The Project on Innovative Teaching Methods — An Overview

Introduction

Over the past several years, the education system in Singapore has undergone very significant and far-reaching changes, especially in terms of the programmes and resources available to teachers and pupils. New textbooks and teaching materials have been introduced into the schools by the Curriculum Development Institute of Singapore (CDIS). Within the Institute of Education (IE), teacher education programmes for pre-service trainees and in-service teachers have also undergone review and change to meet new needs and expectations.

In preparing its students for their multifarious roles in school, IE is not only cognizant of its responsibility of transmitting to them the time-tested or traditional methods of teaching the various subjects of the school curriculum, it also seeks to actively encourage the development and use of innovative teaching methods. While such efforts by IE staff have been going on for some time, it was only recently that a concerted attempt to document and evaluate these efforts was initiated through the Project on Innovative Teaching Methods (Project ITM).

Project Objectives

Project ITM has the following objectives:

(a) To document the new pedagogical ideas, approaches or methods that have been developed and used by IE staff;
(b) To identify and explain the advantages or strengths of each innovation;
(c) To identify the problems or weaknesses (if any) associated with the innovation;
(d) To evaluate (wherever possible) the reaction or effects on trainees/trainers involved in the innovation; and
(e) To examine the possibility of applying the innovation to the school situation (wherever relevant), or possible implications for teaching and learning in school.

Some Initial Problems

In carrying out the project, one problem encountered was in defining the term "Innovative Teaching Methods". The idea of something new seemed integral, but "new" for whom? I suggested to colleagues that perhaps innovative teaching methods should be seen as new teaching methods or techniques in the context of IE's training programmes. A more liberal interpretation might be that "if a practice is new and innovative to the person doing it, it is likely that it will be new to some others as well" (Meeth and Gregory, 1981). I believe it is sterile to argue over the meaning of "innovative", and my colleagues appeared to have accepted one or the other of the above interpretations.

Another problem was "how to go about the project?". Should I sound out a few colleagues as to their interest, willingness, and ability to undertake the project? Could I find a group to share common interests and goals? How could we come up with innovative teaching methods? How could we try out these methods? How could we see to it that subjects across the teacher education curriculum be reasonably well represented? I had no ready answers to these questions.

I decided to opt for an alternative (was it innovative?) approach to the above problem, hoping that it would answer the questions that I raised in my own mind. Hence in October 1982, I requested colleagues to provide me with reports on innovative teaching methods which they might have tried out within their courses or programmes. The response to my request was extremely gratifying. Within a period of 3 months, I received the reports which are now compiled in the volume on Reports on Innovative Teaching Methods. I trust that conference participants would have had the opportunity to read the reports. There is a wealth of ideas for the new teacher as well as for the experienced one. Granted that not all the innovations reported were completely successful or free from problems, nor have all of them been subjected to rigorous evaluation. However, what is important is that the free exchange of ideas can help all of us to improve our teaching or help our students to be more effective learners.

Overview of Selected Innovations

As time does not permit me to present all the innovations reported, I shall confine my discussion to a selection of them.
The IE Vacation Learning Camp 1982

The IE Vacation Learning Camp (VLC) of 1982 is an example of a successful innovation that involved team-work on the part of a great number of people — staff, Certificate in Education students, Further Professional Certificate in Education (FPCE) students, and not least the 182 pupils of monolingual classes. The Camp was organized for a 2-week period just after school had closed for the end-of-year vacation. The main objective of the Camp was to provide a non-traditional milieu in which innovative methods for enhancing learning among the monolingual stream pupils could be tried out. IE trainees worked hard to prepare teaching materials in the form of modules in 8 subjects (English, Mathematics, Science, Art, Home Economics, Woodwork, Metalwork and PE). In addition, fieldtrips to factories, the airport, the museum and fast-food centres were organised.

