was for facilitating the accelerated development of M & S education, particularly for the country's African population. The project has gone through various adaptations in its implementation process. However, they were not of the kind to alter the principal elements of the model.

In what follows, first, the possible advantages, as well as revealed weaknesses of Japanese M & S education cooperation, are reviewed. Then, the experience-sharing model is presented in its conceptual form, followed by its illustration in terms of the South African project. The paper concludes with some preliminary discussion on the working of this model.

Japanese M & S Education Assistance: Possible Advantages and Revealed Weaknesses

Possible Advantages

Japanese education has been the subject of international attention since the beginning of 1980s for the relatively high academic achievement of her primary and secondary school learners. While this attention was largely an American creation at the beginning (National Commission on Excellence in Education 1983), it has added a much wider following with

⁵ JICA is presently conducting an internal evaluation exercise on these M & S education assistance projects in order to draw lessons for future assistance projects in this area. CICE is also carrying out a study of these projects with a particular focus on the domestic structure for the technical service supply.

⁶ The team headed by the author conducted a project planning study in July-August, 1999, with the cooperation of the Department of Education, Mpumalanga Province and the Centre for Science Education, University of Pretoria, and prepared a report embodying this model which, after some modifications, became the central document of the project (JICA 1999).

the publication in 1993 of the World Bank report (1993), *The East Asian Miracle: Economic Growth and Policy*, which highlighted the early and sound development of basic education as one of the key factors that led to the high economic performance of Japan and other East and Southeast Asian countries. The credential of Japanese education was made even higher with the publication of *The Challenge of Eastern Asian Education: Implications for America* edited by W. K. Cummings and P. G. Altbach (1997). Japanese educational experience is considered to form the core of the ‘Asian economic miracle’ (Tilak 2000).

The quality of Japan’s M & S education is often inferred from the high scores achieved in the international M & S surveys, such as TIMSS and PISA. Walberg (1991) cites Japan’s secondary science education as ‘Model’, excelling in the ‘higher cognitive processes such as synthesis, evaluation, and problem solving’, and mentions as key explanatory factors the uniform national science curriculum of high standards and time invested in formal courses and study.

Japanese M & S specialists would tend to put more stress on systemic advantages in the provision of M & S education, rather than the curricular constructs or contents. Shimojo (2000), for example, mentions the following three elements as constituting the ‘superior’ aspects of Japanese science education: (i) well-developed system of legal framework, teacher training support, material facility and other teaching conditions, (ii) established practice of ‘lesson research’ for improvement of classroom instruction, involving teachers,⁷ and (iii) application of advanced science and technology to education.

Needless to say, how the perception of such advantages may be realized would depend on the particular need of the country requesting Japanese cooperation. In actual fact, the M & S education cooperation projects shown in Panel 1 have incorporated either explicitly or implicitly what could be regarded as potential advantages of the Japanese cooperation. The exact combination would vary from project to project, but should encompass some or all of the six elements shown in Panel 2.

These experiences and practices represent an outcome, and a still on-going process, of a nation-wide capacity-building effort of a late-comer industrial country spanning many decades, starting from an income level much lower than many of today’s African countries. As a whole, they constitute the core of what is perceived by leading international educators now as the ‘challenge of Eastern Asian education’ to the Western, industrialized world. To the extent that most African countries are engaged in a similar pursuit for the greater majority of their people, the Japanese experiences may prove relevant or even useful. Various systems and practices developed by the Japanese to stretch meager educational resources for mass education may have significant reference values for these countries. On a more general

⁷ ‘Lesson research’ refers to the voluntary collaborative training initiated by the teachers themselves in the form of teacher study groups. Typically they develop a lesson plan together; then it will be actually tried by one of them in a class with the others observing and taking notes about the teacher’s delivery and the learners’ reaction; and later all the teachers come together to critique the lesson with the aim of improving the lesson plan. Some scholars consider these study groups “clearly the most prominent feature of in-service training in Japan” (Long & Riegel 2002, p. 110). See also Lewis (2000).

level, a look to the East may help African educators lessen somewhat their apparent psychological and intellectual dependence on the West and restore some balance in their educational outlook.

