STRATEGIES FOR IMPROVING SCIENCE EDUCATION PRACTICES IN VIETNAMESE SECONDARY SCHOOLS

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STRATEGIES FOR IMPROVING SCIENCE EDUCATION PRACTICES

IN VIETNAMESE SECONDARY SCHOOLS

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ABSTRACT

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By

Nguyễn thị Đủ

Although studies about Vietnamese secondary school curriculum have been done, no one has yet systematically treated the problem of science teaching in Vietnamese secondary schools and offered realistic ways to improve it.

This study was designed to investigate that problem, by analyzing the Vietnamese secondary school science program and making recommendations for possible changes based on research and current thought.

A historical review of science teaching practices in Vietnamese secondary schools was made, followed by a proposal of a new set of goals and objectives for Vietnamese education. Science education objectives were also developed, based in part on Bloom's Taxonomy of Educational Objectives.

The second part of the study surveyed textbook revision, integration of audio-visual materials in science teaching, extensive use of demonstrations and laboratory experiments, and possible research strategies to improve science education practices in a concrete manner. A plan

of equipping Vietnamese secondary schools with audio-visual materials and equipment--within the framework of the low economic level of the country, considering the wartime difficulties and other regression factors common to all developing nations, was proposed.

In the conclusion, a set of standards for a professional science teacher was outlined as a step in a comprehensive science education program for Vietnam.

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By

Nguyễn thị Đủ

A THESIS

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To my parents,

who have done so much for me

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Many thanks are also due to all of the Vietnamese people at Michigan State University who provided material and moral support throughout this study. And for the Vietnamese at home who struggle and suffer for a better future, this work is dedicated.

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CHAPTER I

INTRODUCTION

Statement of the Problem

This study is an analytical examination of Vietnamese Secondary Science Education, designed to provide a set of guidelines for an improved implementation model.

Significance of the Study

Educators in Vietnam today are faced with the difficult task of providing Vietnamese youth with a relevant system of education which must take into account the severe conditions created by the war, the low economic level of the country, and limited facilities and equipment.

Although great improvements have been made in secondary education during the last decade, in spite of the creation of new schools and classrooms and the addition of new teachers, the demands far exceed the capabilities; the student-teacher ratio remains constant and young men are still being taken from the teaching ranks into the battlefield,[1] making the shortage of teachers even more acute.

This study is, then, specifically concerned with the task of developing both quantitative and qualitative guidelines for improving science education practices in

Vietnamese secondary schools, using the resources provided by modern findings in educational psychology and by applying advances in the field of educational technology at the same time. Also, this study is designed to establish guidelines for the use of these new media and approaches, both to alleviate the shortage of teachers in Vietnam, and to improve the science instructional program.

Scope of the Study

The statement of the problem raises questions of applicable areas to be examined in the study. Included are the following:

a. Science textbook revision

b. Demonstration and laboratory experiments

c. Audio-visual media in science teaching

d. Research in science education.

For each means the questions are the following:

1) In what form should textbooks be written in order to motivate and heighten the interest of the students? What are the guidelines for the selection and use of textbooks in science teaching?

2) How can demonstration and laboratory science experiments be improved?

3) What kind of audio-visual instructional media can be used effectively in science teaching for high schools without making exorbitant expenditures?

4) Finally, how can Science Education be improved

and developed through research?

In answering these questions, Chapter II gives a historical review of the Vietnamese educational development as background for this study.

Chapter III states the philosophy and goals of the Vietnamese Education System, gives an analysis of behavioral objectives in science teaching, and examines functional concepts of critical thinking and problem solving.

Chapter IV deals with the establishment of principles and guidelines for the preparation, selection and use of textbooks for effective science teaching.

Chapter V deals with improvements in the ways of using demonstrations and laboratory work in science teaching.

Chapter VI describes different types of audio-visual media which may contribute effectively to teaching and learning science in secondary schools in Vietnam. Preliminary conditions to be met before implementing a program of using audio-visual media in Vietnamese high schools are also discussed. A plan of equipping Vietnamese high schools with audio-visual equipment and materials is also proposed.

Chapter VII develops the rationale for systematic research in science education, including both basic research and action research.

Conclusions constitute the last portion, Chapter VIII.

Limitations of the Study

1. It is not within the scope of this study to discuss the results of the current experiments in extensive audio-visual teaching or to elaborate on such expensive audio-visual media as closed circuit television or video tape recorders.

The object of this study is, rather, to investigate the possibilities of using new and inexpensive means to teach science more efficiently in secondary schools.

2. This study does not deal with general procedures such as administrative measures, financing problems, school construction, teacher training and foreign aid.

The study focuses on general secondary education with special emphasis on science teaching.

Related Studies

So far, there have not been any studies of this nature.

There were only annual reports from Vietnam for each school year, presented as documents at each session of the International Conference of Education in Geneva, held by UNESCO. These reports appear annually in the International Yearbook of Comparative Education. They are brief descriptions of Vietnamese educational development, one to five or six pages long and do not form the rationale or recommendations developed in this study.

There is another kind of report, published by the

Ministry of Education, Bureau of Statistics.[2] This kind of report is statistical in nature and rarely includes a commentary as the reports mentioned above.

Definition of Terms

"Secondary education": the teaching of children from grade 6 to 12 or from approximately 11 to 18 years old.

"Science education practices": all types of science teaching activities, e.g., lecture, demonstration experiments, laboratory work, and other common teaching procedures.

FOOTNOTES FOR CHAPTER I

[1]Lester Mills, "Science Education in the Republic of Vietnam," <u>The Science Teacher</u>, XXXIV (January, 1967), 37.

[2]The Ministry of Education of the Republic of Vietnam, has been publishing since 1958, a statistical yearbook called <u>Annuaire Statistique de l'Enseignement</u>, which allows educators to make judgments about progresses made by the Government in the educational field during a particular year.

CHAPTER II

GENERAL HISTORY OF VIETNAMESE EDUCATION

Vietnamese Education prior to 1900 A.D.

1) General development: The Vietnamese nation had reached, before the arrival of the French, a certain degree of intellectual culture and already possessed a true school system. The Chinese domination over the country during the first ten centuries of the Christian era had brought into the Vietnamese society the elements of a very aged culture. Thus, at the end of such a long domination period, the Vietnamese people were able to assimilate the best elements of this culture and then to sketch an education system of their own.

2) Examination system: At the beginning of the eleventh (XIth) century, under the monarchy of Lý thánh Tôn, the first examinations were organized, and those periodical examinations had prevailed until the beginning of the nineteenth century. They played an important role in the Vietnamese schooling organization: they allowed the royal government to control the level of the schooling system, to grant diplomas giving access to mandarinate, and finally, to recruit government officials, necessary for the functioning of the government system.

Revised many times under the Lê and particularly under Lê thần Tôn at the end of XVth century, and under Lê Hi Tôn in 1678, those examinations took under the Nguyễn the final shape which endured until the nineteenth century.

The students took triennial examinations in large centers of big cities. If they passed them, they would be granted the title of "Tú Tài" or "Cử Nhân." Finally, superior examinations were organized in the Capitol, under the Emperor's supervision, which allowed superior students to get hold of the "Tiến sĩ" or doctoral degrees. The names of the most brilliant laureates were engraved in gold and stored in the "Văn Miếu."

The tests consisted of numerous compositions (essay types), either in prose or versification, whose topics were drawn from the two basic sets: "Ngũ Kinh" (the Five Canonical Books) and "Tứ Thư" (the Four Classical Books) of Confucianism. The literary degrees so obtained could only lead to administrative careers. However, because of the highly competitive character of these examinations, hundreds of thousands of students spent their whole life in study, attempting to pass them.

3) <u>School organization and curriculum</u>: There were only a few schools (the Quốc-tử-giám, the Thái-học and the Lan-kha-tú-viện) run by the government, in the capital or big cities, reserved for very bright students selected from all over the country, and for sons of mandarins. A great number of

private schools were scattered throughout the country; these were one-teacher Confucian schools set up and taught by scholars without official job and by retired mandarins.

The children were taught to read and write Chinese characters, to learn "Tam tự Kinh." After this elementary period, they would learn to read and comment "Kinh Thư" (joint name of the Canonical and the Classical Books). Then they only had to practice their writing.

Besides learning of the basic materials they also had plenty of opportunities for creative thinking. For instance, talented scholars should know how to combine present facts and historical events, to relate them to the basic principles of Confucianism and, in light of versification rules, could quickly produce meaningful poems.

Once they succeeded in the superior examination and were appointed mandarins they would be able to formulate their projects for administration planning, for military tactics or for foreign affairs policy . . . to bring to the king and the court for approval.

Those who failed these examinations either had to wait and retake the examinations at a later time, or go back to their native villages and open a small school for their subsistence.[1]

In summary, the major purposes of education and examination under the Chinese influence was to provide mandarins for the court and government officials for administrative positions. Nothing had been done for the teaching of science and technology to students, although their developments are essential for the growth and progress of the nation. Such an education system obviously would not meet the true needs of the country, but only has the merit in bringing the stabilization of the society through the Confucian principles which constituted a major part of the school curriculum in those days.

Such an educational system--dedicated almost too exclusively to the study of classics, literature, and versification, at the expense of a more scientific education oriented toward economic progress--would certainly be a major cause of defeat before the invading armies of imperialistic France. As a Vietnamese historian has put it:

> In the past, the goal of the scholar was the knowledge of virtue which enables him to distinguish good from evil, and at the same time the character training which gives him the high moral traits necessary for conducting public affairs. . . .
>
> Gradually, as a result of the daily struggle for existence, these studies were aimed simply toward passing the examinations which permitted the successful candidates to become mandarins.[2]

Vietnamese Education in the First Half of the Twentieth Century

1) General lines: The present educational system of Vietnam originated from the end of the previous century, when the French almost finished their conquest of Indochina in 1884.[3] Along with the new administration system, they set up in Vietnam a scholastic system, so-called "franco-native,"[4]

using French and Vietnamese as vehicular languages, in order to abolish the Chinese influence in the Vietnamese society. The romanization of the native language, introduced early in seventeenth century by the Catholic missionaries (Alexandre de Rhodes) for evangelizing purposes, did help the franco-native system to be workable. The "quốc ngữ"--the Vietnamese national language using Roman characters as alphabet elements--soon became compulsory for all schools. Thirty years after the French conquest, the substitution of franco-native studies to traditional studies was almost complete.

With efforts to develop the "franco-native" educational system using the "quốc ngữ," the French administrators finally came up to the abolishment of the triennial competitive examinations in 1915,[5] and to the closure of classical Confucian schools by 1919.[6] Beside the "franco-native" system for Vietnamese children, there was a system of "French schools," following corresponding programs of schools in France; these French schools were reserved for French children and native students wishing to continue their studies in the universities or technical schools in France.

2) The structure of education in Vietnam during the French Colonial Period (1858-1945): The common principle underlying any French educational system--whether it is entirely French or Franco-native--is the separation of the masses from the elite: only the elite could pursue further their

studies in universities or other establishments of higher education. This principle--well summarized in this sentence: "Instruire la masse et dégager l'élite"[7]--reflected in these following aims set up by the colonial regime at the beginning of the 20th century regarding the education of the Indochinese people:

> 1. First, it hopes to assure, through elementary education given in the native languages, the acquisition of a minimum amount of indispensable knowledge by the masses. This training is to emphasize ethics, physical education, and hygiene.
> 2. Second, the elite are to be instructed in the French language and the oriental humanities.
> 3. Third, all students showing ability will be encouraged to enter professional and technical schools.[8]

There were various levels and types of education during this period:

a) Elementary education: French authorities began to build elementary schools in 1879 after the "quốc ngữ" (the Vietnamese national language) was made compulsory in all elementary schools. There were three kinds of elementary schools:

1) Preparatory schools (écoles primaires élémentaires) in villages, giving 3 years of education of the "three R's," using purely the native language.

2) Elementary schools in chief towns of cantons (small districts), offering 6 years of schooling with the last year in the French language.

3) Primary schools (écoles primaires) in chief-towns of provinces, dispensing an education purely in French

language by French teachers who themselves ran the schools.

The degrees granted at this level of education included the "certificate of elementary studies" (certificat d'études élémentaires) and the "certificate of primary studies" (certificat d'études primaires).[9]

b) General secondary education: General secondary education in Vietnam during the French period was developed more slowly than elementary education.

Around 1900 A.D., there were only eight secondary schools in all Indochina (today, Vietnam, Laos and Cambodia), which adopted the standard French curriculum. Thus, the education provided by these schools--for example, the Lycée d'Hanoi and the Collège Chasseloup-Laubat at Saigon--was entirely French.

It was not until 1918, that the French Governor Albert Sarrault signed the Order, instituting the "Franco-native" system of secondary education, designed for the intellectual and moral education of the Indochinese people. Its curriculum included Vietnamese classical literature (Quốc Văn). The Indochinese diplomas were equivalent to the French ones and could give access to institutions of higher education.[10]

Secondary education--whether French or Franco-native--was given in two kinds of schools: the "collèges" and "lycées."

"Collèges" were four-year schools following elementary schools. "Lycées" provided with seven years of education beyond the elementary level. Usually after a number of years, the "collèges" grew up into "lycées" as the number of students increased. Such was the case of the Chasseloup-Laubat "Collège," which later became the "Lycée" Chasseloup-Laubat.

"Collèges" prepared students for the Diploma of Primary-Superior Studies (diplôme d'études primaires supérieures) but could not prepare them for the Baccalauréats (Part I and Part II) whereas "lycées" could prepare students for both of these diplomas.

c) Normal education: The preparation of teachers designed to carry out the teaching job for a new system of education is very important.

The normal schools were for prospective elementary teachers, providing a four-year education at the "collège" level. The first normal school was created in 1871. The one for girls was opened in 1919.[11]

The normal courses annexed to "collège" also gave "collège" graduates certificate of proficiency in teaching after one year of training. A program of training in physical education in the summer of 1931 attracted 50 teachers, although physical education had not been part of the traditional training.[12]

The School of Pedagogy of the University of Hanoi was given the task of preparing teachers for "lycées" and "collèges."

Competitive entrance examinations were organized to select the most able students into these normal schools.

d) Vocational education: Vocational education was developed even later than secondary education. The construction of technical schools only began in 1918.[13]

By 1924, there were six schools of practical industry[14] training students for a number of occupations such as fitting, carpentry, casting, ironworking, electrical trades, combustion engines. Among these six schools, the School of Asiatic Mechanicians (Ecole des Mécaniciens Asiatiques) was considered to be a first-rate vocational school.[15] There were also five schools of applied arts[16] in all Indochina, responsible for training qualified workmen and artisans capable of reviving traditional Indochinese arts and crafts, as well as designers or technicians capable of assisting heads of undertakings and becoming talented decorators.

Vocational education was also provided in schools for apprentices at Saigon, Sontay and Sonla.[17]

e) Higher education: Higher education was first given in the French-speaking University of Hanoi, which was founded in 1902 for the Indochinese people[18] and which was attached to the University of Paris.[19] By 1917, it included schools of medicine and pharmacy, law and administration, pedagogy, agriculture and forestry, commerce and public works. A school of fine arts was added in 1924 and, in 1931, a school of science.[20]

The University aimed at standards equivalent to European universities;[21] it results that the percentage of those students who graduated each year was very small.

Instead of sending their daughters and sons to this University, wealthy parents could have another choice: sending their children to France for higher studies in Universities or Grandes Ecoles.

f) Girls' education: A remarkable work of the French administrators in Vietnam in scholastic reforms was the development of girls' education. Before 1906, the girls in Indochina hadn't had the opportunity to go to school; they only received the education of the family. By 1929, there were about 30,000 girls attending schools in Vietnam, Laos and Cambodia.[22]

The Search for a National Education System (1945-1954)

The two systems of education--French and Franco-native--continued to function side by side until 1945, when the Japanese invaded the Indochina peninsula and overthrew the French colonial regime. The Vietnamese Nationalists profited from the situation to speed up their struggle for the independence of Vietnam from the French domination. A Vietnamese nationalist government was formed and the scholar Tran Trong Kim became Premier.[23] The new government, alongside with important reforms--e.g., fiscal reform[24]--also reorganized the Vietnamese system of education, using

Vietnamese as vehicular language for instruction. The first Vietnamese curricula for secondary school were introduced in North and Central Vietnam in the school year 1945-1946. In the South the situation was more critical--the French attempted to return to Vietnam and considered South Vietnam as a good base for invasion--to produce similar changes in education.

From 1949 on, successive Decrees and Orders brought progressive changes into the Vietnamese system of education.[25] The most important of these was the "Departmental Order" promulgated on October 14, 1953, which systematically reorganized the Vietnamese system of secondary education.[26] According to this "Order," Vietnamese secondary education comprised two steps (called "cycles").

The first cycle, which lasted for four years, was the same for all students and was designed to give students who left school after this stage, an education as adequate as possible. The first cycle certificate (Brevet d'Etudes du premier cycle--BEPC) was granted to those students who pass an external examination organized twice a year with a time interval of approximately three months.