At the end of the Camp, feedback was obtained from the participants by means of questionnaires and observation. The findings showed that the VLC had provided the pupils with an instructional programme that not only provided for active participation by pupils, but one from which they derived a fair measure of enjoyment and experienced a sense of achievement when the simple learning materials they produced were exhibited. The Camp provided the Certificate students with the opportunities to try out various teaching and motivational strategies in handling pupils who have learning difficulties. The in-service FPCE students were able to apply their knowledge and understanding derived from such courses as "School Organisation and Administration" and "Coping with Curriculum Change". There were problems, of course, but they were manageable. The success of the Camp can be measured by the fact that 93% of the pupils expressed a keenness to attend a second camp of the same kind.

Innovative Methods in Teaching Language and Literature

A number of colleagues in the School of Language Studies have tried out some innovative approaches in teaching Language and Literature. Goh has reported one such approach involving the use of the Video-Tape Recorder (VTR). Instead of using the traditional way of getting students to read and analyse a short story, Goh showed a dramatised version of a short story, "A Family" by Japanese author J. Nakajima on the VTR. The video-tape was stopped at the point where the conflict in the story was introduced. The students were divided into groups of 4 to discuss how they would resolve the conflict and end the story. They had to apply their knowledge of the short story form (theme, plot, characterisation, setting, mood), their understanding of the issues involved (values and attitudes implicit in the situation), and also their own experience. The class then examined the various endings suggested, compared their relative merits, and ranked them. The lecturer finally revealed how the story ended by showing the rest of the video-tape. The students were encouraged to ponder over the differences between their own endings and the actual ending, and to try to see why the author ended the story the way he did.

Heath reported his experience in teaching English to a pre-University I class of Chinese-stream pupils who had just converted to the English-stream, using a variety of methods that were new to them. In themselves, the methods were not radical, but they were perceived by the pupils to be different from their past experience of learning English. The methods include the following:

- Fast unseen dictation.
- Self-correction of written work.
- Speaking in pairs in class.
- Speed reading exercises.
- Extensive reading of easy paperback fiction books.

Heath reported that, over a 6-month period, the pupils showed improved proficiency in English as well as increased motivation for reading and using English.

The use of diagrams as a means of simplifying and clarifying character relationships and plot structures in literature teaching was reported by De Souza. He recommended preparing the diagrams on transparencies for overhead projection as the illuminated nature of the diagrams made them more appealing to the audience. This method was demonstrated in teaching Shakespeare's Othello and Henry Ibsen's Hedda Gabler. As a follow-up, students were asked to devise their own diagrams for teaching a particular literary text.

Innovative Methods in Teaching Mathematics

A study to determine the relative effectiveness of two methods of teaching mathematics to secondary school pupils was carried out by Purbrick, Plant and Fong in 1982. This study was conducted within the framework of Professor R. R. Skemp's theories of relational/instrumental understanding in mathematics. Relational understanding implies the ability to deduce specific rules of procedures from more general
mathematical relationships. It implies that in grasping a new concept, the subject can relate it to his existing conceptual framework. *Instrumental understanding*, on the other hand, is the ability to apply an appropriate remembered rule to the solution of a problem without knowing why the rule works. It is the type of understanding resulting from rote learning.

The main objective of the study was to compare the relative effectiveness of the relational vs. instrumental strategies in teaching/learning Trigonometry at secondary two level. The study involved 356 pupils in 11 classes in the Express stream in Thomson Secondary School. Two English-medium and two Chinese-medium classes were selected as the experimental group. Two Chinese-medium and five English-medium classes served as the control group.

The research design was carefully chosen to fit into the ongoing school programme with the minimum disturbance to the school routine. In the school’s mathematics programme, 3 weeks were assigned for the study of the trigonometric ratios (sine, cosine and tangent). A sequence of 10 lessons on this topic was taught to the experimental group using the relational strategy in the 3 weeks. During the same period, the control group received the traditional direct-teaching or instrumental approach on the same topic.

Prior to the start of the study, all classes had been given a general test of mathematics ability and necessary background knowledge for the development of trigonometry. This pre-test was used in matching pairs of pupils for the statistical analysis of the results. At the end of the 3 weeks of study, all pupils were given a post-test to measure performance on the subject material.