Panel 2 What is offered by Japanese M & S education cooperation

- (1) The experience of a deliberate, wide-spread diffusion of M & S education through systemic efforts. It was not a single policy or policy instrument, not even a clearly enunciated approach, but a conglomeration of multiple efforts mobilized in an increasingly systemic manner over time.
- (2) The long and varied experience in planning and implementing M & S curricular changes with shifting educational philosophies but always under severe resource constraints.
- (3) The accumulated knowledge, know-how and experience in teaching methods and materials for M & S education, emphasizing observation and simple experimentation.
- (4) The long-standing practice of an in-service teacher training system designed for professional development of teachers as well as retraining for periodic curriculum changes.
- (5) The practice of group learning by teachers for self-improvement through lesson research which is usually carried out on a voluntary basis.
- (6) The experience of linking basic M & S education to vocational and technical education with industrial applicability and enhanced employability.

Revealed Weaknesses

The foregoing discussion of the potential advantages offered by the Japanese M & S education cooperation should be qualified for there are also certain inherent difficulties and weaknesses associated with such cooperation. First, the experiences and practices referred to above are, after all, what have been accumulated by the Japanese in their home country but not tested abroad. Japanese school science curriculum at the primary and lower secondary levels, for example, has been developed with a particular emphasis on the learners' understanding of their natural surrounding through observation and experiments rather than the textbook-driven study of scientific principles, discoveries and inventions which may characterize some Western approaches to science education.⁸ The Japanese frame of reference

⁸ Private communication from Prof. Okumura, a senior science education expert, during JICA's M & S education cooperation mission to South Africa in May 2000.

for M & S education may turn out to be quite different from that of African countries in terms not only of natural context but also of historical and socio-cultural background. As such, the Japanese experience in M & S education may not be readily applicable to African countries. For those actually engaged in the cooperation process, such as consultants and advisors, there is an almost inherent tendency to be 'strongly guided' by their country's own experiences as reported by Stockman (1997, p.1774) for German vocational training projects in Latin America.

Second, another critical weakness on the Japanese side is that there is very limited knowledge of the educational situation in African countries. The Japan Overseas Cooperation Volunteers (JOCV) organization has been sending volunteer M & S teachers to African countries for more than three decades, but, as a JICA evaluation report on its activity indicated, the experiences and insights gained by these volunteer teachers tend to be individually held and never accumulated to form a collective asset (JOCV 2003). Concentrated efforts are being made by Hiroshima University's Center for the Study of International Cooperation in Education, with which the author is associated, and affiliated scholars to accumulate the relevant information and knowledge about African education. The intellectual and research infrastructure is hardly adequate for providing technical assistance in an effective and efficient manner.

Third, Japan's manpower resources for M & S technical assistance are rather limited owing to the fact that such resources have been developed almost exclusively for the domestic educational endeavor. Inadequate endowment of foreign languages and cross-cultural communication skills of those to be engaged in the provision of technical assistance should be anticipated (Kuroda 2001). The recent surge in the M & S education cooperation activities has already created difficulties in recruiting experts to go on technical missions or for field assignments in developing countries.

Finally, the Japanese technical assistance effort is characterized by the rigidity in the modus operandi of aid administration (Rix 1993; Yokozeki & Sawamura 1999). This would not pose a serious problem in areas, such as agriculture and water resource development, where much aid experience has been accumulated. However, in a relatively new area of technical cooperation, such as education, there is bound to be much adjustment and adaptation called for on account of newness of the experience for all concerned, and particularly the 'headquarter bureaucrats'.⁹

In the real world setting of technical cooperation, to go from a needs assessment to framing of a technical cooperation project, both potential advantages held by the cooperator and the associated difficulties and weaknesses need to be taken into consideration.

⁹ JICA has set up an internal sectoral working group on education for the purpose of information sharing across departments and divisions. It is yet to assume any decision-making authority.

Experience-Sharing Model of Technical Cooperation

Underlying most technical cooperation projects is the notion of technology transfer. Technology transfer usually means that a developed country that possesses a technology that is relevant to the need of a particular developing country supplies an appropriate package of information, equipment and technical services. It assumes that the developed country's technology is relevant and applicable to the developing country's technological need, and also that the transfer process can actually take place (Saito 1995, pp.224-227). Most technology transfer takes place as inter-firm transactions through the market. Technical cooperation is the technology transfer that materializes through a public (non-market) channel.