The second cycle was established to provide a solid background for further studies in universities or other institutions of higher learning. This second cycle, which lasted for three years, was divided into three sections: Section A, experimental sciences; Section B, mathematics and physical sciences; Section C, literature. At the end of the second year of the second cycle, students were required to take the "Baccalaureat I" examination, a prerequisite for the "Baccalaureat II" examination. The latter is taken at the end of the second cycle. Both types of examinations were external examinations; they were organized twice a year with a time interval of approximately three months.

Despite the establishment of national curricula for Vietnamese secondary schools, the French influence on the intellectual and cultural life of the country was far from being extinct during this period (1945-1954). Middle-class parents--not all of them of course--continued to send their sons and daughters to those "French" schools (mentioned in above sections) or those private schools which followed the standard French curriculum. This was not going unnoticed by the French Government who hoped that this influence might last forever. This resulted in France's attempt to re-establish colonial control. French troops in fact, landed in the south of Vietnam on October, 1945.[27] Thereafter they began to move further north to "re-conquest" the whole country. However, they failed to affect the nationalists and Vietminh (the popular front) who had been gathering forces and organizing movements designed to end French rule. The French restored Bao Dai who had been emperor during a short-lived regime under Japanese rule,[28] in order to weaken the Vietminh and nationalist movements by separating the two groups. They hoped to pull the nationalists to the Bao Dai's side but they failed, and from 1946 on France incurred huge losses and was finally defeated at Điện Biên Phủ, May 8, 1954.[29]

The Geneva Agreement signed on July 21, 1954, divided Vietnam along the Bến Hải River.[30] The withdrawal of French troops led to the end of France's direct participation into the government as well as in the educational system of Vietnam.

In summary, the period from 1945 to 1954 was characterized by the struggle for national independence. In the educational field it was marked by the seeking of a new system of education, purely Vietnamese, that would fully grow in the next fifteen years.

Present Vietnamese Education System

1. Educational Structure in Vietnam

The structure of the educational system in Vietnam has been changed many times both before and after 1954. This evolution, based on the three typical structures, is summarized in the following charts:

Chart I (1949-1950)

Chart II (1965-1966)

Chart III (1969-1970)

Elementary education consisted of five years in primary schools. The village "primaire elementaire" schools offered only three years of schooling, then the children were transferred to primary school. Between 1954-1955 and

1965-1966, there were schools called "pilot community schools"[31] that are also at the primary level.

The <u>secondary level</u> is seven years and divided into two phases called cycles. The first cycle is four years and the second, three years. There are mainly two types of secondary schools: the general and the technical ones.

In <u>general education</u>, pupils finishing the first cycle, before 1954, took the national examination to get the "Diplome d'Etude Primaire Complementaire Indochinoise" or DEPCI if they attended the "Franco-native" section. After 1954, the students passed the examination of the first cycle of secondary education, got the diploma "Trung Hoc De Nhut cap." In 1965-1966, this examination was abolished, and two years later, was reopened just for adult candidates. The young students could only get a certificate of completion of the first cycle.

In the second cycle, the students have to pass two examinations called "Baccalaureats" I and II (part one and part two) after the second and third year in the second cycle. To attend the "Baccalaureat I" the candidates should be holders of the Baccalaureat I and have one year of school in the terminal class of secondary education.

The Baccalaureat II is required for entrance to the universities and higher schools as a standard proof of high school completion.

In <u>technical and vocational education</u> the degrees are of comparable level but more specialized in technical and vocational skills. Before 1955-1956, secondary technical schools offered only four years of schooling,[32] but in 1965-1966 they extended to a full scale of seven years education, thus serving as the intermediate between elementary and higher technical schools for engineers.

There was another type of secondary school, the Agriculture, Forestry and Animal Husbandry school[33] that existed for a short period covering 1965-1966. It prepared technicians in these areas.

The <u>School of Fine Arts</u> consists of a separate kind of vocational school; students cannot transfer to the other two types of vocational schools previously mentioned. It offered 4 years of study in secondary level and 3 years at the higher level.[34] In 1965-66 there were secondary schools of Decorative Arts offering full scale of 7 years, then the students could go on to 1 year of higher education in Fine Arts.

The School of Music and Dramatic Arts, presently in action, offers education to students having an academic background equal to those who have completed the first cycle of secondary education.[35]

<u>Higher education</u>. Before 1954, there were only the basic faculties at the university level such as Faculties of Law, Letters, Sciences, Pharmacy, Dentistry, Architecture, Medicine and a higher School of Fine Arts.[36] Demands for

CHART I

EDUCATIONAL STRUCTURE IN VIETNAM

1949 - 50

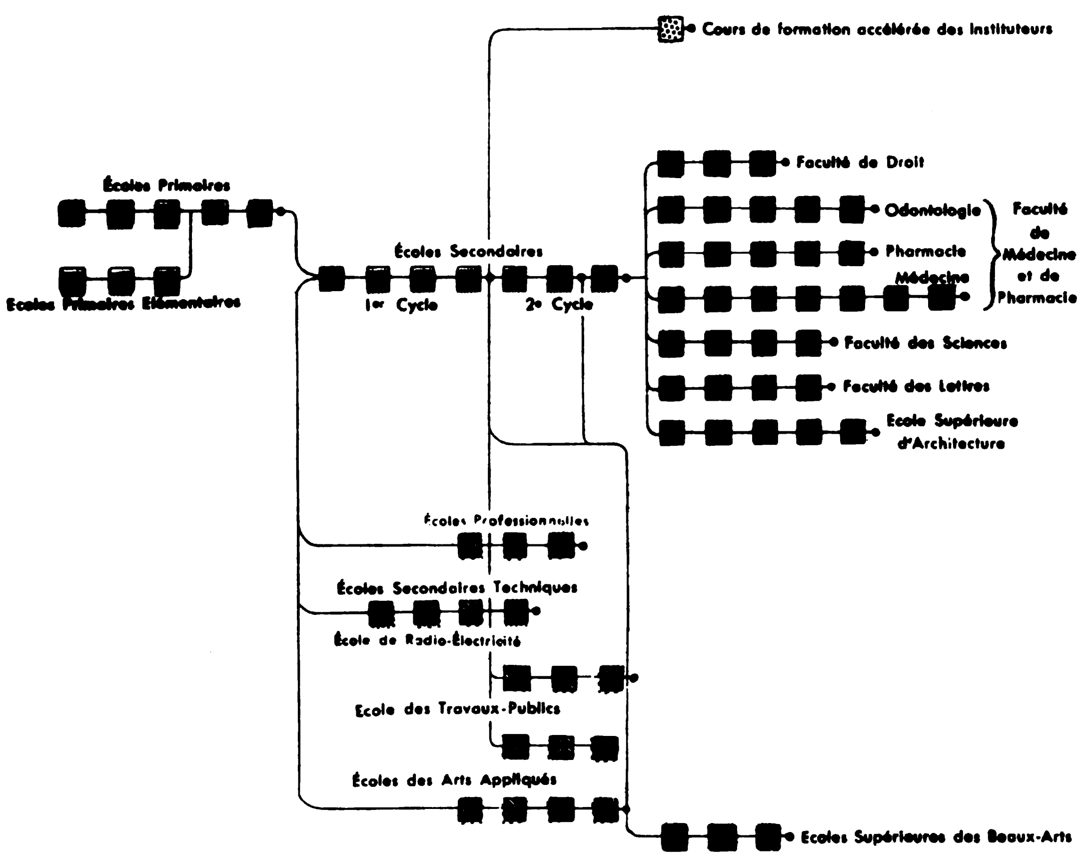


CHART II

EDUCATIONAL STRUCTURE IN VIETNAM

1965 - 66

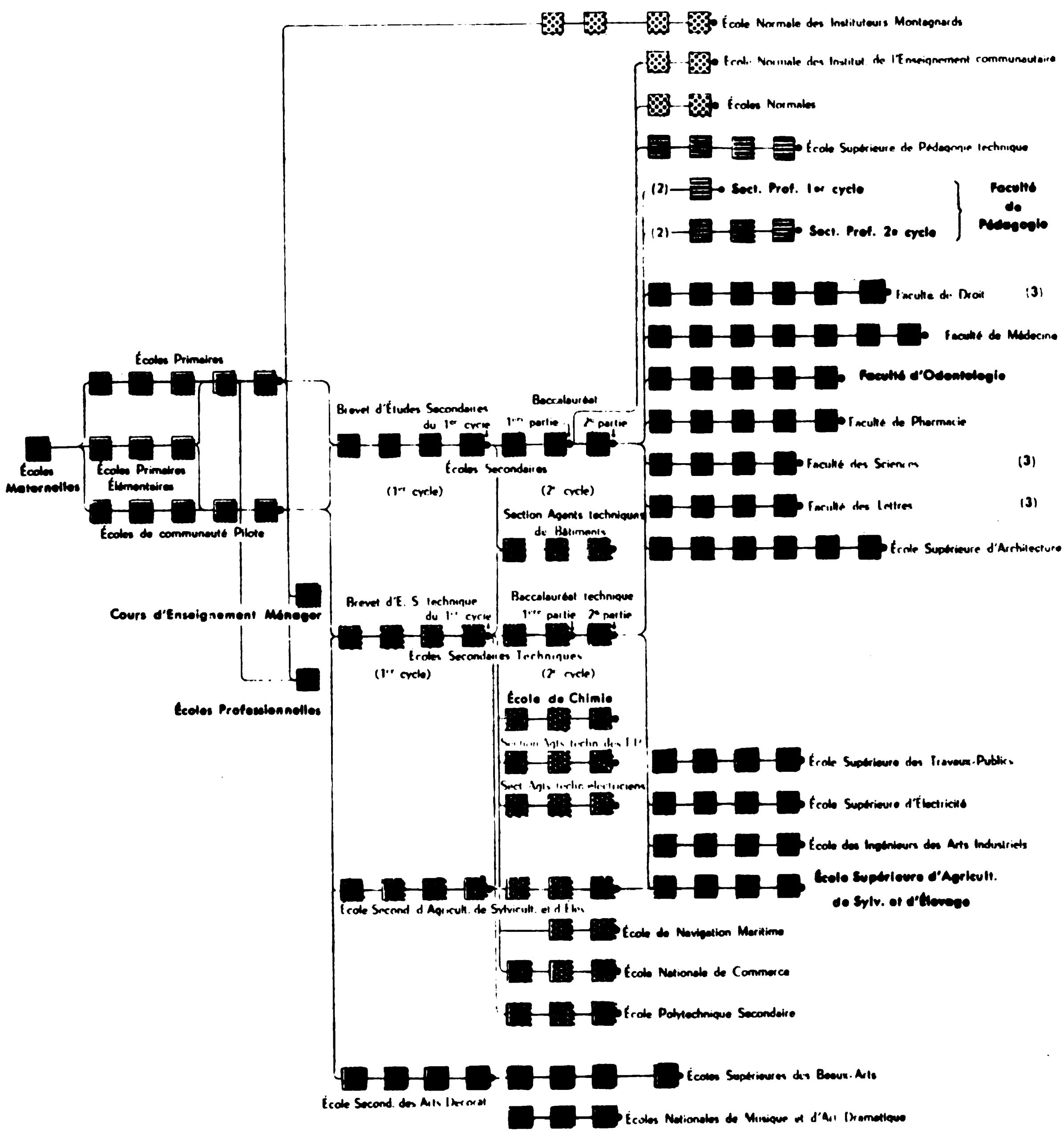
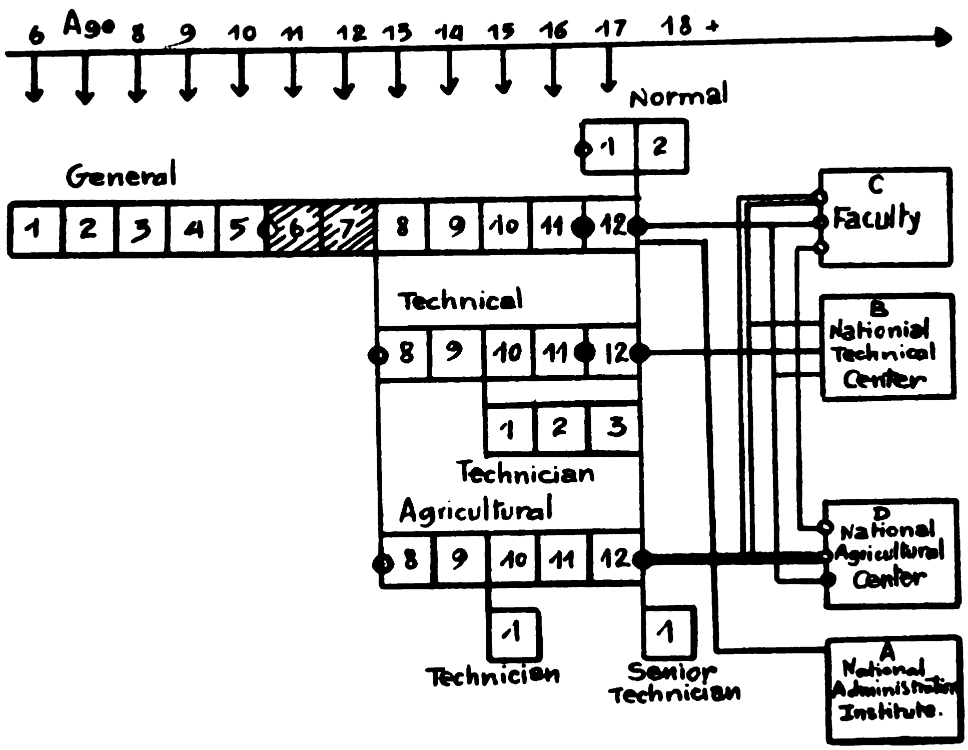


CHART III

EDUCATIONAL STRUCTURE IN VIET-NAM
1969-70



o Entrance Examinations

• Examinations (Baccalaureate I and II)

A. — National Administration Institute

B. — National Technical Center
(School of Civil Engineering, School of Electrical Engineering, School of Chemical Engineering, School of Industrial Engineering)

C. — Faculties of National Universities:
- Pedagogy
- Medecine
- Pharmacy
- Dentistry
- Architecture
- Letters
- Law
- Sciences

D. — National Agricultural Center
(School of Agriculture, School of Forestry, School of Animal Husbandry).

technical education had increased and higher schools of engineering were built in the complex in Phu Tho, the north suburb of Saigon, called National Technical Center, to provide the country with engineers. There are 4 schools in this type including the schools of Civil Engineering, Electrical Engineering, Chemical Engineering, and Industrial Engineering. Each one provides 4 years of study.

The National Administration Institute has been in operation since 1955.[38] It provides administrators of high rank for all areas of government administration. It is under the direction of the Ministry of Interior because of its importance for producing graduates to fill key posts in the government.

2. Curriculum Evolution (before and after 1970)

The following time-tables may give an idea of how Vietnamese secondary school curricula have been developed and undergone changes during the period 1955-1970 (see Tables 1, 2, 3, 4). The changes in Vietnamese secondary school curricula from the period before June, 1970,[39] to the period after June, 1970, were the following:

a) Emphasis was put on History and Geography; an increase of one hour was given to the former two hours of History and Geography throughout secondary level to form a total of three hours per week.

b) Physics and chemistry are now scheduled separately and more time was added to the sciences section (second cycle)

TABLE 1

TIME-TABLE FOR GENERAL SECONDARY SCHOOLS: FIRST CYCLE (BEFORE JUNE, 1970) (in hours per week)

Subject / Class*	VII	VI	V	IV
1. Vietnamese and Chinese characters	5+1	5+1	5+1	5+1
2. History and Geography	2	2	2	2
3. Civics (theory and practice)	2	2	2	2
4. Foreign Language	6	6	5	5
5. Natural Sciences	1	1	2	2
6. Physics and Chemistry	2	2	2 1/2	2 1/2
7. Mathematics	3	3	3 1/2	3 1/2
	22	22	23	23
Drawing	1	1	1	1
Music	1	1	1	1
Physical education	3	3	3	3
Handicraft (for boys)	1	1	1	1
Home economics (girls)	1	1	1	1
Total (for boys and girls)	28	28	29	29

*The classes VII, VI, V, IV were equivalent to today's grades 6, 7, 8, 9 of the First Cycle.

Source: Vietnam (Republic), Ministry of Education, *Chương trình Trung-học* (Secondary Education Curriculum) (Sạigon: Ministry of Education, 1965), p. 7.

TABLE 2

TIME-TABLE FOR GENERAL SECONDARY SCHOOLS: FIRST CYCLE (AFTER JUNE, 1970) (in hours per week)

Subject \ Grades	6	7	8	9
1. Vietnamese* (and Chinese characters)	6	6	6	6
2. History and Geography	3	3	3	3
3. Civics	1	1	1	2
4. Foreign Language	6	6	5	5
5. Biology (Natural Sciences)	1	1 1/2	1 1/2	2
6. Physics	1	1	1 1/2	1 1/2
7. Chemistry	1	1	1	1
8. Mathematics	3	3	3 1/2	3 1/2
Total	22	22 1/2	22 1/2	24
Electives**	6	6	6	6
Grand Total	28	28 1/2	28 1/2	30

*Including Vietnamese language, literature and culture.