Statistical analysis of the pre-test, post-test and other test data showed that the classes were very variable with respect to mathematical attainment and ability. For this reason, it was decided to select matched pairs of pupils for statistical analysis so as to reduce the possibility of important results being obscured by the level of variability. The matched pairs were established on the basis of medium of instruction, sex, age and pre-test score. Having established these matched pairs, the performance of the pupils in the experimental group to which relational understanding was stressed, was compared with the pupils in the control group, in which instrumental learning was the predominant feature, with respect to their post-test scores. The analysis revealed the following:

- There was no significant difference in performance between English-medium pupils exposed to the experimental (relational) mode of instruction and those exposed to the traditional (instrumental) mode in the control group.

However, for the Chinese-medium pupils, the results indicated that the experimental mode of instruction had been more effective than the traditional mode.

The researchers suggest a possible explanation for the above results. English is the medium of instruction in mathematics and science for Chinese-medium pupils. For them, English is taught as a second language; hence, with respect to the use of English, they are at a disadvantage as compared to their peers in the English stream. The relational learning programme (the experimental mode) aimed at securing a sound conceptual grasp of the material through concrete experience, practical activity and classroom discussion, using plenty of visual material. Such an approach is likely to be less dependent upon language, since it provides a direct access to the mind, allowing the pupils to think in Chinese about what is going on. The researchers point out that for the English-stream pupils, while the relational learning programme has not placed the experimental group at an advantage as compared to the control group, it has done no worse; it is possible that the pupils in the experimental group may enjoy some of the long term benefits claimed for relational understanding.

Another example of an innovative approach was that used by Plant in the mathematics curriculum studies course for Diploma students. The course was planned to examine problems, practical situations, and structured materials to see how each of the mathematical situations could be used and adapted as starting points for mathematics lessons in schools. Plant has exemplified his structured-discovery approach in (a) teaching the topic of LOCI — “Taking a Point for a Walk” and (b) demonstrating the use of Geoboards for teaching the topics of similar triangles and the congruence of quadrilaterals.

**Microcomputers in Teaching and Learning**

Although the use of microcomputers in education has been relatively recent, Chong has pointed out that computer education in IE began as early as 1975 when computer programming was first introduced to staff and students. At that time, IE used a mini-computer that was installed at a secondary school by the Ministry of Education. A great impetus was given to computer education when Computer Science was first included in the GCE 'A' level curriculum in 1980 and computer appreciation was included in the ECA programme in secondary schools.

Today, with microcomputers readily available
at reasonable cost, the demand for computer education in IE has grown significantly. Currently 7 computer courses are available to students and staff of IE. In conducting the courses, staff have used two methods viz.,
(a) Computer-Assisted Instruction (CAI) in computer literary courses; and
(b) Students execute and debug computer programmes written by themselves.

In 1982, staff of the Science Education Department decided to undertake a project on CAI in Chemical Education. Their project had 3 main objectives viz.,
(a) To prepare a handbook on CAI in Science Education for teachers;
(b) To develop a CAI programme of the drill-and-practice mode on the topic "Atomic Structure and Chemical Bonding"; and
(c) To investigate whether the CAI programme developed had an effect on pupil/student performance by testing the following null hypothesis:
   • There is no significant difference between the performance of pupils/students given the CAI as a supplement to normal instruction and the performance of pupils/students not given this supplement to normal instruction.

The experimental design in this project involved an experimental and a control group. Pre- and post-tests were administered to both groups. The experimental group received the CAI treatment. There was a time lapse of one and a half months between the pre- and post-tests. The design may be shown diagrammatically as follows:

<table>
<thead>
<tr>
<th></th>
<th>Pre-test</th>
<th>Treatment</th>
<th>Post-test</th>
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<tbody>
<tr>
<td></td>
<td>$X_r$</td>
<td>CAI</td>
<td>$O_3$</td>
</tr>
<tr>
<td>$C_r$</td>
<td>$O_2$</td>
<td>$O_4$</td>
<td></td>
</tr>
</tbody>
</table>

Symbols $O_1$, $O_2$, $O_3$, and $O_4$ indicate the observations made on the 2 groups. The symbol R refers to the random assignment of subjects to the experimental and control groups.