In the case of technical cooperation in such areas as economic infrastructure and manufacturing industries, the superiority and applicability of technologies held by the developed countries are clearly known and the project implementing experience of these countries can be extended without much modification. Hence the technology transfer can proceed without much hindrance. However, in the case of technical cooperation in education, this would not be the case. The 'technology', the object of transfer, cannot be clearly defined. If the need in the developing country is for building a system of in service training, how could the 'technology' to be transferred be specified? Even if the teaching materials, teaching methods and educational equipment and facilities may be packaged as a 'technology' to be offered from a developed country, there should be much doubt about its applicability, still less its superiority, if one considers the cultural and ideological differences that exist between the two countries. These difficulties would be compounded for the Japanese technology supplier with the difficulties mentioned earlier.

Based on these considerations, a new model of technical cooperation is suggested that is geared to 'sharing of experience'. This experience-sharing model contrasts with the technology transfer model in a number of respects, as shown in Panel 3. The object of the cooperation activity under this model is not transfer of a technology but of an 'experience'. The principal mode of intervention would typically be exposure of a group(s) of individuals from the developing countries to the relevant experience of the cooperating country rather than on-site instruction by the dispatched experts. The target outcome would not be an autonomous use of the transferred technology as in the case of the technology transfer model, but more likely be the formation of an autonomous system and practice utilizing the experience. And most importantly, the success of the experience-sharing model would not depend on the quality of the technology supplying transfer agent but on the quality of learning of both sides, especially the developing country side.

Symmetry of Relationship between the Technology 'Supplier' and 'Recipient'

The experience-sharing model is characterized by three distinguishing features - namely, symmetry of relationship between the technology 'supplier' and 'recipient', centrality of the learning function, and the importance of managing the cultural factor. The symmetry of relationship in any experience sharing is essential, since whether or not actual sharing takes

place would depend on the disposition of the ‘recipient’, rather than the ‘supplier’. The latter may offer what it considers the ‘best’ experience, but it will simply not be ‘shared’ if the former does not find it ‘attractive’. The experience-sharing model, therefore, implies the receiving side’s ownership of the project, which is in line with the rethinking that is going on about the nature of North-South partnership towards greater national ownership of aided projects by developing countries (King 1998). King and McGrath (2004) point out that the practice of knowledge management spreading among the donor agencies may lead to greater ‘sharing of expertise for development’ and that JICA for one may be turning in that direction.

Panel 3 Technical cooperation model: technology transfer vs. experience sharing		
<u>Contrasting points</u>	<u>Transfer of technology model</u>	<u>Experience sharing model</u>
Typical field	Manufacturing / Transport	Education / Health / Social welfare
Cooperation aim	Transfer of technology	Transfer of experience
Principal means	Dispatch of expert team by donor for instruction on site	Exposure of aided country team to relevant donor experience
Donor agents	Technical experts	Individuals, organizations and area communities holding experience
Recipient agent	Technical counterparts	Groups, organizations and local communities
Target outcome	Autonomous use of technology	Formation of autonomous system and practice
Key to success	Quality of transfer agents	Quality of learning by both sides

Centrality of the Learning Function

The most critical and instrumental factor in the working of the experience-sharing model is the learning associated with the cooperation project. Learning here means a process by which an individual or an organization grasps elements of a new experience, reflects on them, and uses and adapts them so as to improve the performance. That such learning is essential for sustaining any development activity in developing countries marred by extreme resource scarcity and highly volatile development context is widely recognized, but evidence shows that organizations in these countries tend to ‘downplay’ it while falling back on routines (Brinkerhoff & Goldsmith 1992, p.376). The experience-sharing model takes an engaging view of the learning process, placing learning at the center of the cooperation activities (Brown 1998, p.62-63).

First of all, a project based on the experience-sharing model should be formulated to

maximize learning by the recipient side. In the case of educational cooperation involving Japan as the partner, this learning could relate to any of the elements shown in Panel. The learning could take many forms. Some, such as learning about Japan's policy experience in M & S education development, would only call for a few lectures or good documentation. Others, such as knowing the Japanese teachers' practice of group learning for school-based in-service training, would require observation, explanation and perhaps a question and answer session with those teachers, if not participation in simulated sessions. Yet others, such as learning about Japanese knowledge, know-how and experience in M & S teaching methods and materials for possible adaptation, would involve a considerable amount of research. The supplier side can facilitate the learning process. The learning outcome needs to be defined jointly. This would require that the supplier side should also engage in some serious learning, especially about the educational situation and needs in the developing country concerned. When both parties are engaged in joint learning, the experience-sharing model would elevate their symmetric relationship to one of genuine partnership.