**The electives or optional subjects include:
--physical education (3 hours/week) (gymnastics, sports, youth activities)
--drawing
--craft
--sewing
--child care
--home economics (foods, clothes, farming, family planning)
--music (1 hour/week)

Source: Vietnam (Republic), Ministry of Education, _Chuong trinh Trung-hoc_ (Secondary Education Curriculum), (Saigon: Ministry of Education, 1970), p. 5.

TABLE 3

TIME-TABLE FOR GENERAL SECONDARY SCHOOLS:
SECOND CYCLE (BEFORE JUNE, 1970)
(in hours per week)

Section / Subject	Literature: Modern Language			Literature: Classical Language			Sciences and Mathematics			Experimental Sciences		
	III	II	I	III	II	I	III	II	I	III	II	I
1. Vietnamese	5	5	0	5	5	0	3	3	0	3	3	0
2. History and Geography	2	2	2	2	2	2	2	2	2	2	2	2
3. Civics	2	2	1	2	2	1	2	2	1	2	2	1
4. Philosophy	0	0	9	0	0	9	0	0	3	0	0	4
5. First foreign language	6	6	6	6	6	6	4	4	3	4	4	3
6. Second foreign language	6	6	6	0	0	0	4	4	3	4	4	3
7. Classical language (Latin or Chinese)	0	0	0	6	6	6	0	0	0	0	0	0
8. Physics-Chemistry	1	1	1	1	1	1	4	4	6	4	4	6
9. Mathematics	1	1	1	1	1	1	6	6	8	4	4	4
10. Natural Sciences	1	1	1	1	1	1	1	1	1	3	3	4
	24	24	27	24	24	27	26	26	27	26	26	27
Physical education*	3	3	3	3	3	3	3	3	3	3	3	3
Home economics (girls only)	1	1	0	1	1	0	1	1	0	1	1	0
Total for boys	27	27	30	27	27	30	29	29	30	29	29	30
Total for girls	28	28	-	28	28	-	30	30	-	30	30	-

*Might increase to 6 hours if instructors and facilities are feasible.

Source: Vietnam (Republic), Ministry of Education, <u>Chuong trinh Trung Hoc, 1965</u> (Saigon: Ministry of Education, 1965), p. 7.

TABLE 4

TIME-TABLE FOR GENERAL SECONDARY SCHOOLS:
SECOND CYCLE (AFTER JUNE, 1970)
(in hours per week)

Subject	Section	Literature: Modern Language			Literature: Classical Language			Sciences and Mathematics			Experimental Sciences		
	Grade	10	11	12	10	11	12	10	11	12	10	11	12
1. Vietnamese		5	5	0	5	5	0	3	3	0	3	3	0
2. History and Geography		3	3	3	3	3	3	3	3	3	3	3	3
3. Civics		2	2	1	2	2	1	2	2	1	2	2	1
4. Philosophy		0	0	9	0	0	9	0	0	3	0	0	4
5. First foreign language		6	6	6	6	6	6	4	4	3	4	4	3
6. Second foreign language		6	6	6	0	0	0	4	4	3	4	4	3
7. Classical language (Latin or Chinese)		0	0	0	6	6	6	0	0	0	0	0	0
8. Physics		1/2	1/2	1/2	1/2	1/2	1/2	3	3	5	3	3	5
9. Chemistry		1/2	1/2	1/2	1/2	1/2	1/2	1 1/2	1 1/2	2	1 1/2	1 1/2	2
10. Mathematics		1	1	1	1	1	1	6	6	9	4	4	5
11. Natural Sciences		1	1	1	1	1	1	1	1	1	3	3	4
		25	25	28	25	25	28	$27\frac{1}{2}$	$27\frac{1}{2}$	30	$27\frac{1}{2}$	$27\frac{1}{2}$	30
Electives	Boys	2	2	2	2	2	2	2	2	2	2	2	2
	Girls	3	3	3	3	3	3	3	3	3	3	3	3
Total	Boys	27	27	30	27	27	30	$29\frac{1}{2}$	$29\frac{1}{2}$	32	$29\frac{1}{2}$	$29\frac{1}{2}$	32
	Girls	28	28	31	28	28	31	$30\frac{1}{2}$	$30\frac{1}{2}$	33	$30\frac{1}{2}$	$30\frac{1}{2}$	33

Source: Vietnam (Republic), Ministry of Education, Chuong Trinh Trung-hoc, 1970 (Saigon: Ministry of Education, 1970), p. 6.

for these two subjects. One hour is reserved for chemistry each week during the four years of the first cycle. In the second cycle, literature sections, physics and chemistry are broken down into half and half of the total one hour before 1970.

In the Sciences sections, a total of half-an-hour was added to the former schedule of physics and of chemistry for grades 10 and 11 and one full hour for grade 12. The new schedule shows three hours of physics, one-and-a-half hours of chemistry for grade 10 and 11, compared to the former 4 hours of physics and chemistry. In grade 12 it results in five hours of physics and two hours of chemistry versus a total of six hours of physics and chemistry before 1970.

This change was to underline the importance of chemistry as a science to be taught independently from physics. The reason was that teachers used to neglect the teaching of chemistry, regarding chemistry as a subject for memorizing.

c) Modern mathematics was introduced to grades 12, sciences sections by the order No. 88 GD/QD/PC/HC on February 24, 1970. One hour increase for the schedule of math was added to the eight hours of math in math section and to the four hours of math in Exp. sc. section set theory, probability and descriptive statistics ... were included.

d) There is more flexibility for students to choose minor subjects that become the electives. Besides Physical

Education, Drawing, Music, high school students can have craft, sewing, child care, home economics to select. The last three subjects for girls used to go together, called domestic sciences, now break out into different specialized subjects for more details and practices. The girl students can take this advantage to become more qualified in home-keeping.

3. Students' Enrollment During the Last Decade

a) Students' enrollment in Elementary Education

Public education

Public elementary school enrollment in Vietnam during the school year 1969-1970 was about two millions--actually 1,949,352.[40] It resulted from a 16.8 per cent increase of the previous year--1,682,904 in 1968-1969.[41] In the last ten years, it has doubled: from about one million in 1959-1960[42] to almost two millions in 1969-1970. Table 5 gives a historical picture of enrollments since 1959-1960.

Back in 1954-1955, public schools only had about 330,000 students;[43] ten years later, the number increased to almost 1,263,000, and the year after (1965-66), it rose to 1,340,000. A slight decrease in public school enrollment was found in 1964-1965.[44]

Private education

Private elementary school enrollment increased constantly about 24,000 each year. The number has also doubled in the last ten years: 220,833 in 1959-1960 and 456,912 in

TABLE 5

ENROLLMENT IN ELEMENTARY SCHOOLS IN VIETNAM
(PUBLIC AND PRIVATE)

Type of school / School year	Public	Private	Total
1954-1955	329,598	71,267	400,865
- - - - -	- - - - -	- - - -	- - - - -
1959-1960	1,001,757	220,833	1,222,590
1960-1961	1,034,393	243,409	1,277,820
1961-1962	1,092,490	264,683	1,357,173
1962-1963	1,174,020	276,659	1,450,679
1963-1964	1,292,125	282,554	1,574,674
1964-1965	1,262,651	301,105	1,563,756
1965-1966	1,339,779	321,265	1,661,044
1966-1967	1,436,618	349,223	1,785,841
1967-1968	1,627,018	396,875	2,023,893
1968-1969	1,682,904	400,736	2,083,640
1969-1970	1,949,352	456,912	2,406,264

*This table is compiled from the following sources:

a) Annuaire Statistique de l'Enseignement, 1958-1960, 1965-1967, 1967-1968, 1968-1969 (Saigon: Ministry of Education, Republic of Vietnam, 1960, 1967, 1968, 1969), p. 12 (1958-60); pp. 12, 91 (1965-67); p. 20 (1967-68); p. 20 (1968-69).

b) Situation de l'Enseignement au Vietnam, 1969-1970 (2nd trimestre) (Saigon: Ministry of Education, Republic of Vietnam, 1970), p. 2.

1969-1970.[45] Its magnitude was a little higher than one-fourth of the corresponding public elementary education enrollment. Looking more closely at the number enrolled in each class, from the first year up to the fifth year in elementary, one can see the rapid drop off in both private and public education. The number of pupils in fifth grade was about one-third of the number enrolled in the first grade; for example, 1967-1968. These numbers are as follows: 533,833 (first grade), 366,365 (second grade), 303,686 (third grade), 232,984 (fourth grade), and 183,074 (fifth grade) in public schools.[46] In the same year, in private schools, there were 146,711 first graders, 85,781 second graders, 71,607 third graders, 45,763 fourth graders and 43,367 fifth graders.[47] The decreases were more serious in early grades than they were in the last classes in elementary.

<u>Admission into the first year public elementary school</u>

Each year the percentage of children admitted into the first grade of elementary school was around 90% in each of the last five years. Although the number admitted every year kept increasing, the percentage increased very slowly because the population has been going up and more and more people wanted to send their children to school. Table 6 gives an idea of the number of children admitted and the percentage of children admitted versus the number of demands for admission into public elementary schools, from 1964-1965

TABLE 6

NUMBER OF CHILDREN ADMITTED INTO FIRST GRADE VERSUS DEMANDS FOR ADMISSION

School year	Number of children admitted into first grade	Percentage
1960-1961	252,886	89.6
1961-1962	255,126	90.1
1962-1963	235,245	83.8
1963-1964	272,217	83.9
1964-1965	300,058	89.7
1965-1966	332,294	87.1
1966-1967	357,367	91.5
1967-1968	447,446	94.2
1968-1969	439,051	90.7
1969-1970	528,429	94.28

This table is compiled from the following sources:

a) Annuaire Statistique de l'Enseignement, 1960-61, 1961-62, 1962-64, 1964-65, 1965-67, 1967-68, 1968-69 (Saigon: Ministry of Education, Republic of Vietnam, 1961, 1962, 1964, 1965, 1967, 1968, 1969), p. 50 (1960-61); p. 58 (1961-62); pp. 36, 70 (1962-64); p. 21 (1964-65); pp. 37, 94 (1965-67); p. 21 (1967-68); p. 21 (1968-69).

b) Situation de l'Enseignement au Vietnam, 1969-1970 (2nd trimestre), (Saigon: Ministry of Education, Republic of Vietnam, 1970), p. 2.

to 1969-1970. From these numbers, one can see the effort of the country to admit children for free education in elementary level.

b) Student enrollments in Secondary Education

The special feature of the secondary education enrollments in Vietnam is the importance of private schools that enrolled almost two-thirds of the total secondary education population in the last few years. This fact marked an acute shortage of public secondary schools and teachers.

In private schools previously mentioned included a type of schools called semi-private (or semi-public) where students pay about one-half of the tuition fees currently charged to private school students of the same grade. There is a small number of these compared to the great number of public and private schools of the country.

In 1969-1970, the public secondary education enrollment was 229,181 and 403,040 students were enrolled in private schools.[48] Table 7 lists the range of similar numbers from 1959-1960 to 1969-1970. The percentages of increases over the previous years show that private schools grew very rapidly compared to public secondary schools. In fact, in 1955-1956 the private schools enrolled only 25,870 students while the public schools carried a greater number--27,691--students of secondary level.[49]

TABLE 7

ENROLLMENTS IN SECONDARY EDUCATION IN VIETNAM
(PUBLIC AND PRIVATE)

School year	Public schools	Private schools (and semi-private)	Total
1955-1956	27,691	25,810	53,501
- - - - -	- - - -	- - - -	- - - -
1959-1960	62,130	101,806	163,936
1960-1961	73,681	130,079	203,760
1961-1962	85,554	142,926	228,480
1962-1963	98,749	166,117	264,866
1963-1964	112,606	183,087	295,693
1964-1965	123,271	205,958	329,299
1965-1966	132,885	237,783	370,668
1966-1967	145,875	283,753	429,628
1967-1968	164,895	334,524	499,419
1968-1969	189,285	367,633	556,918
1969-1970	229,181	403,040	632,221

*This table is compiled from the following sources:

a) Annuaire Statistique de l'Enseignement, 1965-1967, 1967-1968, 1968-1969 (Saigon: Ministry of Education, Republic of Vietnam, 1967, 1968, 1969), pp. 13, 112 (1965-67); p. 43 (1967-68); p. 43 (1968-69).

b) Situation de l'Enseignement au Vietnam, 1969-1970 (2nd trimestre), (Saigon: Ministry of Education, Republic of Vietnam, 1970), p. 3.

Admission into Public Secondary Schools--
The Competitive Entrance Examination

The reason for the very large number of students enrolled in private secondary education was that they could not get into public schools. Children completing elementary education can all apply to the Entrance Examination of any public high school (secondary). Unfortunately, the number admitted was strictly limited by the capacity of public schools of classes they have, of teachers paid by the national budget, of facilities and funds the schools possess.

In 1968-1969, the number of students admitted into the first year of secondary public schools (grade 6 today) was 41,380 out of 169,528 children who took the national High School Entrance Examination.[50] That means only 24.4% admitted. Some other numbers are listed in Table 8, showing that the percentage of students admitted into public high school is on the average 19.0% during the four school years from 1961 to 1969.

c) Enrollment in Technical and Vocational Education

In 1969-1970 the student enrollment in Vietnam in technical and vocational education was, in total, 18,619 including primary, secondary teacher training, higher level and engineering training. The distribution was 17,691 at the second level and 928 at the university level.[51]

The enrollments in general education for 1969-1970 were distributed as follows:

TABLE 8

NUMBERS OF STUDENTS ADMITTED INTO THE FIRST YEAR OF PUBLIC SECONDARY SCHOOLS IN VIETNAM

School year	Admitted	Percentage
1961-1962	17,944	19.6
1962-1963	19,821	17.2
1963-1964	22,285	16.5
1964-1965	23,947	16.1
1965-1966	36,602	17.8
1966-1967	29,070	19.3
1967-1968	33,964	21.3
1968-1969	41,380	24.4

*This table is compiled from the following sources: Annuaire Statistique de l'Enseignement, 1961-1962, 1962-1964, 1964-1965, 1965-1967, 1967-1968, 1968-1969 (Saigon: Ministry of Education, Republic of Vietnam, 1962, 1964, 1965, 1967, 1968, 1969) p. 84 (1961-62); pp. 51, 84 (1962-64); p. 41 (1964-65); pp. 59, 116 (1965-67); p. 45 (1967-68); p. 45 (1968-69).

Primary level: 2,406,264[52]

Secondary level: 632,221[53]

University level: 46,022[54]

The total is then 3,084,507 versus 18,619 in technical and vocational education.

On the average, then, there is only one student in technical and vocational education for every hundred and sixty-six students in general education. The correspondence was clearly uneven.

Therefore, the urgent need to reorient the national education into technical and vocational field has been claimed many times. Many projects are being undertaken to build more technical schools and train more teachers in these fields. The process has been very slow, due in large part to shortage of budget, of teachers, of administrators, and to societal bias against manual careers.

In 1969, the Regional Center for Educational Innovation and Technology (INNOTECH) was founded as a part of the South East Asian Ministers of Education Organization[55] (SEAMEO).

The purpose of this organization is

> to promote cooperation among the South East Asian nations through Education, Science and Culture, in order to further respect for justice for the rule of law, and for the human rights and fundamental freedoms which are the birthrights of the people of the world.[56]

To accomplish this purpose, a council (SEAMEC), whose members are the ministers of education from the member countries (Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand and Vietnam) with a population of over 200 millions,[57] was established. The council has for its executive arm a secretariat (SEAMES) which is financed half by the member countries and half by the Ford Foundation.[58] The organization was established on February 7, 1968, and came into force only in March, 1969.

The functions of INNOTECH are mainly training and research. It provides key educators who know how to use the systems approach in education and research methodology as well as application of operative educational technology. It also aims at providing prototype solutions to selected educational problems developed by these key educators during their training, "ready for trial, further experimentation and eventually implementation of the national programs."

Besides the Center for Educational Innovation and Technology (INNOTECH) in Vietnam the organization (SEAMEO) has other centers scattered in the member countries:[59]

--the Regional English Language Center (RELC) in Singapore

--the Regional Center of Graduate Training, Research and Post-graduate Study in Tropical Biology (BIOTROP) in Bogor, Indonesia

--the Regional Center for Education in Science and Mathematics (RECSAM)

--the Regional Center for Graduate Study and Research in Agriculture (SEARCA) in the Philippines

--and the Tropical Medicine and Public Health Project (TROPMED) whose office is in Thailand and which gives courses in Bangkok, Manila, Kuala-Lumpur, Djakarta.

It is hoped that not only technical and vocational education in Vietnam will be developed through the SEAMEO activities in the INNOTECH center but also that the entire system of national education will have chances for a tremendous impact by interaction and help of the developing Asian countries and of UNESCO.

4. <u>Distribution of School Population by Sex</u>

It was stated, in the Educational Developments Report 1968-1970, that "so far as education is concerned, there is no sex discrimination at any level."[60] It is true, indeed, that there is not any judgment for educational opportunities based on sex. Moreover, the rules of examination are the same for boy-candidates as well as for girl-candidates.