The subjects comprised 10 Certificate in Education students (aged about 21) and 59 secondary pupils (aged about 16) taking 'O' level Chemistry. The pupils/students were randomly assigned to the experimental and control groups. Fifteen microcomputers were used in the study. The Apple PILOT Language was used to program the topic "Atomic Structure and Chemical Bonding". The pre- and post-tests comprised 26 multiple choice questions. The reliabilities, determined by the split-half method, were 0.77 and 0.81 for the pre- and post-tests respectively.

The results of the study may be summarized in the table below:

<table>
<thead>
<tr>
<th></th>
<th>Pre-test</th>
<th></th>
<th>Post-test</th>
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<tbody>
<tr>
<td>Group</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>15.08</td>
<td>4.15</td>
<td>18.72</td>
</tr>
<tr>
<td>Control</td>
<td>14.09</td>
<td>4.51</td>
<td>15.33</td>
</tr>
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The F-ratios of the pre- and post-tests of the control and experimental groups were 1.18 and 1.11 respectively. The variance was statistically homogeneous ($p = 0.02$). The t-test for correlated data was performed on the pre- and post-test means to determine changes within the control and experimental groups. The value of t was 0.95 for the pre-test of 2 groups; it was not significant even at the 0.20 level. Hence it could be concluded that the 2 groups were statistically equivalent in initial chemical ability.

On the other hand, a t-value of 3.27 was obtained for the post-test for the 2 groups; the difference of means was significant beyond the 0.01 level. Hence the null hypothesis could be rejected. Thus it could be concluded that a significant gain in chemical knowledge about atomic structure and chemical bonding was made by the experimental group subjected to the CAI treatment. This finding supports previous research done on this aspect of CAI achievement.

Developing Skills in Instructional Technology

The Instructional Technology Department initiated an in-house staff development programme in April 1982. This was a response to a felt need to prepare its staff for their new and extended roles as instructors in (a) an expanded course on instructional technology that was compulsory for all Certificate and Diploma students of the July 1982 intake, (b) advanced in-service media courses, and (c) as advisers and producers of canned video programmes/micro-teaching sessions.

The staff development programme was planned to be implemented over 4 phases and would involve such instructional modes as (a) interaction sessions among peers, (b) attachment of one colleague to another teaching the in-service course with tutorials arranged between them, (c) on-the-spot workshops to be conducted by experts using the IE's video studios, and (d) a formal course.

Concurrently with the above programme, the
pre-service students have been taught the skills and techniques necessary for preparing multi-media packages. And judging by the exhibits put up by the students for the just-concluded IE Exposition, one can fairly observe that the objectives of the 60-hour Instructional Technology course appear to have been well achieved.

Games and Activities

Now we come to the “fun” part of teaching methodology — the use of games and creative activities. In his report, Teo has described how he had used the “Junk Exercise” as a component of his Educational Studies course on “Catering for Individual Differences” to help participants acquire concepts and skills in developing instructional activities. Such an exercise is particularly suitable where commercial teaching materials are not readily available, and teachers have to depend on their creativity and skill to develop their own. After creating their own teaching materials from “junk”, the participants were required to invent games on a group basis, using the materials that they had previously produced. Teo has reported that from his experience with two groups of Diploma students, the “Junk Exercise” has received more positive than negative comments.

In her report on “Puppets as an Educational Tool”, Lee has made the point that puppets have a special appeal for children. Through puppets, children tend to become more alert and attentive in class, enjoy their learning experiences, develop their powers of imagination and creativity, develop language skills and become more co-operative and helpful. Trainee teachers specialising in early childhood education are now taught the skills of puppetry so that they can help to make learning more meaningful and enjoyable for their young pupils. In social studies, Liaw has developed and used a simulation game called “Know Our Singapore” for the learning of co-ordinates and places of interest locally. Like puppets, such games have the advantage of being intrinsically motivating to students. By requiring students to interact co-operatively as well as competitively with one another, games can promote social emotional growth and facilitate socialization into more adult roles.

Developing and Using Self-Instructional Modules

The development and use of self-instructional modules in teacher education is a relatively new approach in Singapore. Then, in her report, provided the background and rationale for IE's involvement in the NTR Project, a regional project which was planned specifically to develop teacher education materials to train or retrain personnel for certain major types of non-traditional educational programmes. For this project, instead of taking courses or attending lectures, teachers would work on their self-improvement through the use of self-instructional materials.

