

## A Consultancy - Based Approach to In-Service Education of Science Teachers\*

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Artikel ini mengkaji berbagai pendekatan yang digunakan untuk melaksanakan kegiatan pendidikan perguruan bagi guru-guru dalam perkhidmatan. Dari kajian-kajian yang telah dibuat, terdapat empat pendekatan yang biasa digunakan, iaitu, pendekatan 'Problem-Solving', pendekatan 'Defect', pendekatan 'Growth', dan pendekatan 'Change'. Dalam artikel ini dibincangkan keempat-empat pendekatan tersebut serta kekurangan-kekurangan tertentu yang wujud dalam pendekatan-pendekatan itu. Penulis-penulis artikel ini mencadangkan suatu pendekatan baru yang dipanggil 'Consultancy-based Approach'.

Artikel ini juga menganalisisakan berjenis-jenis kegiatan pendidikan perguruan yang telah diadakan bagi guru-guru sains dalam perkhidmatan di Malaysia. Terdapat bahawa kebanyakan kegiatan ini mengikut pendekatan seperti 'Change Approach' dan 'Defect Approach'. Memandangkan kekurangan yang dihadapi oleh kursus-kursus dalam perkhidmatan yang menggunakan pendekatan-pendekatan ini, penulis-penulis mengesyorkan pendekatan 'Consultancy-based Approach' digunakan untuk menambahkan usaha-usaha yang telah dibuat supaya guru-guru sains di Malaysia dapat memperbaiki taraf profesional mereka.

Untuk menjelaskan kegunaan pendekatan 'Consultancy-based' dalam pendidikan perguruan, bahagian terakhir artikel ini menghuraikan suatu contoh kajian. Contoh kajian ini menunjukkan bagaimana pendekatan ini dapat digunakan untuk melatih guru-guru Biologi supaya mereka dapat mengajar kerja-amali Biologi dengan lebih berkesan.

### Introduction

The teacher is still one of the most important factors in the educational process. The quality of teaching is very much determined by the stock of knowledge, skills and insights possessed by the teaching force. There is no doubt that national governments have placed major concern on teacher education and recently increasing attention has been given to in-service education and training of teachers (INSET) for various reasons such as:

- (i) there is growing concern in some countries about the quality of teaching and professional development of those who have had less basic education and training than current recruits to teaching;
- (ii) approaches to educational change which neglect the INSET dimension are usually unsuccessful;

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(iii) the realization of the inability of initial teacher training to provide all the knowledge and skills required due to the complexity of a teacher's role. (Eraut, in print).

The first reason is specially appropriate to less developed countries which in their haste to expand their educational systems are forced to equip their schools with unqualified teachers. However, as the demand and supply of teachers reaches a more manageable position, steps are taken to provide in-service training for these unqualified teachers. Hence, the in-service training in these cases usually serve as initial training for the teachers concerned. As for the second reason, many countries do see the need to change their educational systems in accordance with the changing demands of their societies. Such educational changes may include structural, organizational and curriculum change.

In line with these changes, there is a definite need for in-service education for teachers so that they are capable of dealing with the new conditions. As UNESCO (1975b) puts it:

"... the teacher remains a central figure in the educational process, the success of reforms and innovations depends to a large degree on the teacher's understanding of them on his readiness and ability to put them into practice."

The third reason is one of the most recent rationale for INSET activities because teachers, like other adults; also need continuing education to keep abreast with changes in the modern society. It is on this belief that teacher education is perceived as a continuous process (Goble & Poster, 1977). Stephens, (1975) defines INSET as:

"...the development of the individual which arises from the whole range of events and activities by which serving teachers can extend their personal academic or practical education, their professional competence and their understanding of educational principles & methods." (p.37)

Usually, INSET activities are aimed at (1) the transmission of new knowledge to teachers; (2) the facilitation of professional discussion among teachers; and (3) the promotion of innovation in response to educational problems (Eraut, 1974).

To achieve these aims, various countries have developed different structures and practices of INSET. It is the aim of this paper to:

- (i) examine some of the approaches to INSET which have been identified from recent literature;
- (ii) give a brief account to INSET activities for science teachers in Malaysia; and
- (iii) cite a research study on the Consultancy-based Approach to inservice education for Biology teachers in Malaysia.