However, there are schools for girls in Vietnam. In big cities such as Saigon, Huế, Cần-thơ, etc., public high schools for girls separate them from boys of the same age. This isolation of the girls from their male peers in schools has advantages and also disadvantages. Parents prefer to send their daughters to girls' schools, so they do not have to worry about the unwanted problems of boy-friends of their daughters. Traditional education forbids girls to have a boy-friend until they formally get married. Academic records usually are higher and the schools often keep the girls away from problems of drop out by early marriage, unwanted pregnancy, etc.

a) <u>Girls' enrollment in secondary education</u>

The secondary enrollments of school-girls are given separately for the two cycles, and in each cycle, for each of the 3 types of schools: public, semi-public (or semi-private) and private. There are, then, six numbers to be considered each year. Each number is preceded by the total enrollment where it was drawn, and is followed by the percentage of girl-enrollment versus that total enrollment corresponding of the type of school and the educational level considered.

Table 9 gives an idea of the numbers of girls' enrollment versus the total enrollments of the same year, same cycle and same type of school.

In the first cycle, the number of girl students was higher in private schools, but the percentage in public school was higher. The semi-private schools only enroll a relatively small number of girl-students but the percentage was relatively high.

In the second cycle, the percentage was also higher in public schools than in private and semi-private schools of the same year. In 1964-1965 the percentage was 33.0% for public secondary against 30.3% in private and 31.5% in semi-private schools. In 1967-1968, it was 36.9% versus 34.1% and 34.7%.

The same results were drawn from the other years (Table 10). In other words, girls' enrollments have been higher in public than in private secondary education (especially at the second cycle); it was also higher at the first cycle than at the second cycle level. Table 10 summarizes both results.

b) Girls' enrollment in elementary education

In elementary level, girls' enrollment kept increasing

TABLE 9

GIRLS' ENROLLMENT IN GENERAL SECONDARY EDUCATION
PUBLIC AND PRIVATE
FIRST AND SECOND CYCLES

Cycle	Type of school	Total Enrollment	Girls	Percentage
1964-1965:				
	Public	87,959	31,869	36.2
First cycle	Private	147,464	52,763	35.8
	Semi-private	26,809	8,808	32.8
	Public	35,312	11,639	33.0
Second cycle	Private	29,008	8,815	30.3
	Semi-private	2,704	853	31.5
1967-1968:				
	Public	120,949	47,220	39.0
First cycle	Private	236,548	92,796	39.2
	Semi-private	38,546	14,669	38.0
	Public	43,946	16,223	36.9
Second cycle	Private	51,393	17,549	34.1
	Semi-private	5,515	1,566	34.7
1968-1969:				
	Public	141,087	55,898	39.6
First cycle	Private	256,152	101,566	39.6
	Semi-private	41,848	17,360	41.5
	Public	48,198	19,464	40.4
Second cycle	Private	61,613	20,933	34.0
	Semi-private	4,577	1,741	38.0

•This table is compiled from the following sources: Annual Statistique de l'Enseignement, 1964-1965, 1967-1968, 1968-1969 (Saigon: Ministry of Education, Republic of Vietnam, 1965, 1968, 1969), pp. 34, 36, 35, 37 (1964-65); pp. 38, 40, 39, 42, 41 (1967-68); pp. 38, 40, 39, 42, 41 (1968-69).

TABLE 10

PERCENTAGE OF GIRLS' ENROLLMENT IN VIETNAMESE SECONDARY EDUCATION, FIRST AND SECOND CYCLES

Girl enrollment in:	Secondary education	
School year	First cycle	Second cycle
1964-1965	35.7	32.0
1965-1966	37.4	33.6
1966-1967	38.0	34.1
1967-1968	39.1	35.4
1968-1969	42.1	37.2

*The figures in this table are computed from the data listed in the following sources: Annuaire Statistique de l'Enseignement, 1964-1965, 1965-1967, 1967-1968, 1968-1969 (Saigon: Ministry of Education, Republic of Vietnam, 1965, 1967, 1968, 1969), p. 38 (1964-65); pp. 55, 112 (1965-67); p. 43 (1967-68); p. 43 (1968-69).

and the percentage of girls also was higher at elementary than was the percentage at the secondary level. These two main characteristics may be deduced from Table 11 that lists the enrollments of girls and the total enrollment of the year in elementary level, from 1959-1960 to 1967-1968.

First, the rate of increase of girls' enrollment in elementary education was positive, raising from 39.2 to 43.9 from 1959-1960 to 1967-1968. Although the total enrollment has increased, the girls' enrollment has increased much more rapidly than the boys'. In 1959-1960 the number of boys enrolled in elementary level was 741,923 and it increased to 1,134,401 in 1967-1968.

TABLE 11

GIRL STUDENTS IN ELEMENTARY EDUCATION IN VIETNAM

School Year	Total (boys and girls)	Girls	Percentage
1959-1960	1,222,590	480,667	39.2
1960-1961	1,277,808	509,114	39.7
1961-1962	1,357,173	542,757	39.8
1962-1963	1,450,679	593,188	40.8
1963-1964	1,574,679	651,252	41.5
1964-1965	1,563,756	659,632	42.1
1965-1966	1,661,044	717,562	43.0
1966-1967	1,785,840	779,610	43.6
1967-1968	2,023,893	889,492	43.9
1968-1969	2,083,640	927,324	44.5

•This table is compiled from the following sources: Annuaire Statistique de l'Enseignement, 1965-1967, 1967-1968, 1968-1969 (Saigon: Ministry of Education, Republic of Vietnam, 1967, 1968, 1969), pp. 12, 36, 91 (1965-67); p. 20 (1967-68); p. 20 (1968-69).

c) Girls' distribution in school--women population in the society

It is also interesting to make a comparison between the percentage of girl students in the Vietnamese school population and the masculinity ratio in the society of Vietnam.

The sex distribution, estimated for the "Long-term Projection for Education in Vietnam," 1960-1980, assumed for the whole country the following masculinity ratio: 48% for men and 52% for women in 1965; 49% and 51% in 1970. Therefore in 1967-1968 school year it is likely to be, for women, a ratio above 51%.

In the meantime, the percentage of girls enrollment in education, at any level, was far below 51%. Table 10 gives 39.1% girls in the first cycle of secondary, 35.4% in second cycle. The highest percentage of girls was for elementary and equal to 43.9. In higher education, the enrollment of girls was 9,171 against a total of 33,062 in 1967-1968 or equivalent to a percentage of 27.7. In agricultural-technical education, at the same time, there were 474 female students in a total enrollment of 2,349, a ratio of 20.2. In technical and vocational education the ratio was 17.8 (1,917 girls out of 10,783 students enrolled).

The following table summarizes all statistics previously mentioned about the percentage of girls' enrollment in 1967-1968:

Elementary Education:		43.9
Secondary education	first cycle:	39.1
	second cycle:	35.4
Higher education:		27.7
Agricultural education:		20.2
Technical and Vocational:		17.8

The overall view consists of recognizing the decrease of girls' enrollment from elementary through secondary, higher, agricultural to technical and vocational education that was the lowest number. At any level of education, girls' enrollment ratio is far below the women's proportion in the society. The traditional bias, the national customs, the duty of women in the family impose psychological barriers on the way to school of the Vietnamese girls, just like most developing countries.

5. Administration of the Vietnamese Education System

a) Evolution of administrative measures

The main feature of the Vietnamese educational system is its centralization. Thus, after the nation gained its independence in 1954, efforts were made to centralize the administration of the system. The grouping of all parts of the Vietnamese educational system, under the control of the Department of National Education, started in 1957, was completed in 1958-1959.[61]

The major change consisted of the following adjustment: Regional Directorates of Education were abolished and replaced by the Directorate General of Education, located in Saigon. The authorities of the latter extended over all parts of the country, including the central area with 13 provinces, the Highland area with 8 provinces and the South.[62]

The Directorate General of Education then consisted of 2 directorates: one for secondary education, the other for elementary education, and a new division of popular and fundamental education, created in June, 1958. In the same year, two additional divisions were established: the Text-Book Publication Division, April (1958) and the Planning and Statistics Division, June (1958).[63] The latter included three bureaus for research, statistics and documentation and libraries.

To meet the needs of the growing educational system, more and more new directorates, services, and divisions have been created: the Directorate of Fine Arts was established in November, 1959,[64] and the Service of Educational Research, April, 1960.[65] The latter was responsible for studying documentation concerning various education systems, their curricula and teaching methods currently used in other countries, in order to make specific recommendations adaptable to Vietnam.[66] It later became part of the Educational Affairs Service (in the school year 1961-1962, including educational research and scholarship) and recently grew into the Educational Research and Planning Directorate (1967-68).

Similarly, other services grew and became directorates: the Service of Private and Mass Education became a directorate in 1961-62 because of its increasing importance; the Service of Scholarship and Overseas Studies was changed into a directorate in March, 1967.[67]

However, adjustment has also occurred in the reverse direction. The Directorate of Inspection and Examination, as its activities decreased because of the lack of inspectors and the abolishment of some kinds of examination, became the service of Inspection and Examination in 1966-1967.[68]

Reorganization of the Ministry of National Education in 1963-64 divided it into five directorates.[69] They were the directorates of Research, of Higher Education, of Secondary and Primary Education, of Technical and Vocational education and the Directorate of Cultural Affairs transferred from another ministry.

The center for scientific research, including the Vhatrang Institute of Oceanography and the Atomic Energy Agency, was under the responsibility of the Ministry of Education from that time.

Another project of reorganizing the structure of the Central administration was implemented in the school year 1966-1967. Its aim was for a tightening of the co-ordination that would permit a better handling of the growing number of problems facing education.[70] Therefore, steps have been taken in view of a decentralization of educational authority. The Prime Minister has issued a decree for the establishment of School Districts, and studies are being conducted to define the geographical areas.[71]

Furthermore, participation of students' parents is being taken into consideration. Regional Educational Co-ordination and Development Councils in each school district will be established in the near future. These School Boards and Regional Councils will assume the responsibility for educational planning and administration in their own districts.[72] Also a new law (May 2, 1969) established the National Council for Culture and Education as an advisory body for the Government in educational planning and policy.[73]

Educational planning has been especially emphasized due to the help of UNESCO. A two-week workshop in education was organized in Saigon from July 28 to August 9, 1969, with the advice of two UNESCO specialists sent for this purpose. Two staff members of the Directorate of Educational Planning and Legislation were sent abroad to attend UNESCO-sponsored courses in New Delhi and Paris. Another one will be sent to the United States for one year's study in educational planning under Ford Foundation sponsorship. These steps give hope for even more planning to improve Vietnamese education in the future.[74]

b) Structure of the administrative system in Vietnamese education

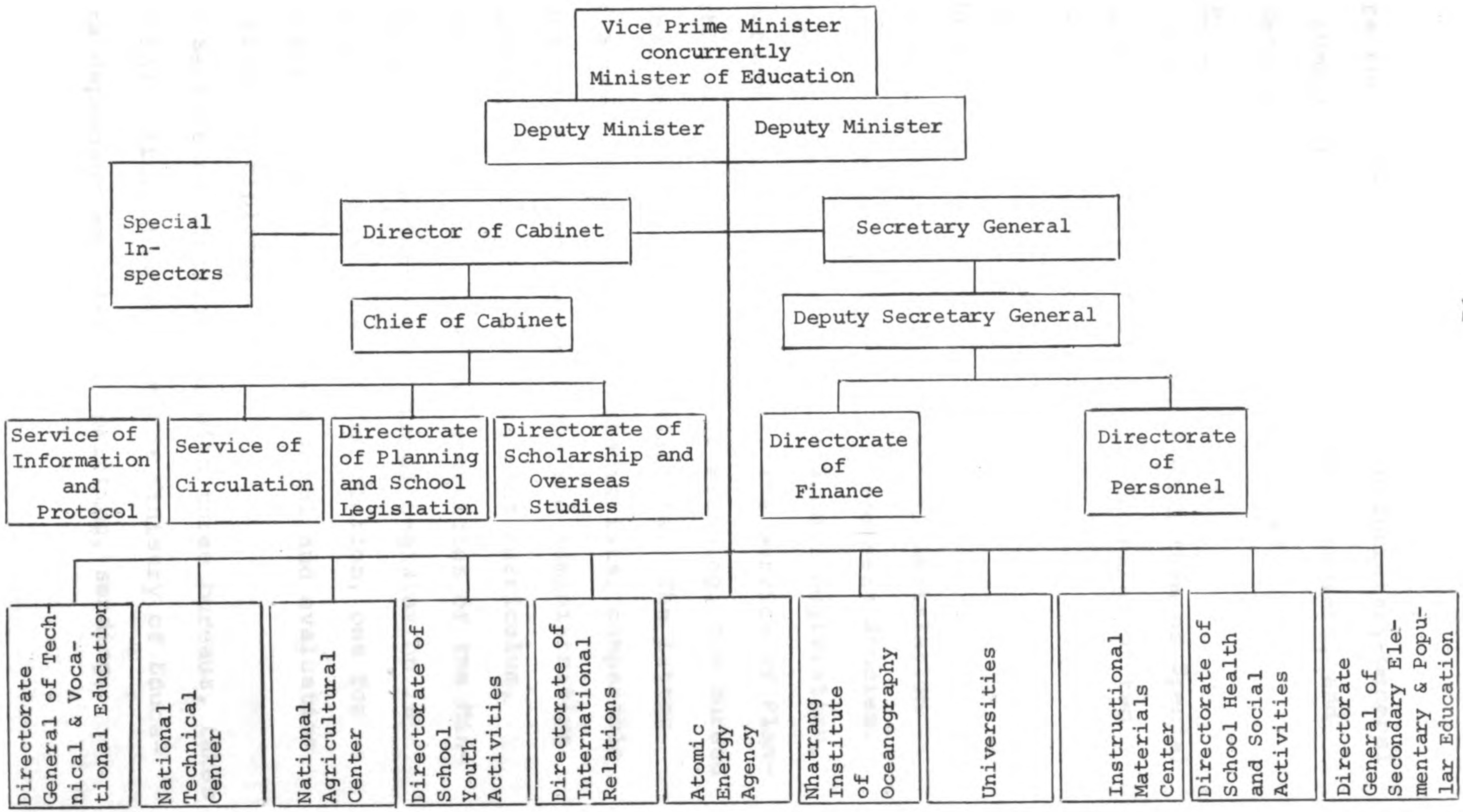
The present organization of the Ministry of Education is the one simplified and shown in the chart (I) issued on January 2, 1970, along with the "arrêté" implementing the organization of central agencies of the Ministry of Education.[75] An examination of the chart gives the reader a general view of those agencies directly placed under the control of the Ministry of National Education.

The Prime Minister, concurrently Minister of Education, is assisted by two Deputy Ministers of Education: one for secondary, elementary and popular education, the other for technical and higher education.

Directly under the authority of the Minister of

CHART IV

ORGANIZATION OF THE MINISTRY OF EDUCATION IN VIETNAM



Education are the director of Cabinet, the Secretary-General and a large number of Heads of directorates, centers, and agencies. Detailed discussion of each follows.

Director of Cabinet

The Director of Cabinet supervises a team of Special Inspectors and a Chief of Cabinet who is in charge of two services and two directorates:

--Service of Information and Protocol

--Service of Circulation

--Directorate of Planning and School Legislation

--Directorate of Scholarship and Overseas Studies.

The Directorate of Planning and School Legislation, recently reorganized, has two services, the Service of Planning with three bureaus: the Bureau of Planning, the Bureau of Statistics, and the Bureau of Specialists. The latter consists of a team of five to seven specialists, comparable to inspectors in educational experience and administrative status, devoted to the study of the current curriculum, the examination system and plans for activities of the Ministry of Education; the Service of School Legislation is composed of three bureaus: one for legislation, one for educational affairs and one for the control and evaluation of various kinds of diplomas.

The Service of Circulation, with three bureaus, takes care of the mail circulation within the Ministry of Education and its dependent agencies, of printing, sending, receiving all kinds of decrees, arrêtés, orders, cooperating with the Ministry of Interior in giving permission to requests for establishing all kinds of associations for educational purposes. It also includes the Bureau of Archives and Libraries which stores all kinds of serial publications and documents, and administers the public libraries of the country.

Secretary General

The Secretary General, assisted by the Deputy Secretary-General, is responsible for the two directorates of vital importance for educational activities. These are the Directorate of Finance and the Directorate of Personnel.

The Directorate of Finance includes three different services: the Accounting Service, the Foreign Aid and the Service of Construction and Materials.

The Directorate of Personnel is divided into two different services: one for the recruitment of new personnel, classification and appointment for the whole range of teachers and staff members of the whole system of education; the other is the Service of Population (of the educational system) and Mobilization (of young men teachers and personnel). The latter Service has the responsibility for the attempt to legally keep young teachers, eligible for military service, or to bring them back into the teaching ranks after a nine-week training period.[76]

Other Operational Units

The group of eleven directorates-general, directorates, centers, institutes, etc., serve as the links between the high authority of the Minister and the activities of establishments in education, including schools and universities.