Secondly, the learning function should encompass a capacity building aspect, especially for adaptation and utilization of whatever learning is achieved through cooperation to the local context in the recipient countries. The conventional technical cooperation projects often neglect this aspect as the technical tasks are performed by the consultants and advisors commissioned by the supplier while the technically qualified local talents sit idle (Habte 1999, pp.56-57). In the experience-sharing model, the burden is as much, if not more, on the side of the recipient for ensuring that this aspect is not neglected. The learning invariably occurs through individual participation, for example, in teacher retraining activity. The experience-sharing model would require that individual learning should be complemented by team learning and organizational learning, which should necessitate institutionalization of the learning process to permit wider sharing of the learning achieved by particular individuals. Whether one employs a cascade model of training or a pilot-and-replication approach, the scope of institutionalization would involve a complex set of factors such as leadership, systems and communication structures (Preskill & Torres 1999).

Thirdly, the experience-sharing model is a learning process focused model, which takes a somewhat agnostic, or at least flexible, view of the learning outcome. This goes against the general tide in the international aid community which appears to be preoccupied with outcome concern and results-based management (DAC 2000). Evaluation should play a key functional role in the working of this model so as to make sure that the learning is actually taking place and that it is having a positive impact on the project. In conventional cooperation projects, evaluation tends to be regarded as donor's instrument and the recipient organizations take a passive view of its usefulness (Brown 1998, pp.64-65). Here again, the recipient side, in particular, should take a leading role in promoting the evaluation function. If this function is prudently utilized, starting with the needs survey and combining monitoring with mid-term and final evaluations, this would encourage sharing of the collective learning achieved.

Importance of Managing the Cultural Factor

The smooth functioning of the experience-sharing model is predicated on the close communication and partnership between the supplier and recipient. Because of the relative weaknesses of the Japanese cooperation side, there is an added handicap for meeting this condition. The communication gap may not be so burdensome for jointly tackling the specific tasks or problems which are clearly identified. A more problematic situation may emerge in relation to over-all management of the project, since it touches a complex set of values, beliefs, attitudes and behavior for which the cultural factor comes into play on both sides. Take, for example, work habit. The work culture differs from country to country. When, for example, the supplier and recipient sides are engaged in jointly organizing a training workshop, establishment of its detailed program may require harmonizing their work habit expectations. Similar consideration may apply to valuing of field work vis-à-vis office work, punctuality, individual vs. group work, etc.¹⁰ Quite clearly, the cultural factor needs to be managed.

Illustration: Mpumalanga Secondary Science Initiative (South Africa)

The Mpumalanga Secondary Science Initiative (MSSI 1999; Nagao 2004) is a project of the Mpumalanga Department of Education in South Africa to improve the quality of M & S teaching in classrooms in the province's 540 secondary schools (Please see the project outline in Panel 4). The Department proposes to do this by retraining its M & S teachers. The retraining is needed not only to compensate for whatever gaps and deficiencies may exist in their instructional capacity owing to the training shortfall dating back to apartheid times, but also to facilitate the introduction of Curriculum 2005 which is built on an outcome-based approach. The retraining is to be done through a sequence of activities. It begins by empowering the Department's M & S 'Curriculum Implementers' (CIs), who act as teacher trainers, through a 6-week group study in Japan. Upon their return, they organize District-level workshops for Heads of M & S Departments (HODs) of the secondary schools in the respective districts. The HODs, in their turn, convene training sessions for their colleagues once back at their respective schools. The project aims at establishing a province-wide school-based in-service training system (INSET). The working of this system may be visualized by, for example, monthly training meetings organized at each school by the teachers to improve M & S teaching in their classrooms. To do all this, the Mpumalanga Department of Education has formed a collaborative partnership with JICA and the University of Pretoria.

Learning-Intensive Approach

The MSSI project is an attempt to find a practical application of an experience-sharing model with a 'learning-intensive' approach through an educational joint venture that utilizes

¹⁰ Jain (1997) argues that how well the program management is handled determines (CHNGE) the success of primary education interventions in developing countries.