## 1. Approaches to INSET

A brief review of the literature on INSET shows that much have been written on the main trends and problems of in-service education (UNESCO, 1975b); the various patterns of in-service education in different countries (UNESCO, 1975a); and the various perspectives concerning what in-service education needs are and how INSET activities should be further developed (Adams, 1975; Lomax, 1976; Goble & Porter, 1977). However, Eraut, in his paper "In-Service Education and Training of Teachers" (to be published in the International Encyclopedia of Education: Research & Studies) has come up with four particular approaches to INSET. We feel that it is appropriate at this juncture to review these four approaches in detail because they do give a clear picture pertaining to the conceptualization of INSET.

The first two of his suggested approaches are based on Jackson's work published in the book entitled "Improving In-Service Education - proposal and procedure for change" (Rubin, 1971). In his paper, "Old Dogs and New Tricks: Observations on the continuing education of teachers", he identified two approaches to INSET which essentially differ in the basic assumptions made. The first of the two is the "Defect" approach which bears the notion of repair and remediation.

This approach assumes that teachers are obsolescent in their knowledge and inefficient in their teaching skills because they had either little or no training at all. At the heart of this conception is the belief that education is a rapidly developing field in which old ways of doing things are constantly being replaced by new and better ways. Teachers, unfortunately, are quite ignorant of these latest developments due to lack of exposure. So, like old dogs, they need to be taught new tricks of the trade. Permeating this view is also the notion that someone knows more about how the teacher should behave in his classroom than he does himself. Therefore, the weaknesses of the teacher are diagnosed by an **outsider** who proceeds to prescribe remedies for correcting those weaknesses, usually through training programmes designed to change specific aspects of the teacher's behaviour in the classroom.

In contrast, the "Growth" approach begins with the assumption that "..... teaching is a complex and multifaceted activity about which there is more to know than can ever be known by one person, and the motive for learning more about teaching is not to repair a personal inadequacy as a teacher but to seek greater fulfillment as a practitioner of the art ....." (Jackson, 1971; p. 26).

Proponents of this approach recognize the fact that teacher growth is often lacking, but they attribute this problem not to defects in teachers but to defects in the system. Schools are not environments in which professional growth is encouraged. Hence, the central goals of in-service training from a growth perspective are: "to help the teacher become progressively more sensitive to what is happening in his classroom and to support his efforts to improve on what he is doing" (Jackson, 1971; p. 28). Moreover, this can only be achieved first by giving teachers more time to think about what they are doing; and, second, by allowing teachers to have more control over their own professional destinies. The teacher is not a helpless learner, and he should be given autonomy in the means and ends of his own professional growth. The teacher should be an active rather than a passive participant in any in-service programmes. In short, the defect and growth approaches to INSET differ fundamentally in their assumptions about what constitute valid knowledge about teaching and also to who decides what is to count as valid knowledge about teaching. While the political interests of university lecturers, researchers and educational administrators are protected by the assumption made by the defect approach, the teachers' political interests would appear to be served by adherence to the growth approach.

Another two approaches, as identified by Eraut himself, are the "Change" approach and the "Problem-solving" approach. He argues that neither of Jackson's approaches take into account the substantial expenditure on government-sponsored change during the last decade. While some national initiatives such as the first wave of curriculum projects might be interpreted in terms of the defect approach's concern with "obsolescence", others such as funding for multicultural education or children with special needs fit neither the growth nor the defect approach. The core assumption of the change approach is that the educational system needs redirection from time to time in accordance with social, economic and political changes in society; and such redirection is usually under very tight central control. Under these circumstances, a major purpose of INSET is to aid the school in implementing new educational programmes by helping teachers acquire understanding, skills and attitudes essential to the roles and tasks they are to play in these new programmes.

The types of educational change referred to here are externally initiated either through government legislation or national projects with government funding. Moreover, like the

defect approach, it depends on a stimulus external to the teacher or school, and the difference between these two approaches is that while the defect approach aims at improvement, the change approach aims at redirection.