Some of them appear more cultural than educational, such as the:

--directorate of International Relations

--directorate of School Youth Activities

--directorate of School Health and Social Activities

Some concern with research purposes like the Atomic Energy Agency, the Nha trang Institute of Oceanography.

The Instructional Materials Center, relatively young, grew from the "Textbook, Translation and Publication Service," first created in 1958. From 1963 it included an audio-visual section and a printing plan became "Instructional Material Service"[77] and in 1966 it took the present name with the addition of two new activities: Radio Education and Educational television. Generous support has been provided. The Center has given top priorities to textbook production and in the last few years, there has been emphasis on production of inexpensive "teacher's kits" for elementary schools.[78] Further discussion concerning textbook production will be in the next chapter.

Besides the Instructional Materials Center, there are two other centers: the National Agricultural Center and the Technical Center. The latter is the grouping of four schools of Engineering in Phu tho, a suburb of Saigon.

The structure of the educational system will be discussed in greater detail in subsequent sections.

The Directorate-General of Secondary, Elementary and Popular Education is the largest and its activities are assigned to five different directorates. They are: (1) the Directorate of Private Education, (2) Directorate of Elementary and Popular Education, (3) of Secondary education, (4) of Examination and (5) the Directorate of Pedagogy, In-service training and Adult Education.

The other directorate-general is the Directorate General of Technical and Vocational Education that adds variety to the system of education by its "directorate of Fine Arts and Vocational Studies" and the directorate of Agriculture, Forestry and Animal Husbandry education.

Finally, the Directorate of Universities controls all the universities, both public and private. Although they belong to the Ministry of Education, these universities recently possess the autonomy of administration, finance and curriculum regulations.[79] Each university has its own Board of Trustees for administrative and financial policy determination, and a University council for developing curriculum and setting regulations.[80]

At the present time, there are three public universities, one in Saigon, one in Huế and one in Cầnthơ. The University of Saigon was transferred from Hanoi in 1954, the University of Huế was created in 1957 for the central part of Vietnam and the University of Cầnthơ, was established in 1965 for the Mekong delta of the South. Other universities are private and there are three of them in operation: the University of Dalat built in 1958 by Catholic missionaries; the University of Van Hanh in Saigon run by the Buddhists; and a quite new one in the Mekong delta, the University of Hòa-Hảo of another Buddhist denomination, opened for the school year 1970-1971.

Plans are being made for the construction of more universities and community colleges to meet the demands for professional and higher learning in Vietnam.

FOOTNOTES FOR CHAPTER II

[1]Henri Gourdon, "L'oeuvre Sociale et Intellectuelle," in Un Empire Colonial Francais: l'Indochine, II, ed. by M. Georges Maspero (Paris et Bruxelles: Editions G. Van Oest, 1930), pp. 88-91.

[2]Trần Trong Kim, ViêtNam Su Luoc (Saigon, Vietnam: Tân Viêt, 1958), p. 484.

[3]Jacques Garnier, "La Conquête" in Histoire Populaire des Colonies Francaises: l'Indochine, ed. by Albert De Pouvourville (Paris: Editions du Vélin d'Or, 1932), p. 124.

[4]This term franco-native was used in UNESCO, World Survey of Education, III (New York: International Documents Service, Columbia University Press, 1961), 1454.

[5]Gourdon, op. cit., p. 92.

[6]Direction Générale de l'Instruction Publique, L'Annam Scolaire (Hanoi: Direction Générale de l'Instruction Publique, 1931), p. 92.

[7]Statement attributed to Governor-General Carde of French West Africa by Lord Hailey in his book, An African Survey (London: OUP/RHA, 1945), p. 1263.

[8]Thomas E. Ennis, French Policy and Developments in Indochina (Chicago, Illinois: The University of Chicago Press, 1936), p. 173.

[9]Gourdon, op. cit., p. 92.

[10]UNESCO, World Survey of Education, III (New York: International Documents Service, Columbia University Press, 1961), p. 1454.

[11]M. Poirier, "La Politique d'Education en Indochine," L'Asie Francaise, June, 1913, pp. 265-71.

[12]Ennis, op. cit., p. 174.

[13]Comité de l'Asie Francaise, "L'Enseignement Supérieur en Indochine," L'Asie Francaise, January-April, 1918, pp. 28-30.

[14]Ennis, op. cit., p. 170.

[15]Albert Sarraut, "Les Cinq Pays de l'Union," in Histoire Populaire des Colonies Francaises: l'Indochine, ed. by Albert De Pouvourville (Paris: Editions du Vélin d'Or, 1932), p. 236.

[16]Ibid.

[17]Ennis, op. cit., p. 175. Also, Sarraut, op. cit., p. 236.

[18]Dennis J. Duncanson, Government and Revolution in Vietnam (New York and London: Oxford University Press, 1968), p. 106.

[19]Nghiêm Dang, Vietnam: Politics and Public Administration (Honolulu: East-West Center Press, 1966), p. 358.

[20]UNESCO, World Survey of Education, IV (New York: International Documents Service, Columbia University Press, 1966), p. 1404.

[21]Duncanson, op. cit., p. 106.

[22]Gourdon, op. cit., p. 93.

[23]Joseph Buttinger, The Smaller Dragon: A Political History of Vietnam (New York: Frederick A. Praeger, 1958), p. 443.

[24]Ibid.

[25]See footnote 10, p. 1452.

[26]Ibid.

[27]Buttinger, op. cit., p. 448.

[28]Buttinger, op. cit., p. 442.

[29]Bernard B. Fall, The Two Vietnams: A Political and Military Analysis (2nd rev. ed., New York: Frederick A. Praeger, 1967), p. 127.

[30]Ibid., p. 129.

[31]See chart on page 9 of: Annuaire Statistique de l'Enseignement, 1965-67 (Saigon: Ministry of Education, Republic of Vietnam, 1967), p. 9.

[32]Ibid.

[33]Ibid.

[34] *Ibid*.

[35] *Ibid*.

[36] Vietnam (Republic), Ministry of Education, *Some Features of the University of Saigon, 1917-1971* (Saigon: Ministry of Education, 1970), pp. 1-2.

[37] *Ibid*., p. 3.

[38] Nghiêm Dăng, *Viêtnam: Politics and Public Administration* (Honolulu: East-West Center Press, 1966), p. 337.

[39] Vietnam (Republic), Ministry of Education, *Chuong-Trình Trung-Hoc, 1965* (Secondary Education Curriculum, 1965), p. 6.

[40] Vietnam (Republic), Ministry of Education, *Situation de l'Enseignement au Vietnam, 1969-1970 (2nd trimestre)* (Saigon: Ministry of Education, 1970), p. 2.

[41] Vietnam (Republic), Ministry of Education, *Annuaire Statistique de l'Enseignement, 1968-1969* (Saigon: Ministry of Education, 1969), p. 20.

[42] Vietnam (Republic), Ministry of Education, *Annuaire Statistique de l'Enseignement, 1965-1967* (Saigon: Ministry of Education, 1967), p. 12.

[43] Vietnam (Republic), Ministry of Education, *Annuaire Statistique de l'Enseignement, 1958-1959 and 1959-1960* (Saigon: Ministry of Education, 1960), p. 12.

[44] Vietnam (Republic), Ministry of Education, *Annuaire Statistique de l'Enseignement, 1965-1967* (Saigon: Ministry of Education, 1967), p. 12.

[45] Vietnam (Republic), Ministry of Education, *Situation de l'Enseignement au Vietnam, 1969-1970 (2nd trimestre)* (Saigon: Ministry of Education, 1970), p. 2.

[46] Vietnam (Republic), Ministry of Education, *Annuaire Statistique de l'Enseignement, 1967-1968* (Saigon: Ministry of Education, 1968), p. 18.

[47] *Ibid*., p. 19.

[48] Vietnam (Republic), Ministry of Education, *Situation de l'Enseignement au Vietnam, 1969-1970 (2nd trimestre)* (Saigon: Ministry of Education, 1970), p. 3.

[49]Vietnam (Republic), Ministry of Education, Annuaire Statistique de l'Enseignement, 1965-1967 (Saigon: Ministry of Education, 1967), p. 13.

[50]Vietnam (Republic), Ministry of Education, Annuaire Statistique de l'Enseignement, 1968-1969 (Saigon: Ministry of Education, 1969), p. 45.

[51]Vietnam (Republic), Ministry of Education, Educational Development, 1968-1970 (Saigon: Ministry of Education, 1970), p. 50.

[52]Ibid., p. 48.

[53]Ibid., p. 49.

[54]Ibid., p. 52.

[55]SouthEast Asian Ministers of Education Organization (SEAMEO), Education...the Challenge and Promise of SouthEast Asia (Bangkok, Thailand: SEAMES, c/o Ministry of Education, 1970).

[56]Ibid.

[57]Ibid.

[58]Ibid.

[59]Ibid.

[60]Vietnam (Republic), Ministry of Education, Educational Development, 1968-1970 (Saigon: Ministry of Education, 1970), p. 45.

[61]UNESCO, International Yearbook of Education, Vol. XXI, 1959 (Paris and Geneva: Unesco and International Bureau of Education, 1959), p. 490.

[62]Vietnam (Republic), Ministry of Education, Annuaire Statistique de l'Enseignement, 1965-1967 (Saigon: Ministry of Education, 1967), pp. 107-109.

[63]UNESCO, International Yearbook of Education, Vol. XXI, 1959 (Paris and Geneva: Unesco and International Bureau of Education, 1959), p. 490.

[64]UNESCO, International Yearbook of Education, Vol. XXII, 1960 (Paris and Geneva: Unesco and International Bureau of Education, 1960), p. 456.

[65]*Ibid.*

[66]*Ibid.*

[67]UNESCO, *International Yearbook of Education*, Vol. XXIX, 1967 (Paris and Geneva: Unesco and International Bureau of Education, 1967).

[68]*Ibid.*

[69]UNESCO, *International Yearbook of Education*, Vol. XXVI, 1964 (Paris and Geneva: Unesco and International Bureau of Education, 1964), p. 382.

[70]Vietnam (Republic), Ministry of Education, *Progress of Education in Vietnam During the School Year 1966-1967* (Saigon: Ministry of Education, 1967), p. 10.

[71]Vietnam (Republic), Ministry of Education, *Educational Developments, 1968-1970* (Saigon: Ministry of Education, 1970), p. 32.

[72]*Ibid.*

[73]*Ibid.*

[74]*Ibid.*

[75]See Chart IV.

[76]The nine-week military training period is recently applied for teachers.

[77]Vietnam (Republic), Ministry of Education, *Instructional Materials Center* (Saigon: Ministry of Education, October, 1970).

[78]*Ibid.*, p. 8.

[79]Vietnam (Republic), Ministry of Education, *Educational Developments, 1968-1970* (Saigon: Ministry of Education, 1970), p. 32.

[80]*Ibid.*

CHAPTER III

OBJECTIVES OF SCIENCE EDUCATION IN VIETNAM

The purpose of this chapter is to establish specific objectives for science education in Vietnam at the present time. An examination of the philosophy and goals of Vietnamese education will be made first. Thereafter, a new set of educational goals will be proposed, which best respond to the present needs of the country. Specific objectives of science education in Vietnam can then be derived from those general educational goals just proposed.

Philosophy of Vietnamese Education

The Philosophy of Vietnamese Education reflects the following three fundamental principles:[1]

1) "Education in Vietnam must be humanistic"

A humanistic education must stress the value of the human being, regard man as an end by himself, not as a means, and search for ways to develop man to his full potential.

2) "Education in Vietnam must be nationalistic"

A nationalistic education must respect all traditional values and preserve the valuable ones. It must emphasize the harmony of man with his environment (family, society, country). It must preoccupy itself with the task of collective progress and the prosperity of its people.

3) "Education in Vietnam must be an open education"

An open education must value the scientific attitude as a factor of progress. It must also cultivate the sociability and the democratic spirit of its people. The capacity of understanding other cultures must also be developed.

These three principles constituted the guidelines for the reformed curriculum proposed during the First National Education Congress (July, 1958) whose purpose was to apply those principles into Vietnamese education.

The 1958-1959 school year was marked by the study of these main objectives on Vietnamese education, and the creation of an education system which met these objectives. This year was crucial in shaping up the future of Vietnamese education based on these basic principles; it was said that it "has marked a period of great reform which will guide the prospects of Vietnamese education for many years to come."[2]

Attempts have been made by the Ministry of Education after this important date to bring amelioration for the Vietnamese education system. The National Education Council, composed of 175 representatives from 45 provinces, 228 districts, met for two weeks. They discussed democratic freedom, national discipline, community education, vocational and technical education, teacher training, literacy and adult education, and organization of school system.[3] They also reviewed the three fundamental principles of 1958 and gave recommendations to reaffirm the objectives of Vietnamese Education to be humanistic, nationalistic and scientific. They also emphasized moral, intellectual and physical development as other important aims of education.

General Goals of Vietnamese Education

The four following broad objectives or goals can be confirmed by inspection of the three fundamental principles of Vietnamese education:[4]

1. Education in Vietnam should be concerned with the Development of the Learner, including his use of fundamental tools of learning, his health, his recreation, and his personal conception of life. These purposes of education can be referred to as the objectives of self-realization.

2. Education in Vietnam should be concerned with Home, Family and Community life where immediate, person-to-person contacts of everyday set up and smooth the relationship between members of homes and communities which constitute the basic units of democracy: i.e., objectives of Human Relationship.

3. Education in Vietnam should be concerned with economic demands. This requires from each person a safe career to assure his basic needs: the objectives of economic efficiency.

4. Education in Vietnam should be concerned with civil and social duties that involve his relationship with

his government objectives of civic responsibility.

Set of Specific Educational Objectives for Vietnam

Educational objectives in Vietnam have so far appeared in the form of instructional directives conveyed from the Ministry of Education to the teachers, through the school principals or along with the new curriculum printed materials. Therefore, they have not been studied and stated systematically. Teachers in general have not clearly delineated objectives and have tended to depend heavily on textbooks and government curriculum guides.

It seems reasonable, therefore, to attempt to specify objectives in some details and the following discussion, based on Bloom's taxonomy, is such an attempt. Bloom's three general categories, listed below, form the basis for this rationale:[5]

1) the cognitive objectives, including the objectives of knowledge and intellectual abilities.

2) the affective objectives covering emotion, likes and dislikes, and appreciations.

3) the psychomotor objectives, related to skills and habits, pertinent to physical activities in execution, manipulation and performance.

Analysis of Specific Educational Objectives

The Cognitive Type[6]

The acquisition of knowledge or information has been the basis for most traditional objectives. Thus, one judges the acquisition of knowledge by the degree of retention of facts and ideas. However, this manner of acquiring knowledge is not the only objective sought under the cognitive label. There exists a wide range of cognitive objectives, varying from simple behavior such as recalling facts and ideas to more complex ones such as the ability to combine and synthesize new ideas or materials.

The different cognitive levels are as follows:[7]

1.00. Knowledge

This forms the lowest level of learning involving only recall and memory: recall of specifics (facts, events, symbols, terminology) and also of universals and abstractions in a field (principles and generalizations, theories and structures). Also included in this level is knowledge of ways and means of dealing with specifics (conventions, trends and sequences, classifications and categories, criteria and methodology).

> Knowledge as defined here includes those behaviors and test situations which emphasize the remembering, either by recognition or recall, of ideas, materials, or phenomena. . . . The process of relating and judging is also involved to the extent that the student is expected to answer questions or problems which are posed in a different form, in the test situation than in the original learning situation.[8]

1.10. The first level of knowledge is knowledge of specifics, defined as "the recall of specific and isolable bits of information, . . . by the virtue of their very specificity, that is, they can be isolated as elements or bits which have some meaning and value by themselves."[9]

Specifics can be terminology or specific facts. Examples that follow will illustrate these two kinds of knowledge of specifics concerning terminology and specific facts.

1.11. Knowledge of terminology: the student knows the vocabularies such as atom, element if he is to study the periodic table.

1.12. Knowledge of specific facts: the learner knows that Marie Curie and Pierre Curie codiscovered radium in France in 1898 and later, its use for treatment of disease (cancer).

1.20. The second level of knowledge is knowledge of ways and means of dealing with specifics, defined as "knowledge of the ways of organizing, studying, judging and criticizing ideas and phenomena...ways and means will refer to process rather than products."[10]

This level includes:

1.21. Knowledge of convention--for example, convention about the definitions of the two kinds of electricity: positive and negative.

1.22. Knowledge of trends and sequences--such as the Water Cycle, the Carbon and Energy Cycle in Biology.

1.23. Knowledge of classification and categories. At this level the student can recognize elements in the family of inert gases located in column 0 or 8 of the Periodic Table.