Six main categories of teacher competencies were identified for module development. These were:

(a) Instructional planning;
(b) Instructional execution;
(c) Instructional management;
(d) Instructional evaluation;
(e) Pupil counselling; and
(f) Professional development.

During Phase I of the project (1978 — 80), 10 modules were developed by the project team, and field-tested by 280 teachers of the less academically-inclined pupils in primary schools. The teachers generally indicated favourable opinions about the contents of the modules. In 1981, a second phase for the project was proposed by INNOTECH (the SEAMEO Regional Center for Educational Innovation and Technology in overall charge of the NTR Project), and agreed to by the five participating countries. The main task of Phase II was the evaluation of the modules to determine their effectiveness. Furthermore, it was envisaged that eventually a regional model could be drawn up for the development of teacher-training materials that could serve as a guide to countries and institutions concerned about promoting the professional growth of their teachers. Time does not permit me to go into the details of the evaluation instruments and procedures used in Phase II of the project. Suffice it to say that it has been a very comprehensive exercise. The project team is now finalising the production of selected modules on a large scale for dissemination and use by teachers.

A Team Approach

While team-teaching, as an educational idea from the 1960s appears to have been pushed out of the limelight by more recent innovations, it is alive and well in IE. Chew and Beck, in their report on “The Principles and Practice of Education Course: A Team Approach”, has provided a comprehensive picture of an innovation that has taken place within a major course in the pre-service programmes of IE. Since there can be many patterns of team-teaching, Chew and Beck have carefully defined their “team approach” as follows:
“The lectures on topics related to a particular theme are delivered by a team of lecturers from various disciplines included in the course. In this team approach, these lecturers contribute to the organisation of the framework of the schedule and content of the lectures and tutorials in which thematic interrelatedness of discipline-based topics and relationship between theory and practical implications are stressed. The planning and organisation of the tutorial would also closely involve tutors who are not in the team of staff conducting the lectures. Other major activities which constitute the team approach are those in the areas of student performance assessment and course evaluation.”

The impetus for a change in the organisation, structure and mode of delivery of the Principles and Practice of Education course (also known as Core Education, CE) came from the recommendations of Professor William Taylor, who had undertaken a study of the teacher education programme in IE in March 1980.

Professor Taylor had identified several areas of weaknesses in the existing CE course. These weaknesses include the following:

- fragmented nature of the discipline-based approach.
- the impossibility of proper sequencing of the topics since different intakes of students sat in the same lectures.
- mode of delivery involving 2-hour mass lectures.
- lack of clear focus in the course.

As a possible solution to the above shortcomings, Professor Taylor had recommended that a thematic approach be tried out, and that students be grouped in tutorial classes with a tutor assuming responsibility for a large part of the course. In this way, students could gain from discussing the educational concepts and issues presented at the lectures. An internal review committee considered in detail all of Professor Taylor’s recommendations, and after months of hard work, planning and discussions, came up with the present CE course. The new approach has since been tried out with two intakes of both Diploma and Certificate students.

Chew and Beck have discussed in detail the experiences of the team of lecturers involved in this innovation, as well as the advantages and disadvantages of the approach. I think there were many valuable lessons that have been learned in this commendable effort of team-work; ultimately it is the students who will judge the degree of success of this particular innovation.

Conclusion

This has been a brief overview of some of the innovations in teaching that have been developed and implemented by IE staff in recent years. In concluding this overview, may I suggest a number of criteria that may be used to evaluate the success or otherwise of such innovations. These criteria could include the following:

- relevancy to needs and expectations of the “clients” or consumers of the innovation;
- quality of the innovation i.e. to what extent do the inputs, processes, and products of the innovation appear to be of high quality?
- learner outcomes i.e. the extent to which learner outcomes resulting from involvement in the innovation are satisfactory;
- cost effectiveness of the innovation;
- impact of the innovation; and
- practicality of the innovation.

Finally, I would like to place on record my sincere thanks to the many contributors of this project report. As I have said elsewhere, I look forward to receiving more reports on innovative teaching methods from my colleagues in the future.

REFERENCES