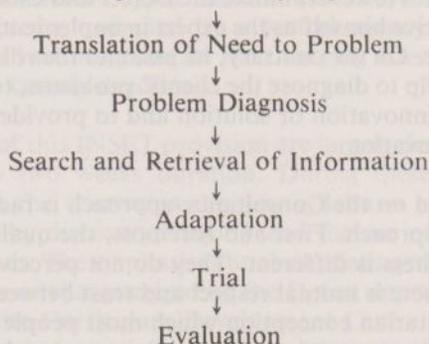
However, there is yet a fourth approach, the "Problem-solving" approach which assumes that, because education is an inherently difficult and complex process and because circumstances are constantly changing, problems will inevitably arise in individual schools and classrooms. These problems are best diagnosed by the teachers most closely concerned because only they know the students and the context sufficiently well. INSET activities should be closely geared to the study and solution of these problems. External consultants may sometimes be desirable, but effective change will only occur if the stimulus is internal instead of external. This is only possible if those most immediately concerned are involved throughout the process of identification of these problems and the search for solutions.

In brief, these four approaches arise, fundamentally, from differing conceptions on what INSET is all about, especially in terms of its goal and stimulus. As discussed above, the goal may be on improvement or redirection, and the stimulus may be external or internal. The following figure (Fig. 1) shows how the different approaches differ in their goals and what stimulus they depend on.

		STIMULUS	
		Internal	External
GOAL	Improvement	Problem-Solving	Defect
	Redirection	Growth	Change

FIGURE 1: 4 Approaches to INSET (Eraut, in print)

The problem-solving approach to INSET has its origin from the problem-solving model of change (Huberman, 1973; Havelock, 1969; Dalin, 1973) which describes the problem-solving process as consisting the following steps:



The sequence of activities begins with a need as identified by the practitioner himself who in turn translates it into a problem statement and diagnosis. When the problem statement is formulated, he then will conduct a meaningful search and retrieval of ideas and information which may be helpful to him in formulating or selecting a solution to his particular problem.

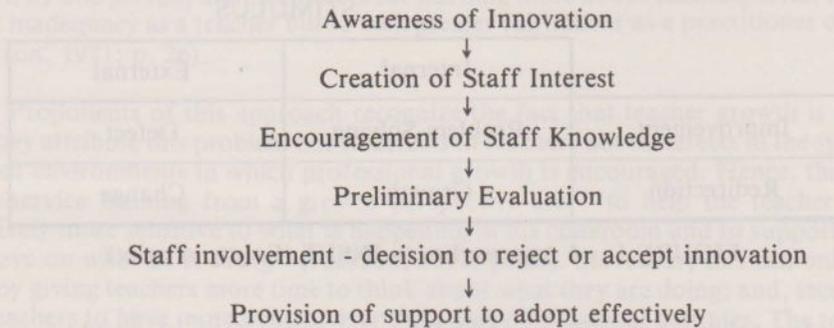
After identifying a potential solution, he will adapt it, try it out and evaluate its effectiveness in satisfying his original need. The underlying assumption of the problem-solving

approach to INSET is that the practitioner is able to conduct search, retrieve information and ideas to formulate a given innovation. However, this assumption may not be true for it is generally known that practitioners seldom search outside their own field or environment for new ideas. Moreover, in the educational scene, it is not often clear as to what the problem is, who has the problem or who has the right to define to problem. It is also common that teachers, like those in Malaysia, may not be able to identify their problems nor are they able to find solutions for them.

In view of this, the problem-solving approach to INSET may not be applicable to all education systems. Another approach which is based on the Social Interaction model of change is suggested and it is called the Consultancy-based approach to INSET. According to the Social Interaction model by Havelock (1971):

“An innovation ... is **presented** or brought to the attention of a potential receiver population. The receiver and the receiver's need are defined and determined exclusively by the **sender**. The receiver is supposed to react to the new information, the nature of his reaction determines whether or not subsequent stages will occur. If his awareness is followed by an expression of interest, he is launched on a series of stages which terminate with acceptance or rejection of the innovation.”

Hence, the introduction of an innovation from outside into a school will involve the following stages:



In this model, the role of the outside change agent is important because he is the person who initiates the innovation. However, unlike the Defect and Change approach, this external change agent does not perceive himself as the expert in implementing the innovation nor does he take on the directive role. On the contrary, he assumes the role of a **consultant** or adviser and his main tasks are to help to diagnose the clients' problems, to assess the clients' motivation, to select appropriate innovation or solution and to provide continuous support to the implementation of this innovation.