1.24. Knowledge of criteria. The knowledge of criteria by which facts, principles, opinions, and conduct are tested or judged. The utilization of the criteria in the actual problem situations will be found in the evaluation objective.[11]

1.25. Knowledge of methodology: This is defined as "knowledge of inquiry, techniques, and procedures employed in a particular subject field as well as those employed in investigating particular problems and phenomena."[12]

The student knows the method of attack relevant to a problem in Dynamics: first consider forces applied to the moving object, its mass, its orbit, then apply Newton's second law of motion ($F = ma$) to determine its acceleration a; hence, the characteristics of the motion.

1.30. The third and last type of knowledge is the knowledge of the universals and abstractions in a field, including two following objectives:

1.31. Knowledge of principles and generalizations such as the Action-Reaction principle or the Universal Attraction law.

1.32. Knowledge of theories and structures such as theory of Relativity of Einstein, or structure of the atom, its electron configuration.

The higher level of Cognitive Domain is composed of intellectual abilities and skills, ranged from comprehension to Application, Analysis, Synthesis and evaluation.

2.00. Comprehension is the first skill required from the learner. At this level he is able to understand directly the materials learned without relating them to other materials (translation and interpretation). He may also be able to draw inferences by thinking beyond the data (extrapolation). A science student can draw conclusions from a simple demonstration at his class level.

3.00. Application involves the application of abstract ideas to concrete situations. Abstract ideas include concepts, laws, principles or theories underlying phenomena.

A science student, at this level, is able to apply basic principles of science to relate or analyze experiments or scientific phenomena.

4.00. Analysis. This consists of dividing into specific elements and making relationships. The purpose is to uncover the hidden meanings and understand the basic structure.

The science student must distinguish between relevant and extraneous materials in exploring experimental phenomena, or detect unstated assumptions. In studying gravity, Galileo used the inclined plane to demonstrate the uniformly accelerated movement of an object on the earth; the student, in order to understand the process, has to consider the forces influencing the ball.

5.00. Synthesis. This is an operation of putting ideas together to form new or creative ideas not previously stated. Ideas do not need to be related to the particular problem under study. Instead, they may come from different sources in addition to the problem under investigation. Production of a plan or proposed set of operations is included.

Synthesis of new organic compounds in chemistry is an example very often seen.

6.00. Evaluation involves making judgments in the information when conceived in relation to the problem-solving process, or selecting one of the possible processes over all the rest. Judgments can be in terms of internal evidence (subjective) or external criteria (objective).

The Affective Domain[13]

1.0. Receiving (or attending). At this level the individual simply becomes conscious of different aspects of his environment: facts, ideas or processes. He may also assume a more active role by directing his attention to others' communication without being wavered by distracting stimuli.

There are three different levels of receiving, depending on how active the learner is:

1.1. Awareness is the primary stage of receiving where "the learner will merely be conscious of something--he may not be able to verbalize the aspects of the stimulus which cause his awareness."[14]

Consciousness at this level is the lowest level of learning. It is different from the knowledge level in the cognitive domain because the latter requires a high degree of consciousness.

The science student can realize the importance of laboratory work for his science course, but he might not know how to explain that importance to his classmates, nor can he perform an experiment of the series required for that course.

1.2. Willingness to receive. This level is defined as follows: "He (the learner) is willing to take notice of the phenomenon and give it his attention."[15]

Appropriate terms describing his attitude are amenable to, disposed toward, inclined toward, tractable, with respect to, etc. He is ready to sign up for an optional laboratory session to show his willingness to receive instruction from the teacher.

1.3. Controlled or selected attention. "The perception is still without tension or assessment, and the student may not know the technical terms or symbols with which to describe it correctly or precisely to others."[16]

However, he can recognize different periods of the perception.

The science student looks carefully at a demonstration experiment, performed by the instructor, and remembers the successive phases of the experiment.

2.0. Responding. At this level, instead of merely perceiving the phenomenon, the learner shows an interest in it and may reap thereby, a feeling of pleasure or satisfaction which can be expressed by such statement as "reading science lectures for personal pleasure."

There are three subcategories "to illustrate the continuum of responding as the learner becomes more fully committed to the practice or phenomena of the objective."[17]

2.1. Acquiescence in responding. There is the element of compliance or obedience at the first level, of will at the second level and of emotion, pleasure or enjoyment at the third level.

"The student makes the response but he has not fully accepted the necessity for doing so."[18] For example, he tries to solve the physics problem, just because his teacher assigned it for tomorrow's class meeting. He does the work passively.

2.2. Willingness to respond. There is at this level, a "willingness" with its implication of capacity for voluntary activity."[19] By this voluntary basis, the student is able to cooperate with peers in formulating a science project for his class. Without willingness to respond, class discussions cannot be fruitful, even if only to evaluate a science film after viewing it.

2.3. Satisfaction in response. This step goes beyond the voluntary response, and is accompanied by a feeling of satisfaction, an emotional response generally of pleasure, zest or enjoyment. The student enjoys reading about new scientific developments from books he checked out voluntarily from the school library.

3.0. Valuing. Beyond pleasure and satisfaction of responding, the learner tends to accept for himself a belief or to take an attitude reflecting his own criterion of worth.

There exist three levels of valuing, "each representing a stage of deeper internalization."[20]

3.1. Acceptance of a value. This is the lowest level of certainty regarding the "belief" that is still "somewhat tentative . . . , not yet firmly founded."

The desire of the science student for participating in every laboratory session of his class (including the optional ones) reflects his acceptance of the following value: "Laboratory teaching is basic for science education."

He got this belief without any previous experience; he might have got the idea from the teacher, from his book or from friends.

3.2. Preference for a value. This is the intermediate stage between mere belief and commitment to the value previously conceived.

As the student goes on in the course he makes progress, gets more self-confidence in skills of handling laboratory equipment. He then decides to participate actively in the value previously cited; this time more positively.

3.3. Commitment. Then comes the last stage where the belief assumes a high degree of certainty. At this level "the action is the result of an aroused need or drive. There is a real motivation to act out the behavior."[21]

The science student finally develops fully his skills and decides to be a scientist.

At this upper end, he tries to persuade other people--friends, students--of his conviction.

4.0. Organization. At this level, the individual is able to conceptualize a value and then organize a value system, which serves as basis for his decision-making processes.

The child can think that science is good (conceptualization of a value) and is able to answer the questions. "What are the aims of scientists?"[22] (4.2. Organization of a value system).

5.0. Characterization by a value or value complex. Here the learner has integrated his values into a broader and internally consistent system of all traditions and values. He is described as having a well defined philosophy of life.

He can be confident in his ability to succeed.

The Psycho-motor Type of Objectives

These objectives are traditionally known as skills and habits. However, the range of objectives extends far beyond these latter and include the following:

1.0. Observing. The learner at this level may be asked to observe activity or read the directions related to this activity. Thus, the beginning science student may watch his instructor perform a very simple experiment, that he already has read in the laboratory guide.

2.0. Imitating. At this level, the learner imitates the model, which can be his instructor or a picture in his manual. What he could do is follow directions and sequences under close supervision.

3.0. Practicing. By the time the learner has advanced to this level, he has gained for himself a certain sense of sequential order in his act. As the performance is repeated, less effort in performing the act is required from the learner.

4.0. Adapting. This terminal level involves adapting minor details which give "greater perfection" to the acquired skill. This is the process by which a scientist becomes an expert.

There is also in this psychomotor realm a gradation which goes from simple to complex, and which must be taken into account by the instructor in his planning of instructional activity so that grade effectiveness may be obtained.[23]

The three types of objectives--cognitive, affective and psychomotor--are not mutually exclusive; they overlap. However, the attainment of one does not guarantee the attainment of the remaining.

Those specific objectives can be further integrated into a body of broader aims in science education.

1) The first type of aims deals with the content or subject matter of science. Although science facts are indispensable to science teaching, they are not the ultimate aims of science. The ultimate aims of science can be called the understanding of science generalization, i.e., an understanding of generalization which make clear the relationship of a number of facts to the interpretation of a natural phenomenon.

2) The second type of ultimate aims of science teaching includes the development of critical thinking, of problem solving ability involved in the process of "sciencing."

3) The third type of ultimate aims in science teaching is developing ability to apply scientific methods to the solution of everyday problems and the growth of scientific attitudes: raising questions about things that are not understood, the search for valid explanation, the attitude of waiting for more reliable data before elaborating judgments.

Critical Thinking

1) Definition

Among other important aspects of thinking such as associative thinking, concept formation, problem-solving, creative thinking and reflective thinking, critical thinking is necessary for acquiring knowledge and skills. It is defined in the Educator's Encyclopedia as a way to make good judgment.

"Critical thinking may be described as good, unemotional judgment that results from an analysis of the material or a situation."[24]

It is closely related to problem-solving, necessary for problem-solving and can be developed through problem-solving, but it has a broader field of use:

> Closely allied to the scientific attitude, critical thinking can be developed as the result of the problem-solving approach to learning, but it is involved also in a more personal analysis of a situation or of a written or oral presentation.[25]

2) Aspects of Critical Thinking

A complete concept of critical thinking was carefully explained and proposed by Robert Ennis for Research in the Teaching and Evaluation of Critical Thinking Ability in 1962.[26] He listed the different aspects of critical thinking, covering the basic notion of the latter as "the correct assessing of statements." To the various kinds of statements, there correspond twelve aspects of critical thinking as follows:

1. Grasping the meaning of a statement.
2. Judging whether there is ambiguity in a line of reasoning.
3. Judging whether certain statements contradict each other.
4. Judging whether a conclusion follows necessarily.
5. Judging whether a statement is specific enough.
6. Judging whether a statement is actually the application of a certain principle.
7. Judging whether an observation statement is reliable.
8. Judging whether an inductive conclusion is warranted.
9. Judging whether the problem has been identified.
10. Judging whether something is an assumption.
11. Judging whether a definition is adequate.

12. Judging whether a statement made by an alleged authority is acceptable.[27]

From this proposed concept, he distinguished three basic analytical dimensions: a logical dimension, a criterial dimension and a pragmatic dimension.

> The logical dimension, roughly speaking, covers judging alleged relationships between meanings of words and statements. . . . [For this purpose, the thinker has to know] the meaning of basic terms in the field in which the statement under consideration is made.
> The critical dimension covers knowledge of the criteria for judging statements, except for the logical criteria.
> The pragmatic dimension . . . covers the decision as to whether the statement is good enough for the purpose.[28]

An analysis of the aspects of critical thinking showed that items 1, 3, 4, 10 involve only logical dimension, items 7 and 9 involve only criterial dimension; items 5, 6 involve both logical and pragmatic dimensions; the rest (items 2, 8, 11, 12) involve all of the three dimensions.

Problem-Solving

It is defined by Mills and Dean as both a way of thinking and a method of teaching. This is a type of thinking that occurs when the situation presents "a difficulty that cannot be met by other means."

Steps involved in problem-solving are:

a. A difficulty is recognized.
b. The problem is clarified and defined.
c. A search for clues is made.
d. Various suggestions are made and are evaluated and tried out.
e. A suggested solution is accepted or the thinker gives up in defeat.[29]

The problem-solving process differs from the critical thinking because it applies to more specific problems that students try to get the answer.

Science teachers can well apply the problem-solving method, either in demonstration or a class discussion, a field trip, and especially in the laboratory where his students learn the way a scientist does. Brandwein[30] distinguishes between problem-solving of the scientist (concept seeking) and the problem doing of the pupils (concept confirming); although both can have a proper place in the science courses.

FOOTNOTES FOR CHAPTER III

[1]Vietnam (Republic), Ministry of Education, Chương-Trình Trung-Học (Secondary Education Curriculum), (Saigon: Ministry of Education, 1958), pp. 5-6.

[2]UNESCO, International Yearbook of Education, Vol. XXI, 1959 (Paris and Geneva: Unesco and International Bureau of Education, 1959), p. 490.

[3]UNESCO, International Yearbook of Education, Vol. XXVII, 1965 (Paris and Geneva: Unesco and International Bureau of Education, 1965), p. 399.

[4]These objectives are set up according to the three fundamental principles of Vietnamese Education, with additional consideration to the present situation (war time conditions, low economic level, etc.).

[5]Benjamin S. Bloom, ed., Taxonomy of Educational Objectives. Handbook I: Cognitive Domain (New York: Longmans, Green and Co., 1956), p. 7.

[6]Ibid., pp. 8-9.

[7]Ibid., pp. 61-200.

[8]Ibid., p. 62.

[9]Ibid., p. 63.

[10]Ibid., p. 68.

[11]Ibid., p. 72.

[12]Ibid., p. 73.

[13]David R. Krathwohl, Benjamin S. Bloom, and Bertram B. Masia, Taxonomy of Educational Objectives. Handbook II: Affective Domain (New York: David McKay Company, Inc., 1964), pp. 12-14.

[14]Ibid., p. 100.

[15]Ibid., p. 107.

[16]*Ibid.*, p. 112.

[17]*Ibid.*, p. 118.

[18]*Ibid.*, p. 119.

[19]*Ibid.*, p. 124.

[20]*Ibid.*, p. 139.

[21]*Ibid.*, p. 149.

[22]Louis T. Kuslan and A. Harris Stone, *Teaching Children Science: an Inquiry Approach* (Belmont, California: Wadsworth Publishing Company, Inc., 1968), p. 356.

[23]Kenneth H. Hoover, *Learning and Teaching in the Secondary School* (second edition; Boston: Allyn and Bacon, Inc., 1968), pp. 54-55.

[24]Edward W. Smith, Stanley W. Krouse, Jr., and Mark M. Atkinson, *The Educator's Encyclopedia* (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1961), p. 615.

[25]*Ibid.*

[26]Robert H. Ennis, "Concept of Critical Thinking," *Harvard Educational Review*, XXXII, No. 1 (1962), pp. 81-111.

[27]*Ibid.*

[28]*Ibid.*

[29]Lester C. Mills and Peter M. Dean, *Problem-Solving Methods in Science Teaching* (New York: Bureau of Publications, Teachers College, Columbia University, 1960), p. 12.

[30]Paul F. Brandwein, Fletcher Watson, and Paul F. Blackwood, *Teaching High School Science: A Book of Methods* (New York: Harcourt, Brace and Co., 1958), p. 27.

CHAPTER IV

PRINCIPLES AND GUIDELINES FOR THE PREPARATION, SELECTION AND USE OF TEXTBOOKS IN SCIENCE TEACHING

In Vietnam, the shortage of up-to-date science textbooks for the schools is almost as critical as the shortage of teachers. It has been felt at almost all levels--whether elementary, secondary or higher education.

At the university level, there have been some efforts in the production of textbooks, problem books for freshmen and sophomores. However, those efforts are rather modest, limiting themselves to the translation of foreign texts--French or English--into the Vietnamese language.

There has been no attempt to write textbooks adapted to the thinking behavior of Vietnamese students. This is due, first of all, to the lack of specialists and responsible persons in various fields of knowledge. It happened very often in the past that authorities in science were absorbed by the administrative and executive sectors of the educational system. They then no longer devote themselves to the teaching task and, consequently, to the production of materials needed for teaching.

On the other hand, some teachers really want to publish textbooks which might help their peers in their teaching duties. However, they fear that their books will not be very welcome by the public, due to their lack of authority, whether it may be a Ph.D. degree or some other experiences in their subject area. Another big stumbling block is authorization from the Ministry of Education.

Textbook Role in Vietnamese Secondary Schools

Textbooks are a major factor in the formation of Vietnamese school curricula: in the majority of Vietnamese schools today, the textbook is the curriculum in many classrooms.

Most Vietnamese teachers nowadays still consider the textbook as a necessary companion in their teaching work, regardless of whether they use them alone or supplement them with monographs, pamphlets or magazines. Foreign textbooks--French or English--are considered as cherished treasures.

Another aspect of this importance can be seen in the sending of personnel of the Instructional Material Center to Japan to be trained for Book Publication in a special eighty-day course, sponsored by UNESCO.[1]

In summary, for a long time to come the influence of textbooks will remain--as it is now and as it has been in the past--powerful and will be welcome by the public in Vietnam at large, particularly by Vietnamese teachers in their daily work.

Arguments in Favor of the Use of Textbooks in Vietnamese Secondary Schools

Teachers and laymen who agree on the necessity of using textbooks in Vietnamese schools present their arguments as follows:

1) Economic Reasons

Vietnam is a developing country. Most of the children who go to schools come from poor and rural areas where the only learning resource available for them is the pupil's textbook. To enrich their studies and readings, the children have practically nothing: no periodicals, no supplementary texts, no radio or television! Also there is a lack of libraries in some communities.

2) Usefulness of Textbooks for the Learner

The main advantages provided to the pupil by the use of textbooks are as follows:

a. Textbooks are organized in learning sequences, sometimes in order of increasing difficulty of the subject. This is not necessarily true with supplementary texts and materials a teacher may use in his teaching.

b. Textbooks allow students to study at their own pace, which is determined by their intellectual abilities or interest. They enable them to repeat their studies as many times as they want, at convenient moments. This individualism of instruction offered by textbooks is particularly adequate with textbooks in programmed form, which are not available in Vietnam yet.

c. The textbook may be considered by the student as an "assistant teacher in printed form." It may be used as a teaching device, regarding teacher's instruction in class, whether his equation and formulas written on the blackboard are correct: the teacher sometimes may make mistakes by wrong memorizing!