Panel 4 Mpumalanga Secondary Science Initiative

- Goal:** Improved math & science understanding of secondary students
- Aim:**
1. Improvement of math & science teaching via teacher retraining
 2. Development of a province-wide system of school-based in-service training (INSET) using a 'lesson study' approach
- Duration:** Phase 1 Nov. 1999 ~ Mar. 2003
Phase 2 Apr. 2003 ~ Mar. 2006
- Partners:** Mpumalanga Department of Education / University of Pretoria (UP)/
Japan International Cooperation Agency (JICA)
- Target:** M & S teachers in all (540) secondary schools
- Characteristic approaches:**
1. Retraining for teacher capacity improvement and curriculum reform
 2. Cascade model of training targeted at school-based INSET
 3. Promotion of Peer Teacher Learning as a project instrument
 4. Individual teacher incentives through University of Pretoria (UP) accreditation scheme
 5. Extensive use of evaluation as a tool of project development

South African and Japanese university resources. It is an approach that is designed to promote learning of different kinds by the parties involved in the project, as summarized in Panel 5.

Even before the initiation of the MSSSI project, key officials of the provincial Department of Education were sent on an inspection mission to Japan for direct exposure to the relevant Japanese experience. Once the project starts, the teacher trainers are exposed to the Japanese experiences and practices through study missions in Japan and interaction with Japanese experts who assist their workshops. They are accompanied on this mission by a University of Pretoria researcher who can help explain what is observed in Japan.

The District Education Chiefs are also sent to Japan to observe the local education administration practices so that they may better understand and support the efforts of the teacher trainers at the level of districts and in schools. The Teachers' Centres, which have been established in each of the province's 10 districts, are to be equipped with equipment and materials for experimental and practical instruction in M & S again to enable hands-on learning experience. These centers also function as field centers for keeping track of the in-service training activities that take place at each school.

The reason for bringing the MDE teacher trainers and administrative officials to Japan for a study mission in spite of the considerable travel expenditures that need to be incurred is three-fold. One is to expose them to the 'full menu' of the Japanese experience in M & S education so that they may actually see it and then 'pick and choose' what they consider relevant and useful. One concrete result of the direct exposure has been CIs' development of the concept of 'Peer Teacher Learning' on the basis of their participation in Japanese teachers'

Panel 5 ‘Learning-intensive’ approach in MSSSI

- Learning by the ‘target’ groups in South Africa through direct exposure to the Japanese experience
 - Leading officials of the Department of Education (pre-project visits)
 - Teacher trainers (study missions)
 - District education heads (observation visits)
- Learning by the ‘support’ group in South Africa (University of Pretoria)
 - JICA’s research grant
 - Accompanying of teacher trainers visit by university staff
 - Visiting programs for the faculty, including visiting professorships
- Learning by the Japanese technical cooperation team
 - Joint research with the University of Pretoria team on project implementation at the school level

group study sessions. Upon their return to South Africa, they jointly wrote and published as an MSSSI technical guide a booklet bearing that title, which is now used as a standard reference material for explaining about the practice of school-based INSET.

Secondly, the Japan study missions provide them with an opportunity for an intensive group work which they may not experience otherwise. In addition to any individual learning gains they may make, the program emphasizes the importance of collective learning. Both the teacher trainer group and administrator group are required to prepare a group report as a joint output of the program. The fact that they are removed from their familiar environment and daily routines and placed in a very unfamiliar and difficult to communicate environment seems to foster the solidarity among the mission participants.

Thirdly, although the duration of the mission is only for 5~6 weeks, they are immersed in the Japanese cultural setting day in and day out. This seems to help them greatly in understanding the Japanese ways of thinking and doing things. Since their counterparts in Japan are the experts later dispatched by JICA to work in Mpumalanga on short assignments, the mutual communication improves, which facilitates the task of jointly managing the cultural factor mentioned earlier.

The University of Pretoria plays a critical role in analyzing and drawing lessons from the Japanese experience as well as in introducing Curriculum 2005 thinking into the teacher retraining program. The university receives a research grant from JICA to investigate the implementation process of MSSSI, including the applicability of the Japanese experience. The university is also to offer accreditation schemes for work done by enterprising teacher trainers and teachers so that the latter would have individual incentives for relevant learning.

The Japanese technical cooperation team joins the University of Pretoria team to conduct research on the implementation of the project, with a particular focus on monitoring of the

school-based in-service training activities. One aspect of this joint research covers the functioning of the monitoring system itself, intended to test if the information feedback mechanism operating in the opposite direction of the cascade-type training intervention can generate the dynamic of a learning organization (Johnson 1999). The exercise is, in effect, an effort to establish a formative monitoring mechanism to keep pushing forward after the project. Another aspect of the research has to do with examining the applicability in a foreign educational setting of the Japanese practice of lesson research (Lewis 2000).