INSET activities based on the Consultancy-approach is radically different from those of the Change or Defect approach. First and foremost, the quality of relationship between the consultant and the teachers is different. They do not perceive themselves as the trainer and trainees, but instead, there is mutual respect and trust between the individuals involved. In other words, the authoritarian conception which most people have of in-service training should not exist. No one is in a position to prescribe exactly what should be done, and so there is no training in the traditional sense of the word. Furthermore, it is also different from the Problem-Solving approach in that neither the problem nor its solution is identified by the teachers. By the Consultancy-based approach, it is the consultant who identifies the problem area and it is also he who suggests the solution to the teachers although he may leave those problems that arise from adaptation or implementation to the teachers to solve. Another crucial element of the Consultancy-based approach is that it emphasizes the interaction between the Consultant and the teachers. Hence, INSET activities are not restricted to holiday or week-end courses but can also take various modes such as workshops, seminars, bulletin and others.

In describing these approaches, one tends to oversimplify, as well as exaggerate the differences among them. However, this exercise is deemed useful because the purpose, mode of interaction and the relationship between the parties involved in any INSET activities are dependent on the conceptualization of INSET that one has. The following section will illustrate how the INSET activities for science teachers in Malaysia have evolved in line with the changing concept of in-service education.

## 2. In-Service Education of Science Teachers in Malaysia

To a great extent, INSET activities for science teachers in Malaysia have arisen from curriculum reforms that were implemented in schools by the Ministry of Education. Like other developing countries, the Malaysian government sees the importance of science and technology to national development especially in terms of economic growth. Starting from the late 60s, much effort and resources were channelled into the implementation of nationwide 'project-centred' curriculum change in the teaching of science and mathematics of school level. In 1968, Projek Khas which aims at the improvement of science and mathematics in rural primary schools was implemented. This was followed by the introduction of the Integrated Science programme, which is an adoption of the Scottish Integrated Science Syllabus, at the lower secondary level. Similar adoptions were made on both the Nuffield O-level Sciences and the Nuffield Secondary Science programmes for pupils from the Science and Arts Streams, respectively, at the upper secondary level. Concurrent to the implementation of these programmes, INSET activities were organized for practising science teachers. The approaches adopted are very much similar to Eraut's Change approach and Jackson's Defect approach.

The main purpose of these INSET activities is to help science teachers to acquire the knowledge, skills and attitudes which are essential to them when they teach these new science programmes in schools. These INSET activities are said to be based on the Change approach because they are externally initiated, in this case, by the Ministry of Education. There is also the element of redirection of the educational system in view of the economic changes in the Malaysian society which aims at modernization of the economy through industrialization. Before a country can be industrialized, skilled manpower are needed. Therefore it is quite understandable why the Malaysian Government is so determined to redirect its education system with major emphasis being placed on science education. Because these curriculum reforms are both funded and decreed by the Government, they are very centralized in nature. Curriculum materials adopted or adapted by a central agency known as the Curriculum Development Centre, and all schools, despite their varying sizes and location have to make use of these materials by a certain deadline.

The types of activity of this INSET provision are largely dominated by holiday courses which range from one to two weeks duration. During these courses, science teachers familiarize themselves with the content in the new syllabuses as well as the new teaching strategies such as teaching by discovery, inquiry and the use of worksheets which are advocated by these programmes. The emphasis is on the updating of teacher knowledge and the acquisition of specific skills as characterized by the Defect approach. These courses are run by either personnel from the Curriculum Development Centre of science teachers who are selected to be key-personnel because they happen to have attended these courses earlier on. Here, because of the large number of teachers, the multiplier effect has been adopted to disseminate these new curriculum packages.

The end result of these in-service courses for science teachers were quite unsatisfactory as reported by evaluative studies on the implementation of these new science curricula in Malaysian Schools (Sim, 1973; Charlesworth, 1975; Watson, 1979); to quote Watson:

"Teachers, often poorly trained, with an inadequate grasp of the concepts behind the Integrated Science Programme .... Having themselves being taught through

memorization and rote learning it has been difficult to change their ways. They have found it hard to learn new course content, teaching techniques, new scientific language and the need for more time to be spent in planning and organization."

Very often, one comes across a science teacher using the old expository method to teach the new syllabuses. Hence, the science curricula in schools may have taken on new labels such as Integrated Science, Modern Physics and others but little has changed within the classroom.

One of the strongest criticisms on this type of in-service courses is directed to the change approach which depends on a stimulus external to the teacher or school to initiate change in the classroom. Skilbeck (1975) argues that the research-development-diffusion attitude to education change diminishes the role of the teacher. It assigns to experts outside the classroom all the decisive roles in curriculum development until the stage of adoption has been reached. Experts conduct research, prepare the objectives which teachers and pupils are to pursue, design and undertake the development of new teaching materials, drawing upon schools and teachers for use in trial runs.