The textbook also offers a rich source of learning experience that the teacher could not provide himself, due to time limitations. Abundant illustrations in the book--color flat pictures, charts, diagrams--enhance learning and add pleasure to it.

3) <u>Usefulness of Textbooks for the Teacher</u>

Teachers who use textbooks in their classroom generally found that:

a. Textbooks give to the teacher a sense of security and self-confidence. This is particularly true for the inexperienced teacher who is just beginning his career.

b. Textbooks are considered as practical means to improve teacher's skills in handling various instruction problems, through rich suggestions in teacher's manuals, prepared by experienced teachers or experts.

<u>Arguments Against the Use of Textbooks</u>

On the other hand, the arguments criticizing the use of textbooks are not lacking. They are:

1. Textbooks become outdated as soon as they come off the press. This problem is more serious for some fields than for others. Financial reasons are a major cause for the delay of textbook revision.

2. There are wide disagreements among textbook authors regarding the content of the book, the goals and objectives to be achieved. Also, textbook writers show neglect in following recommendations of national committees regarding changes to be made in textbook content and presentation.

3. The presentation of information as it has been done so far in narrative form in textbooks does not invite students to use their thinking creatively, to discover truth by themselves, by their own efforts. Then, reading becomes for students an act of "remembering" rather than a process of using data from the book to solve problems. This "artificial linearity"[2] characteristic of most printed materials today can also be said about textbook presentation.

4. The teacher, by relying too much on the book, limits his own growth of creative teaching, i.e., of finding more than one alternative to solve certain problems or to teach difficult concepts and principles.

5. Textbooks are unable to handle controversial issues and topics that periodicals can do very well.

Conclusion: One can learn a great deal from both of these types of arguments. They may help in the differentiation between good and bad textbooks.

In summary, there are no reasons why one should not use textbooks in teaching, providing they are accurate and well written, and used along with other instructional materials. And, if all books are used wisely to meet group and individual needs of pupils, they are good and effective tools. For Vietnamese schools, textbooks are not likely to disappear for at least some time.

Guiding Principles for Science Textbook Writing

1) Necessity of Textbook Guidance Committee

The preparation or writing of textbooks for science teaching and learning in Vietnam should be placed under the supervision of committees, each committee being in charge of one area of science: biology, physics or chemistry. Textbook authors should comply to the rules and guidelines set up by their respective committees so that there is some uniformity in the work of many individuals: uniformity in the terminology and in the notations or symbols used, uniformity in the style and organization of content.

2) Suitability of Objectives

Books which are newly prepared should present facts and principles of science in such a way that the objectives of science education in Vietnam could be met. For instance, if we agree that one of the general goals of science teaching is to teach understanding of generalizations (knowledge of universals and abstractions) we should not organize our textbooks in the traditional way, the "encyclopedic" way with a large number of scattered and fragmented topics, without any liaison between each other. Instead we should try to relate one topic with another, make comparisons between them, combine various topics into a short number of well developed units of instruction. The following example illustrates the idea discussed:

> There are many incidents in which one animal may be observed eating some form of plants. There are many incidents in which one specific animal may be observed eating or otherwise using another animal to maintain itself. One may read that green plants use carbon dioxide in manufacturing food. Furthermore, one may read or observe through indirect means that human beings give off carbon dioxide as a waste product.
>
> Each of these may be considered a fact of science and possibly an interesting fact. But these facts individually have little meaning or significance in understanding the environment, or in solving problems related to the use of our biotic resources.
>
> On the other hand, they can have meaning when, through guided learning experiences, they are related to an important generalization of Biology: Living things are interdependent. This generalization in turn has significance when it is applied with understanding in making decisions regarding such questions as: should we kill off the hawks in our community?[3]

3) Incorporation of Critical Thinking

A good writer also leaves room for critical thinking and discovery of scientific principles by the students themselves. He should also induce trying several approaches to a given problem which may be different from the one proposed by the teacher. Thus, "textbook writers are including many aids to learning such as student activities which will provide that element of 'discovery' for the student rather than 'tell all' before the student has a chance to find out for himself."[4]

4) Inductive Approach to Science

Inductive teaching in science uses particular or actual cases to develop concepts and principles. Whenever the development of an understanding of a principle or a concept is the main objective of a lesson, the inductive method should be used. Science textbooks should provide illustrations to this approach in science teaching. For instance, the effective way to teach students the simple lever principle is starting with the observation "in moving an object with a lever, the farther away from the fulcrum the force is exerted, the less the force needs to be."[5] Photographs or pictures in the book should help the students correctly perform the experiments.

Guiding Principles for the Selection and Use of Textbooks in Science Teaching

Recommendations regarding the selection and use of textbooks should be based upon research done on textual materials in general. Some of these research findings are:[6]

1) More learning is obtained if more than one medium is used: textbooks with lecture, textbooks with slides or pamphlets, etc.

2) However, real supplementation should be insured

through such coordinated use. No gains could be achieved if the added medium does not give the added interpretation.

3) Virtually no experimental research has been done on how students read and understand different forms of written reasoning or exposition. Some evidence, however, points out the fact that a writing style in which examples or particular cases are subordinated to general explanatory principles developed in the text, bring out more meaning and appeal to the students than a style in which examples and principles have the same emphasis.

4) The use of color results in gains of attention and interest, but there is no evidence that greater learning is obtained inevitably when color itself is not integral to concepts or principles to be learned.

5) A relationship exists between the redundance of textbook language and the extent to which it will be remembered. Repetition seems to be beneficial to comprehension but the most appropriate amounts and kinds of such repetition for different instructional purposes are still unknown.

These research findings are helpful in establishing a set of guidelines for the selection of science textbooks for use in secondary schools.

1. <u>Content</u>

Science textbooks that are chosen should be in line with the goals and objectives of science teaching in Vietnam. The most important factor is in the undertaking of the content analysis of any science textbook by the teacher. Also the specific objectives for the teaching of the course must be taken into account in this analysis.

Other factors worth considering in the evaluation of textbook contents include the following:

a) The content should be suitable to the students' maturity and their past experiences in science.

b) The content should meet students' needs and interests.

c) The statements in the textbooks must be accurate.

2. Readability

The teacher must also pay attention to the readability of the books used. A standard literary style for science textbooks should have these characteristics:

a) The length of sentences as well as the number of ideas per sentence must be well balanced. Long sentences should be avoided.

b) Irrelevant thought should be absent.

c) There should be a continuity of thought throughout a given topic by the use of connection sentences between paragraphs.

Readability depends also on vocabulary itself.

The excessive use of technical terms as well as non-technical ones in science textbooks reduces the students' interest in reading science, since their trends of thought are likely to be interrupted by frequent consultations of the dictionary.

3. Illustrations

Illustrations in science textbooks should have eye appeal. Shading techniques should be appropriately used to enhance the attractiveness of illustrations. These techniques can adequately serve the purpose of using color in illustrations which is not widely used in Vietnam, due to the high cost.

Ratings of illustrations in science textbooks should not be made solely on their attractiveness alone. Other factors should also be considered, e.g., the extent to which illustrations are related to the topic of interest. Illustrations should be placed in proximity to the worded part of the topic with captions closely related to the surrounding paragraphs.

4. Detailed Indexes and Tables of Content should be preferred to succinct ones. A glossary may be useful in providing a quick reference to important concepts learned.

5. Physical Appearance

The physical appearance of a science textbook should not be neglected. An attractive cover design and a well proportioned size--neither too thick nor too thin--imparts to the book an attractive overall appearance.

The ease and pleasure with which the text is read depends largely on the size and legibility of type used. The type used should be sharp and big enough for a person with normal eyes. Legibility is further enhanced by providing ample spaces between lines.

Relatively low importance factors in selecting a textbook are:

(1) Not all well-known science educators are necessarily good writers. Therefore, the educational rank and prestige of the author should not be considered as important factors in determining the quality of a science textbook.

(2) There are some other factors which should not be considered as good criteria for selecting textbooks:[7]

a. The widely used textbook can meet the needs of students in many schools, but may not serve well in some other particular schools. Thus, wide use of a text does not necessarily guarantee its usefulness in every particular situation.

b. The cost of a textbook should be carefully studied. An apparently expensive textbook which can be used for several years actually costs less than a cheap textbook which has to be thrown away after a short period of use, due to its poor academic value.

Methods of Evaluating Textbooks

Various methods of evaluating textbooks employ score cards or rating sheets. A score card consists of a list of major items considered important for the evaluation. The importance of each item, relative to all others, is established by the number of maximum points given to it.

An example of a score card for evaluation of textbooks was provided by Hunter.[8]

1.	Educational rank of author	50
2.	Mechanical make-up and cost	100
3.	Psychological soundness	300
4.	Subject matter	250
5.	Literary style	110
6.	Learning exercises	140
7.	Teacher's help	50
		1000

The rating of textbooks is based upon this list; the total score obtained for a particular textbook may then be compared to that of other books.

Another evaluation method, the "Vogel's spot check method,"[9] also uses a score card, in which each item has been assigned a maximum value of two points.

The main purpose of score cards or rating sheets is to make the selection of textbooks as objective as possible. To be meaningful score cards or rating sheets should be developed by a textbook selection committee (at the regional level) composed of educators from various types of schools in the region. Although each region will have its own method of selecting science textbooks, the following points are worth keeping in mind:

1. Have a written form stating policies and procedures for selecting textbook materials.
2. Establish criteria based upon the course of study.
3. Select a representative committee to participate in the study.
4. Have as many titles as are available from which to make a selection.
5. Obtain reactions from as many people as seem appropriate such as pupils, teachers, librarians, principals, and in some cases, qualified laymen.

6. Be objective in making the selection. Use a rating sheet.
7. Introduce new materials to the teachers through a planned in-service training program.[10]

Teaching with Science Textbooks

Science teachers should be flexible in using textbooks. They should adapt them to the particular group of students and the specific classroom situation. Thus, the sequence of presentation may be modified. They may, for instance, start out by lessons on Newton's laws rather than tedious introductions to units of measurement.

Another aspect of adaptation consists of omitting content which does not suit the purpose of the lesson or the comprehension level of most of the students in the class.

To make textbook learning more meaningful, more "real and alive," science teachers should provide various supplementary instructional materials along with textbooks. For example, seeing films or slides, using models and mock-ups, organizing science exhibits and displays, visiting industrial plants, may help in making more meaningful what students read in textbooks. Readings are most beneficial when they are used as follow-up activities to real life or audio-visual learning experiences.

Science teachers should also place stress upon the importance of visual contents--charts, diagrams, flat pictures--in facilitating comprehension and learning of the verbal parts in science textbooks. They should help students read and interpret these visual contents which constitute valuable resources for classroom teaching.

read and interpret these visual contents which constitute valuable resources for classroom teaching.

FOOTNOTES FOR CHAPTER IV

[1]Vietnam (Republic), Ministry of Education, Report, 1970 UNESCO In-Service Training for Book Publication in Asia, Sep. 11 - Dec. 1, 1970 (Saigon, Vietnam: Ministry of Education, 1970).

[2]Marshall McLuhan, Understanding Media: The Extensions of Man (2nd ed., New York: New American Library, 1964), pp. vii-xi.

[3]J. Darrell Barnard, Teaching High-School Science, What Research Says to the Teacher, No. 10 (Washington, D.C.: National Education Association, Association of Classroom Teachers, 1956), p. 7.

[4]Archie M. Owen, "Selecting Science Textbooks," The Science Teacher, XXIX (November, 1962), 21.

[5]Nelson B. Henry, ed., Science Education in American Schools, Forty-sixth Yearbook of the National Society for the Study of Education, Part I (Chicago: The University of Chicago Press, 1947), p. 49.

[6]Wilbur Schramm, "The Publishing Process," in Text Materials in Modern Education, ed. by Lee J. Cronbach (Urbana, Illinois: University of Illinois, 1955), pp. 145-55.

[7]Guy Montrose Whipple, ed., The Textbook in American Education, Thirtieth Yearbook of the National Society for the Study of Education, Part II (Bloomington, Illinois: Public School Publishing Company, 1931), pp. 306-307.

[8]George W. Hunter, Science Teaching at Junior and Senior High School Level (New York: American Book Co., 1934), pp. 252-55.

[9]Louis F. Vogel, "A Spot-check Evaluation Scale for High-School Science Textbooks," The Science Teacher, XVIII (March, 1951), 70-72.

[10]Owen, op. cit., 23.

CHAPTER V

IMPROVING SCIENCE TEACHING THROUGH DEMONSTRATION AND LABORATORY WORK

Introduction

The most widely used method of science teaching in Vietnam is lecturing. With a textbook and a chalk board, the secondary school science teacher tries to transmit his knowledge of the day's lesson to his students. He also makes detailed plans to cover the whole program of his subject by the end of the academic year.

Science teachers sometimes use demonstrations along with their lectures whenever conditions permit. They may set up laboratory sessions for their students of tenth grade once in a while. Scarcity in demonstration and laboratory work is due to the various following reasons: lack of laboratory facilities and scientific equipment, lack of adequately trained science teachers in laboratory teaching, serious pressure of the national examinations on students' and teachers' activities, too large class size, etc.

1) Lack of Laboratory Facilities and Scientific Equipment

In large cities in Vietnam, each public secondary school--of two or three thousand students--has only one laboratory, a small and all-purpose laboratory for all science subjects. There is neither darkroom for optical work, nor workshop where equipment can be made or repaired. Most of the laboratories do not have fume-hoods for chemical experiments producing poisonous gases.

Basic services such as water, gas, and electricity are not always available. Some school districts do not provide clear, pure water all the time due to erosion of the pipes or their disconnection. Electricity supply is even in worse condition. During the last five years, there has been partial power shortage in Saigon and not any school has its own generator to provide electricity. Some schools cannot afford to buy gas tanks for burners and teachers have to use alcohol lamps that usually cannot give high temperature for some experiments.

Scientific equipment is limited and sometimes not appropriate for any science course. Chemicals needed by science teachers for classroom demonstrations usually cannot be bought on time because of the lack of funds from a restricted budget of the school itself.

Preservation and maintenance of scientific equipment gives rise to much difficulty due to the high humidity in the atmosphere, especially during the rainy season. For example, science teachers fail in performing demonstration experiments in electrostatics quite often because the pith balls have captured too much moisture and become heavy conductors.

Deterioration of apparatus which has not been especially constructed for the tropical climate of Vietnam cannot be prevented or stopped despite the various precautions taken by science teachers and laboratory assistants.

There is also a general lack of well-trained laboratory assistants. Only a few of laboratory assistants are former science teachers of first cycle classes, and most of them keep the position very loosely and temporarily. Therefore, in some cases science teachers themselves are responsible for the supervision of the laboratories; they make arrangements and set up equipment for their own demonstrations and students' laboratory work, without receiving much help from the laboratory assistants.

2) Lack of Well-Trained Science Teachers

All science teachers in Vietnam are fully aware of the need of using experiments in their teaching. They surely agree that:

"Science is not 'chalk talk'; it is experience in search for meaning. . . .

"The fruits of science are developed in the deed. Brain and muscle, mind and hand are in constant collaboration."[1]

However, not many of them are well trained in laboratory work. Those who graduated from the Faculty of Pedagogy (College of Education) were taught in the traditional way of viewing science as content rather than as process.

This is reflected in their way of handling of demonstrations and experiments in class. They expect the students "to accept the idea because the demonstration is proving it or because it is in the textbook."[2] For occasional laboratory sessions, they expect the students to proceed by following a "cookbook type of laboratory manual"[3] and fill out the blanks.

Today's scientists and science educators give greater attention to the understanding of science as a process. Teaching science as inquiry, for discovery, by using critical thinking and problem solving process, etc., are the main features of science teaching. Therefore, prospective teachers need to be well-prepared, in-service science teachers need to be trained quite often in order for them to overcome difficult situations and to acquire effective teaching practices.

3) Pressure of the National Examinations on Teachers' and Students' Activities

The teaching in secondary schools in Vietnam is too much directed toward the national examinations. Success of students in these examinations determines the performance of their teachers. This way of evaluation is indeed inappropriate and challenges the teachers to prepare their students for the kind of test students will take in the examinations rather than for students' own growth in thinking and creativity.

Therefore, to cover the whole science program by the end of the academic year is the main concern of science teachers of grades eleven and twelve. National science syllabuses for these grades are loaded, especially with physics and biology, hence, require a great part of the class time to be covered. Furthermore, only specific facts and principles will be tested in the examination, in the form of essay questions; only what is in the textbook will be needed for students. Laboratory skills apparently are not required to pass the Baccalaureate I and Baccalaureate II and to get out of high school.

For these reasons, laboratory work is not as necessary as practicing physics problem-doing and reviewing the whole textbook a number of times before the examinations come.

As long as the national examination system in Vietnam remains, it is difficult to reorient the science courses from the examination-directed nature into the laboratory-oriented goal which must be the immediate objective that "leads students to modify their behavior to face problems in a scientific manner, not only in laboratory but in life situation as well."[4]

4) Too Large Class Size

Class size in Vietnamese secondary schools is too large. With an average of 58 students[5] in one classroom the science teacher can give lectures, but can hardly show demonstrations (visibility problem for students) and it is almost impossible to set up and guide laboratory sessions for the whole class at the same time.