Extensive Use of Monitoring and Evaluation as a Tool of Project Development

MSSI pursues multiple objectives, tries to combine different teacher training concerns into a single in-service training program, targets all the secondary schools in the Province, with three different target groups, seeks to utilize technical inputs from both domestic and foreign sources, and aims at establishment of a practice for in-service training to be conducted on a continual basis rather than at 'once-for-all' teacher upgrading effort. Based on these considerations, MSSI started with a fairly elaborate monitoring and evaluation scheme. Those concerned directly with the project development were particularly concerned with the monitoring of school-based INSET activities, which provided evidence on the extent of achievement of system-building effort. JICA, the donor agency, was equally concerned with the outcome of the training efforts. The compromise design is seen in Panel 6.

Panel 6 Compromise design of evaluation use in MSSI

<u>Project objective</u>	<u>Monitoring/Evaluation</u>	<u>Activities</u>
<i>Pre-project study</i>	<i>'Meta-analysis' of other M & S projects</i>	<i>Document search/Interviews</i>
To improve M & S teaching in schools	Impact evaluation - On students - On teachers	Internal evaluation (Baseline study)
<i>To develop a Province-wide system of school-based INSET</i>	<i>Monitoring/Development evaluation</i>	<i>Internal monitoring and evaluation through:</i> - <i>Progress assess. reports</i> - <i>Joint periodic review & group learning</i>
3-year review Final review	Outcome evaluation	Internal/external evaluation

* Program staff's views in italics and agency's concern in regular font.

The Role of the Japanese Assistance

JICA supports MSSSI both technically and financially. Its technical support has been mainly concentrated in its organization of study-cum-training sessions for CIs and educational administrators in Japan. It is during these missions that MDE project personnel are exposed to the Japanese experience in teacher training practices and M & S teaching methods and materials. Although an University of Pretoria expert accompanies the CI study mission, the Japanese team of experts serves as the primary technical service provider. JICA places only one young expert in Mpumalanga Province to work as a member of the MSSSI Coordinator Team. The Japanese experts are dispatched on short technical missions to the Province; typically a team of 4~5 experts go on a 2~3 week mission three times a year. The financial contribution by the Japanese side consists of supporting the holding of CI workshops and District-level workshops, and monitoring and evaluation work including the research carried out by the University of Pretoria team. The Japanese side also provides M & S equipment for furnishing the Teachers' Centers.

Compared with other Japanese education cooperation projects, the role of the Japanese assistance has been much more limited. This is so by design through the employment of the experience-sharing model. It should be granted that this has been made possible by the relatively well-endowed resource base of MDE and the technical support provided by the University of Pretoria. From the beginning, the Japanese side aimed at achieving project sustainability independent of direct Japanese support.

Has the Experience-Sharing Model Worked in MSSSI?

All these project inputs and supporting measures, and many others, have been put in place for a single and most critical effort, which is to develop group learning practices among the province's M & S teachers for self-improvement and innovative classroom teaching. It should be a group learning sustained by mutual cooperation and stimulation by the teachers in every secondary school in the Province with the technical and research support from the South African and Japanese university teams. So what has been the initial result of the working of the experience-sharing model?

An evaluatory note was prepared on the development of the Province-wide school-based INSET system two and a half years after the initiation of the project on the basis of the data obtained from regular monitoring activities and observations by the CIs. The following is an extract from this note:¹¹

(1) MSSSI school-based INSET activities appear to have taken firm roots in around 45~50 schools, or around 15 % of the total participating schools of 313 schools. These schools conduct one or more INSET activities per month. These are schools with active HOD leadership backed by strong school management support.

¹¹ Extracted from Nagao (2002).

(2) There are probably an additional 80~90 schools where the idea of school-based INSET is well-understood by the HODs, who manage to organize such activities occasionally. They may not receive strong support from their school management and/or support from fellow M & S teachers, which prevent these schools from adopting the regular INSET practice.

(3) As the number of MSSSI-participating schools increases in each region, the intensity of MSSSI school-based INSET activities seems to have declined in most of the Districts. This is to be expected given the limited amount of time at the disposal of CIs. For those schools which joined the MSSSI project in Highveld and Lowveld districts this year, another handicap has been the new restriction on attendance of workshops by teachers that it should not be allowed during school class hours.