Only at the stage where materials are to be "diffused" do the classroom practitioners become important. This criticism is particularly true to the type of curriculum development activities in Malaysia which is characterized by the lack of participation on the part of the teachers. Nearly all the new science programmes are adopted or adapted by the Curriculum Development Centre and all that is required of the science teachers is to use them in the classroom. However, it cannot be denied that, in some instances, there has been an element of 'token' participation whereby a small number of teachers are invited to take part in the initial stages of curriculum development. Nevertheless, this lack of teachers participation in an innovation can result in obstacles to the successful implementation of the innovation, (Gross, et.al., 1970). Science teachers are not committed to the teaching of science by any new methods probably because the directive to change comes from outside. Moreover, because they are not involved in the planning and developing stages of the programmes, many of them are unclear about the objectives and rationale behind the adoption of these programmes. This lack of clarity is among Sim findings which states that:

"... principals and teachers alike were relatively unclear concerning the possible relevance of the new Science and Mathematics programmes to the Second Malaysia Plan Objectives, let alone the lack of clarity or even knowledge concerning the Second Malaysia Plan goals themselves." (Sim, 1973)

The second type of criticism is directed to the way in which these INSET courses are run. As mentioned earlier on, these courses are held during school holidays where science teachers from various schools in a particular region gather together for a period of one to two weeks. It is doubtful whether the teachers are able to inquire more about these new science programmes during the brief duration of these holiday courses. Sim (1973) found that there is hardly enough time for them to examine and explore the range of curriculum materials available. The usual practice is for the teachers to go through the worksheets or textbooks and to discuss the various experiments as suggested. More often than not, practically all the experiments involved in these new programmes would be set up or laid out by the instructors instead of having the participants to figure things out for themselves. More exposure to activities associated with the new curricula does not provide an adequate basis for equipping the teachers with the understanding, skills and attitudes necessary to them if they are to teach these programmes effectively. Such courses, which sometimes take the form of nothing more than a 'cookbook recipe', are not effective in helping teachers to fully understand the underlying rationale and principles behind these programmes. Furthermore, the method of selecting key-personnel from among earlier participants has its own drawbacks. For example, in some cases, the younger and less experienced teachers are sent first and it has been rather awkward when some of the teachers become instructors to their more senior colleagues at the state or district level of INSET.

Another shortcoming of these courses is the passiveness of the participants. During these courses, participants are being told what to do and how to do it by their instructors. This mode of INSET ignores the fact that the participants are often experienced teachers with as much to contribute as to receive. It also assumes that there is a common solution which fits a large number of teachers' problems, and the purpose of in-service training is to transmit it. According to Eraut (1974) if the purpose of INSET is to support the professional development of teachers, then they should be given a more active role. He points out then different problems arise from different schools and classrooms and these problems are best diagnosed by teachers, and the solutions have to be found by the teachers themselves too.

Despite of what had been said so far concerning the adoption of the Change and Defect approach to INSET activities for Science teachers in Malaysia, it cannot be denied that these approaches also have their advantages. First, there is no doubt that the Change approach is one of the most economical ways of reorienting teachers to teach new curriculum programmes in schools. In this way, the constraints of time and money can be easily overcome. Moreover, the educational system in Malaysia is centralized in its structure, therefore any curriculum change must be uniformly implemented throughout the whole country. This is particularly so in view of the common public examinations that pupils are required to sit at various stages of their schooling. Furthermore, Malaysian teachers are generally quite used to being directed from above without question (Watson, 1976). Hence, this attitude of unquestioned acceptance of authority among the teachers allow outside 'experts' to tell them how to teach in their own classrooms.

Thus the INSET courses for science teachers in Malaysia may have served their purpose in inducting practising teachers to the new science programmes. However, we do feel that there is a general need for more INSET activities which are geared towards the professional development of science teachers. The Consultancy-based approach to INSET may have its shortcomings like it can be time-consuming and it needs a core of consultants who are readily accessible to the teaching force. Nevertheless, we do believe that the Consultancy-based type of INSET activities is essential for the science teachers in Malaysian schools. Not only will this type of provision be appropriate to the adaptation of small-scale innovations in schools but also serve as a supplement to the Change approach type of INSET activities. The following section is a case study of how this approach was being tried out on the in-service education of Biology teachers in Malaysia with respect to Biology practical work.

### **3. A Consultancy-Based Approach to INSET**

This small-scale innovation is an attempt to improve the quality of Biology practical work in a few selected schools in Malaysia. In, most cases the type of Biology practical work done by students in school laboratories tends to show a lack of involvement in real experimentation or genuine enquiry based on critical observation and deductive reasoning (Tan, 1980). Students tend to engage in physical and mechanical type of activities such as setting up of apparatus and collecting data, but they seldom exercise their mental faculties in the analysis and interpretation of their findings. Moreover, very often students are allowed several days after the laboratory work to write or even copy their laboratory reports as homework. The innovative approach to Biology practical work suggests that the report writing should form an intergral part of the laboratory activity. To achieve this a dual-function worksheet is constructed for each laboratory session to facilitate the record of observation and analysis of results or answering of questions. The completed worksheet will then serve as evidence of performance for assessment purposes.

This innovation makes several drastic changes in conducting the Biology practical work. Not only does it stressed more on the mental activity on the part of students, but it also requires a more systematic planning, organizing and supervising of laboratory work on the part of the teacher. In introducing this innovation to schools, it is envisaged that teachers will encounter a lot of problems, partly because of the varying conditions that exist in in-

dividual schools. Hence an appropriate INSET programme for these Biology teachers must be able to take into account the various types of problems that may be encountered by these teachers on the implementation of this innovation. Since the nature of the problems is likely to vary from school to school, it is not possible to have standard solutions to all the schools. The extent to which an outside expert can help on solving such problems is indeed very limited. Therefore it is suggested that the teachers themselves be encouraged to play a more active role in identifying and solving their own problems; and the outside expert will assume the role of a consultant whose main tasks are to motivate the teachers; to help them in diagnosing their problems; and to provide continuous support to teachers as they attempt to adopt this innovation.

To achieve this objective, a systematic involvement schedule was drawn up and followed through during the field trial in Malaysian Schools (Tan, 1980).

- Februari — March, 1978 : Teachers were invited to participate in the project and informed of the nature and purpose of the project.
- March — April, 1978 : Teachers attended individual discussion with the consultant concerning laboratory work in general and the project in particular.
- April — May, 1978 : Teachers attended workshop sessions pertaining to design of worksheets, supervision of laboratory assessment procedures and etc.
- May — June, 1978 : Teachers conducted laboratory sessions in accordance to the new approach.
- June — August, 1978 : Teacher conducted as well as assessed laboratory work in accordance to the new approach.

Another important aspect of the INSET programme is the relationship between the consultant and the school teachers. The consultant does not perceive himself as the trainer nor is his interaction with the teachers restricted to activities like formal courses. On the contrary, the relationship between the consultant and teachers is based on mutual respect and trust, and the establishment of such a relationship is nurtured through regular interactions over a period of time. During the whole period of the project, various modes of interaction were used under differing circumstances. Briefly, these included:

- (i) Bulletin Mode — which took the form of letters, notes with information concerning the innovation that were sent to teachers.
- (ii) Query Mode — which took the form of communication over the telephone between the consultant and teachers.
- (iii) Consultancy Mode — which took the form of individual discussions pertaining to specific problem between teachers and the consultant during his visit to schools.
- (iv) Workshop Mode — which took the form of group discussions over a wide range of issues between the consultant and the whole group of teachers.

Through these various modes of interaction, it was possible for the consultant to establish a good rapport with the teachers. The bulletin and query modes were particularly useful in helping teachers to clarify their doubts on the rationale and objectives of the innovation. While the workshop sessions enabled teachers to acquire certain skills in the con-

struction of worksheets and to formulate common grading criteria, the consultancy mode provided opportunities for the teachers to raise certain administrative and organizational problems related to a particular school and attempts were made to overcome these problems with the help of the consultant.

### Conclusion

For the implementation of any educational innovation, may it be **externally** or **internally** initiated, may the goal be for **improvement** of an existing programme or **redirecting** to a new line of development, it inevitably involves INSET activities which are aimed at:

- (i) the clarification of the innovation to teachers;
- (ii) the acquisition of knowledge and skills required to implement the innovation; and
- (iii) equipping teachers with the ability to deal with problems which arise from the implementation of the innovation.