Conclusions

This paper opened with a question, 'Could Japan be a good M & S teacher for Africa', and attempted to answer it by suggesting a new model of technical cooperation - the experience-sharing model. The distinguishing features of this model are the symmetric relationship between the technology supplying and recipient countries, the centrality of learning function and the importance of managing the cultural factors. Whereas the usual technical cooperation model based on the concept of technology transfer tends to give the technology supplier the control of the cooperation process, this model places the recipient in the driver's seat, with the supplier facilitating the learning process. This model is quite demanding of the technology receiving country in terms of the need to institutionalize the learning process so that accumulation and utilization of collective experience, knowledge and skills may proceed at their own pace. The emphasis on the learning function in this model may hold the promise of genuine partnership between the technology supplier and recipient and, at the same time, of greater sustainability of aided projects.

The experience-sharing model presented in this paper has been elaborated in the actual process of a M & S technical cooperation project in South Africa in which Japan participates as a cooperation partner. The project is into its 4th year. The initial result is quite promising. However, as with most development cooperation projects, it is not free from changing development and cooperation contexts.¹² It is still too early to tell if the project proves to be a positive testing ground for the experience-sharing model.

¹² The MSSSI project has faced a major challenge on both the technology supply and receiving ends. In October 2003, JICA became an autonomous body with a special status with the Government. The change has ignited a major structural reform of the organization, which is still going on and which has involved a shift in the unit responsible for the MSSSI project. In 2002, the Mpumalanga Province has implemented a major administrative reform converting its 10 Districts into 3 Regions and dividing the curriculum development work of the secondary education into upper and lower, placing the latter with the primary education. These changes and the accompanying personnel movements have forced the project to make major adjustments in its organization, strategy and working methods. The adjustments are still continuing.

So could Japan be a good M & S teacher for Africa? The answer should be ‘Yes, if the African partners learn well’ and ‘if, at the same time, the Japanese learn to develop a workable system for an experience-sharing model of technical cooperation in the area of M & S education. There is an undeniable shift in the international aid to education toward greater national ownership of cooperation projects by developing countries. Attempts at creating a genuine partnership employing such models as the experience-sharing model should be encouraged.

References

- Brinkerhoff, D. W. & Goldsmith, A. A. (1992). Promoting the Sustainability of Development Institutions: A Framework for Strategy. *World Development*, 20 (3), 369-383.
- Brown, D. R. (1998). Evaluating Institutional Sustainability in Development Programmes: Beyond Dollars and Cents. *Journal of International Development*, 10 (1), 55-69.
- Caillods, F., Gottelmann-Duret, G. & Lewin, K. (1996). *Science education and development: planning and policy issues at secondary level*. Paris: UNESCO International Institute for Educational Planning.
- Cummings, W. K. & Altbach, F. G. (Ed.) (1997). *The Challenge of Eastern Asian Education: Implications for America*. Albany, NY: State University of New York Press.
- Development Assistance Committee (2000). *Results Based Management in the Development Co-operation Agencies: A Review of Experience, Executive Summary*. Working Party on Aid Evaluation. Paris: OECD.
- Jain, P. S. (1997). Program Success and Management of Integrated Primary Education in Developing Countries. *World Development*, 25 (3), 349-358.
- Japan International Cooperation Agency (1999). Project Document for Mpumalanga Secondary Science Initiative (MSSI). Tokyo: JICA.
- Japan Overseas Cooperation Volunteers (2003). *21-Seiki Borantia Jigyo no Arikata; Live Together, Advance Together* [Report on the Future of the Volunteer Program in the 21st Century]. Tokyo: JOCV.
- Johnson, N. (2000). *Meeting the challenge: becoming learning communities*. In J. Retallick et al. (Ed.), *Learning communities in Education: Issues, Strategies and Contexts* (pp.26-37). Routledge Research in Education 1. London: Routledge.
- King, K. (1998). New Challenges to International Development cooperation in Education. *Journal of International Cooperation in Education*, 1 (1), 3-16.
- King, K. & McGrath, S. (2004). *Knowledge for Development? Comparing British, Japanese, Swedish and World Bank Aid* (Chapter 7). London: Zed Press.
- Kuroda, N. (2001). Professional Expertise in Japan for International Development Cooperation in Education - Findings and Issues from the Two Surveys. Paper presented at the 45th Annual Meeting of the Comparative and International Education Society (Washington DC, March 15, 2001).
- Lewis, C. (2000). Lesson Study: The Core of Japanese Professional Development. Invite Address