The traditional INSET activities which operate within the framework of **defect, change** or **Research-Development-Diffusion** model, commonly used in Malaysia is effective only at the level of dissemination of information about the innovation (Eraut, 1974) and may also be useful for the acquisition of knowledge and skills to implement the innovation, but it does **NOT** deal with the rationale of the innovation at any length, nor does it equip the teachers to solve any organizational problems that may arise from its implementation. This is because the concept of INSET under such a framework has been conceived as a 'training process' in the traditional sense of the term. It is not conducive for teachers to assume a professional role while being treated as 'trainees'.

A more effective type of INSET activities are those based on the Consultancy-based approach which are school-based and which allow teachers to take stock of their teaching experience and exercise their professional judgement over the adoption or rejection of a particular innovation. The project described in this paper is only an example of such INSET activities. There is a general need for more of the Consultancy-based type of INSET activities to supplement the Change approach type of INSET activities for science teachers in Malaysia. To meet this need, organizations like Associations for Science Teachers, the Federal School Inspectorate, Education Faculties in Universities and Teacher Training Colleges will have to play a more active part in organizing the Consultancy-based type of INSET activities along the guidelines suggested in this paper.

### References

- Abonseif, A.A. *Evaluation of Practical Examination*. M.A. Thesis, University of London, 1963.
- Adams, E. *In-Service Education and Teachers' Centres*. Oxford: Pergamon Press, 1975.
- Charlesworth, J.D.R. *Educational Change in Malaysia: A Case Study of the Implementation of a Curriculum Innovation*. Doctoral dissertation, University of Kentucky, U.S.A., 1975.
- Dalin, P. *Strategies for Innovation in Education*. Paris CERI Case Studies of Educational Innovation, Vol. IV, OECD, 1973.
- Eraut, M. *In-Service Education for Innovation. Occasional Paper 4*. National Council for Education Technology, 10, Queen Anne Street, London W1M 9LO: Councils Education Press Ltd., 1974.
- Eraut, M. *In-Service Education and Training of Teachers*, prepared for International Encyclopedia of Education: Research and Studies, (to be published).

- Goble, N.M. & Porter, J.F. *The Changing Role of the Teacher: International Perspectives*. Paris: IBE UNESCO, 1977.
- Gross, N. et.al., *Implementating Organisational Innovations*. Harper International, 1971.
- Havelock, R.G. *Planning for Innovation - A Comparative Study of Literature on the Dissemination and Utilization of Scientific Knowledge*. Ann Arbor, Michigan: Centre for Research on Utilization of Scientific Knowledge, 1969.
- Havelock, R.G. *Planning for Innovation through the Dissemination and Utilization of Knowledge*. Ann Arbor: Centre for Research and Utilization of Knowledge, 1971.
- Huberman, A.M. *Understanding Change in Education: An Introduction: Experiments and Innovation in Education Series No. 4*, IBE UNESCO Press, 1973.
- Jackson, P.W. "Old Dogs and New Tricks: Observations on the Continuing Education of Teachers". In Rubin, L.J. *Improving In-Service Education: Proposals and Procedures for Change*. Boston: Allyn and Bacon, 1971.
- Lomax, D.E. *European Perspective in Teacher Education*. London: John Wiley, 1976.
- OECD. *New Patterns of Teacher Educations and Task: General Analysis*. Paris: OECD, 1974.
- Rubin, L.J. *Improving In-Service Education: Proposals and Procedures for Change*. Boston: Allyn and Bacon, 1971.
- Sim, W.K. et.al. A position paper on the Evaluation of Science and Mathematics in Relation to the Mid-Term Review of the Second Malaysia Plan (1971-1975), 1973.
- Skilbeck, M. *School Based Curriculum Development and the Task of In-Service Education*. In Adams (1975).
- Stephen, J. *Some Current Issues for Teacher In-Service Education*. In Adams (1975).
- Tan, Y.L. *Towards Achieving the Central Objectives of School Science Practical Work*. In SAINSAB, Vol. 2, No. 1, Dec. 1980.
- UNESCO, *Alternative Structures and Methods in Teacher Education*. APEID, Bangkok: UNISCO, 1975a.
- UNESCO, *The Changing Role of the Teacher and its Influences on Preparation for the Profession and on In-Service Training*. International Conference on Education, 35th Session, Geneva, 1975b.
- Watson, K. *Influences and Constraints on Curriculum Development in the Third World*. A paper prepare for the Ninth Conference of Comparative Education Society in Europe (CESE), Valancia, Spain, 1979.