- to the Special Interest Group on Research in Mathematics Education, American Educational Research Association Meetings, Session 47.09, New Orleans.
- Long, D. & Riegle, R. (2002). *Teacher Education: The Key to Effective School Reform*. West Port, Connecticut: Bergin & Garvey.
- Magno, M. (2004). JICA-Assisted Mathematics and Science Education Project in the Philippines. Paper submitted to the CICE/NISMED Workshop on “Japan’s Mathematics and Science Education Cooperation: Assessment of Classroom-level Impact” (January 21-23, 2004, UP NISMED, Quezon City, Philippines).
- Martin, M. O. et al. (2000). *TIMSS 1999 International Science Report*. International Association for the Evaluation of Educational Achievement, Boston.
- Mingat, A. (1998). The Strategy Used by High-performing Asian Economies in Education: Some Lessons for Developing Countries. *World Development*, 26 (4), 695-715.
- Ministry of Foreign Affairs, Government of Japan (2001). Major Examples of Japan’s Follow-up Measures to the Second Tokyo International Conference on African Development (TICAD II), Tokyo.
- Ministry of Foreign Affairs, Government of Japan (2003). Summary by the Chair of TICAD III, Tokyo.
- Mpumalanga Department of Education (1999). Mpumalanga Secondary Science Initiative (MSSI). Project Document, Middelburg, South Africa.
- Mullis, I. et al. (2000). *TIMSS 1999 International Mathematics Report*. International Association for the Evaluation of Educational Achievement, Boston.
- Nagao, M. (2002). Present Status of MSSI School-based INSET activities. Evaluation Mission Memo: No. 4, June 29.
- Nagao, M. (2004). Mpumalanga Secondary Science Initiative. Project description document.
- National Commission on Excellence in Education (1983). *A Nation at Risk: The imperative for educational reform*. Washington DC: Government Printing Office.
- Ninomiya, M. (2002). *Data Book of the World 2002*. Tokyo: Ninomiya Shoten.
- OECD (2002). *Education at a Glance: OECD Indicators 2002*, Paris.
- Preskill, H. & Torres, R. T. (1999). *Evaluation Inquiry for Learning in Organizations*, Thousand Oaks. CA: Sage Publications.
- Rix, A. (1993). *Japan’s foreign aid challenge: Policy reform and aid leadership*. London and New York: Routledge.
- Saito, M. (1995). *Kokusai Kaihatsu Ron* [Treatise on International Development]. Tokyo: Yuhikaku.
- Sawamura, N. (2001). Changing Policy and Practice of Japan’s International Cooperation in Education. Paper presented at the 45th Annual Meeting of the Comparative and International Education Society (Washington DC, March 15).
- Shimojo, T. (2000). Indonesia de susumete iru Risuuka Kyouiku no Kokusaikyouryoku kara mita Kokusaikyouiku Kyouryoku no Kadai [Issues in international educational cooperation looked at from the international cooperation in M & S education being implemented in Indonesia]. In Nihon Gakujutsu Kaigi (Ed.), *Kagaku Gijutsu Kyouiku no Kokusai Kyouryoku*

- Network no Kouchiku* [Establishment of an international cooperation network for science and technology education]. Tokyo: Nihon Gakujutsu Kyouryoku Zaidan.
- Stockmann, R. (1997). The Sustainability of Development Projects: An Impact Assessment of German Vocational-Training Projects in Latin America. *World Development*, 25 (11), 1767-1784.
- Tilak, J. B. G. (1993). Investment in Education in East Asia. *ASEAN Economic Bulletin*, 9 (3), 301-322.
- Walberg, H. G. (1991). Improving School Science in Advanced and Developing Countries. *Review of Educational Research*, 61 (1), 25-69.
- World Bank (1993). *The East Asian Miracle: Economic Growth and Policy*. New York: Oxford University Press.
- Yokozeke, Y. & Sawamura, N. (1999). Redefining strategies of assistance: recent trends in Japanese assistance to education in Africa. In K. King & L. Buchert (Eds.), *Changing International Aid to Education: Global Patterns and National Contexts* (pp.173-181). Paris: UNESCO.