Laboratories in secondary schools in Vietnam are actually built to provide facilities for an average of thirty-pupil groups. One teacher alone--no matter how good he is--can hardly supervise experiments for individuals of the whole class.

Possible solutions can be the following: divide the class, randomly--so that there will be no students' complaint--into two groups (25 to 30 students) and set up two separate laboratory sessions for them. Two ways can be used for scheduling:

a. Laboratory session during class hours: one group having laboratory work while the other takes the test of control (quiz) and then reads or does its homework, and vice-versa. However, the problem of discipline (order) bothers the administrator staff (principal, his assistants, etc.) and possibly other classroom teachers in the class neighborhood.

b. Laboratory session out of class hours: this would be on Sundays, if the teacher did not intend to occupy these place of the other shift classes in the laboratory.[6] This solution creates problemsof extra work for teacher and students and also requires parents' permission.

Therefore, science teachers gradually give up the idea of organizing laboratory work for individual students, the idea they conceive as the most interesting and creative before they actually confront reality in getting the first teaching job.

The Demonstration Method

In planning to teach a lesson of a particular unit, the science teacher usually checks the availability of apparatus or chemicals, instruments needed for the experiments that can be given as demonstrations for the lesson.

The demonstration method is preferred by some science teachers because "it is accepted by science teachers as an effective and economical means of helping students to visualize, memorize and understand specific kinds of specific information."[7]

Furthermore, a demonstration can also be given inductively by the instructor who asks several questions to stress inquiry. It involves thinking and motivation of the students and gives the teacher "immediate feedback" from their answers.[8]

Despite its many advantages, the demonstration method has its own limitations. In order to successfully apply this method, one has to be fully aware of its functions, advantages and limitations. Criteria for good demonstrations and the different ways to present a demonstration should be considered when one plans and makes the presentation of the demonstration.

1) Functions of the Demonstration Method

The demonstration has many possible functions; six of them are the following:

a. To set a problem. A demonstration can be presented without previous discussion to initiate a new unit. The traditional "water to wine" trick is shown to introduce the study of chemical coloring indicators for acid and base solutions: the water, containing a little phenolphtalein from a bottle, when poured into a drinking glass having traces of sodium hydroxide, becomes bright pink.[9] In the interest and surprise of the students, the teacher can, then, begin his lecture successfully.

b. To solve a problem. Discussion or reading in science sometimes results in common problems of general interest. At the request of the students, the teacher can arrange and show a demonstration that gives a satisfactory answer to the problem.

c. To illustrate a point. This is the most common use of the demonstration. For example, during an eclipse, the teacher can arrange to demonstrate the relative position of the sun-moon-earth system to illustrate the phenomenon.[10]

d. To show method and techniques. In the teaching of acid-base titrations, demonstration of the method based on Le Chatelier's principle of the reaction:[11]

$$OH^- (aq) + H^+ (aq) \rightarrow H_2O$$

as well as the technique of using the burette is necessary for the whole lesson.

e. To verify, to substantiate and to review. A demonstration to show that, in the absence of sunlight, no starch is formed on the leaf,[12] can be performed by testing starch with iodine in a leaf partly covered with a piece of cord or black card.

f. To evaluate student achievement. This can be done when a student is designated by the teacher to interpret a new demonstration of a familiar principle, or to justify the application of a general scientific law to particular cases.

Students can explain the principle of a kaleidoscope after they have lessons about light reflection and the image of an object given by a plane mirror. Also, when they thoroughly understand the principle of a kaleidoscope with three angles, students can explain one with five, six or more angles.

2) Advantages of the Demonstration Method

Advantages of demonstrations are various; major ones include the following:

a. Direction of class thinking by the teacher. A demonstration guides the thinking of all the students into approximately the same channel. The whole class follows the teacher's activity in raising the problem, performing steps of the demonstration, collecting data, proposing solutions, testing them and drawing final conclusions. All the pupils may gain approximately the same understanding.

In teaching "composition of water," the teacher first shows the demonstration on electrolysis of water.[13] He starts by setting up the necessary apparatus, filling up the tubes with a dilute solution of sodium sulfate; then he sets up the circuit, starts the current, watches the bubbles coming up and waits for a while. When the amounts of gases collected are sufficient, he cuts the current, reads their volumes, identifies them by combustion tests. Then comes interpretations where conclusions are drawn and the reaction written.

The next demonstration would be combining hydrogen and oxygen, and then a series of experiments similar to the second one using different simple ratios of the combining volumes. The students follow the teacher through all these steps and gain the knowledge he wants them to get.

b. Economy of materials. A demonstration is economical in materials. Equipment and materials are needed only for setting up one experiment. When the school cannot afford to buy materials for the whole class laboratory session, the demonstration is used instead.

Expensive materials such as a silver or a platinum coil to be used as catalyst in the oxidation of ethanol cannot be provided for each student, then the teacher shows the demonstration to the class; only one coil is needed.

c. Economy of teacher time and energy. A demonstration can be economical in teacher time and energy. It is faster and easier for the teacher to prepare materials for one demonstration than for sixty duplicate experiments or even for thirty (in case he can afford to give two laboratory sessions to the halves of the class).

d. Economy in class time. A demonstration may be economical in class time because the teacher, being more experienced than the students, can perform the demonstration experiment more satisfactorily and more quickly than students.

This is particularly applicable to the situation of classes that are going to have the national examinations at the end of the year. It helps to save the class time, which is very limited for the coverage of the academic program.

e. Students' safety. The demonstration allows the teacher to carry out experiments that would be too dangerous for students to perform by themselves, even under teacher's supervision. For example, in the case of experiments involving inductive coil of high voltage or those using too strong chemicals such as the sodium that decomposes water.

3) Limitations of the Demonstration Method

Although demonstrations have many advantages previously discussed, teachers should realize their numerous limitations to avoid possible failures in teaching with the demonstration method.

a. Visibility. This is an important problem teachers have to be aware of. Class size in Vietnam is too large and teachers do not have "giant size" test tubes or big balloons, etc., to make all details of the experiment visible for students in the back rows. Audio-visual materials such as the overhead projectors, which can help to solve this problem, are unfortunately not available in Vietnamese high schools at the present time.

Furthermore, the color of the background of the experiment setting should be in contrast to the color of the materials and liquid or vapor in operation. Teachers usually forget this detail that is indeed more important than most of them realize.

b. Students have little opportunity to get acquainted with the materials.[14] In order to be confident in what they learn from an experiment, the students need to see clearly every part of the equipment, to touch it, to work with it. In a demonstration experiment most of the students sit far away from the desk; they could not even take a close look at the materials, hence, they are not likely to be enthusiastic about what is going on.

For example, in the demonstration "electrolysis of water," students need to be familiar with the tiny silver electrodes by looking closely at them. Then, they can realize the importance of the electrode presence in the electrolysis process.

c. Results can be collected not only by observation. Odors (alcohol, vinegar, etc.), textures, forces should be assured by students themselves, but they usually could not for the same reason with the previous limitation.

d. A demonstration happens at a rapid pace that not all of the students can follow the steps and can have time to raise questions. Reactions in inorganic chemistry are usually rapid and it is hard to get the attention of all the students at the same time; for example, at the instant where the change of color occurs in the titration of an acid solution demonstration.

e. During the demonstration, most of the students remain inactive.[15] They only have interest in work they can involve in; and attention cannot be held long if there is no interest. A demonstration that happens too long without students' involvement (in any way) is subject to class distraction.

A failure in the teacher's demonstration is usually accompanied by a loss of confidence in the students if he does not know how to handle the situation.

4) Criteria for Good Demonstrations

The previous discussion about advantages and limitations of the demonstration method enables us to set up criteria for good demonstrations. Among the principal criteria are the following:[16]

a. Trying out in advance. It is suggested that the teacher try out the demonstration in advance. He should be certain that the necessary apparatus and supplies are available. In going through the techniques of planning and in trying out the demonstration at least one time, he will be able to realize some possible and unexpected problems he might confront.

Even if he will let the student perform the demonstration, he also has to try it out, so that he will be in better position to guide the students in case some problems develop that do not permit a successful demonstration.[17]

b. Clear purpose. The purpose of the demonstration should be clear either at the beginning or during the presentation. The techniques of presenting a demonstration are indeed very important in the way the teacher directs and guides the thinking of students in the class.

c. Visibility. The demonstration should be visible to everyone in the room. Attention should be given to the size and clarity of the apparatus when the planning process takes place; a large class needs large scale apparatus. An overhead projector can serve well to solve this problem in some cases.

Lighting is also an important factor: well-lighted apparatus captures more students' attention and permits clarity of the results obtained.

d. Simple apparatus. Apparatus used should be as simple as possible. Complex apparatus either attracts too much attention of students or discourages understanding its function.

In case the teacher has to use a complex machine, such as the oscilloscope, to record the form of various sounds, the teacher should limit the curiosity of the students who try to understand the principle of the machine. Since the latter is not the object of the lesson, it should not be thoroughly discussed in class at that time.

e. Along with other methods. The demonstration should be used along with other teaching methods such as lecture, discussion, field trip, etc., whenever appropriate, in order to fully develop the science teaching objectives.

5) Planning and Presenting a Demonstration

Techniques of planning and presenting a demonstration are necessary in order to meet the criteria for a good demonstration.

a. Planning techniques. Different and successive steps must be taken in planning an efficient and effective demonstration:

1. List concepts and principles one wishes to teach by the demonstration, then set up a design for the experiment.

2. Break the concepts that are too complex into simple ones.

3. Select sources of reference, either in textbooks, demonstration books, or suggestions in magazines, foreign books or other printed sources.

4. Gather necessary equipment.

5. Try out demonstration once or many times until results are satisfactory.

6. Outline questions to ask students during the steps of the demonstration.

7. Consider the audio-visual materials that may be employed.

8. Consider the time spent for the demonstration, the average time needed. Adjustment will be made during the time it is presented, according to the students' reaction and the success of the demonstration.

b. Presenting a demonstration. The success of a demonstration depends on how the demonstration is presented. The teacher should keep in mind the following hints if he wants to make the demonstration method an effective teaching device:

1. Never give too much information about the demonstration, but rather ask careful questions to provoke pupils' thinking.

2. Focus attention of pupils on the demonstration by introducing the items needed one at a time. First put them in a tray at one end of the table, and take out as soon as they are introduced. If the apparatus must be assembled beforehand, the teacher should cover it and unveil gradually as its parts are introduced.

In a demonstration of "How is water purified?" the water is purified by evaporation and condensation of its vapor. The equipment takes time to be set up. The teacher can introduce the assembled apparatus by unveiling three different parts: evaporating device, condensing device with a cold water stream and pure water in a collecting device.

3. Pacing the demonstration according to the audience speed of comprehension to get maximum effectiveness. Usually a demonstration is in a short time but occasionally it is good to extend a certain length of time for students' interest or relaxation, or for formulating an answer.

4. Use the chalk board to describe the purpose of the demonstration, to collect data, to infer conclusions. A beginning teacher often fails to realize or even to consider how the chalk board can complement the learning activity.[18]

5. If, unfortunately, something "goes wrong" the teacher has to turn the situation into a learning opportunity for students by leading them to infer deductions and analyze a given problem.[19]

6) Ways to Present a Demonstration

The most frequent way to present a demonstration is by the classroom teacher himself, but to get more students' involvement, there can be other ways, also very effective. There are five ways in which a demonstration can be presented:[20]

a. By the teacher alone. When the demonstration is a dangerous one, when time is limited, or when the experiment requires accurate measurements.

Burnett emphasizes this method as a good one to illustrate a scientific principle:

The teacher

> has a mature understanding of the principle or phenomenon, whereas the student is at the learning stage where there are many hazy aspects. The teacher is experienced in handling the equipment and in interpreting and explaining it to others, whereas the student tends to be inept and confused about the best means of clarifying for others points of difficulty or ambiguity. It is for these reasons that every science class should have the opportunity of observing many clean-cut, clear demonstrations by the teacher.[21]

b. By the teacher and student assistant who helps him in many ways; either to read the temperature of a liquid from a thermometer in a measure concerning calorimetry; to read the graduation in an ammeter of an electric current; to read the volume of a gas collected; or to light a bunsen burner; to carry the result of a chemical reaction around to show to students who sit too far from the desk.

More attention is given to the demonstration because students prefer to watch their peer working with the teacher. By this process, the teacher enjoys training his assistant--usually a good student he likes--and is relieved from too much busy work.

c. By a group of students. This group approach involves more students' activities than the previous ones. In planning and preparing the demonstration, the group learns, not only how to perform the experiment, but they also learn how to work together, how to collaborate, to cooperate in their daily work. The group process will consequently lead to effective laboratory work organization if the teacher can get help from these students.

The teacher should be careful in selecting students for group members in such a way that all the members of the group are productive. He also should be aware that the group approach is only appropriate for demonstrations that are not dangerous, and easy to carry out. Examples are some experiments in mechanics or magnetism such as the free falling body, characteristics of magnets, etc.

d. By individual student. Demonstrations of this type can be very effective. They can be presented by a student of high status among his peers or by a student of an upper grade.[22]

The latter is usually a classroom teacher's former assistant or a very good student of another science class introduced by his own teacher. The demonstration presented may be the student's favorite one he showed last year. It can be one of the series he learns by himself to prepare for his future career.

For example, a boy student in senior class (grade 12) had learned the whole series of basic electricity and basic electronics lessons.[23] He usually came to his former teacher to get help at the beginning, but now that he has mastered the content of the course, the teacher invites him to show a demonstration for his class about the diode and its functions.

This student is in a position that helps him to answer some detailed questions of the curious students in the class. Questions can be about discovery of the diode, electron emission, or why a diode is called a valve or rectifier, how current flow in a diode is formed, how twin diode rectifiers are arranged, difference between indirectly heated and directly heated rectifier tubes, how does the half-wave vacuum tube rectifier work, etc.[24]

e. By a guest. A guest can be another science teacher, a professional scientist or a college professor. The guest demonstration gives to the class something new and exciting to break the routine of the other methods of teaching, although the teacher has the least control of the class and of the demonstrator. He has to make careful arrangement about the schedule and prepare his students for what is going to be shown.

This kind of demonstration can successfully lead to field trips, visits to factories or college laboratories and museums.

The Laboratory Approach

1) Introduction

The demonstration method cannot be a substitute for the laboratory work.[25] "Learning by doing" is an efficient maxim and the laboratory approach is the most appropriate means to apply it. Warren Weaver comments that the scientific inquiry in the laboratory is a very natural tendency:

> It seems to me absolutely essential students do something more than listen to lectures, look at demonstration experiments, study a textbook, recite a lesson. The students simply must do something on their own, with their own minds and with their own hands. They must have a scientific experience, even if it is so simple as swinging a bunch of keys hanging on a string and timing this pendulum with their pulse.[26]

The idea is psychologically sound because it satisfies the urge for activity which is a fundamental drive in human beings.[27]

Another scientist expresses the idea that the laboratory approach is the heart of the teaching of science as follows:

> Demonstrations, science clubs, science fairs, audio-visual devices, field trips, textbooks and other aids have a place in the resourceful teaching of science. But when the laboratory and its emphasis on the investigative or research-type exercises disappears from day-in, day-out science teaching, then the heart and chief inspiration of science as a form of human endeavor have been lost.[28]

The contributions of science laboratory to science courses are tremendous. It deepens the students' understanding that scientific and technological concepts and applications are closely related to his own natural environment. In the laboratory "the student can be taught to be discriminating in observation, to evaluate evidence or data and to sense the importance of care and skill in the taking of measurements."[29] He also develops the contemporary view of the limitations of measurement; hence, he will have an application for the continuing utility of such measurements.

New programs should place major emphasis on laboratory work and have the proper equipment and facilities. The laboratory then becomes a place to gather data, to observe, to experiment. It is used just as a scientist would use it. Students do not know answers ahead of time nor does the teacher.[30]

2) Functions of Laboratory Activities

Considering laboratory activities as individual or small group activities where a subject topic of concern in science is selected and a teacher provides the necessary guidance, research reveals the following findings as functions of the laboratory activities:

1. A means of securing information
2. A means of determining cause and effect relationships
3. A means of verifying certain factors or phenomena
4. A means of applying what is known
5. A means of developing skill
6. A means of providing drill
7. A means of helping pupils learn to use scientific methods of solving problems
8. A means of carrying on individual research.[31]

Each function is important and directly related to the nature of the desired learning outcomes or objectives of the course.[32] For example, the first function corresponds to the understanding of the course content of science; the two last functions prepare the student to think and act as a scientist, or at least, give him the understanding of the scientist's role in our society.

Sund and Trowbridge considered the laboratory as the right place to acquire all kinds of skills: acquisitive skills (such as listening, observing, searching, investigating); organizational skills (recording, comparing, classifying, outlining, analyzing, etc.); creative skills (planning ahead, designing new problems, synthesizing); manipulative skills (using instrument, caring for it, repair, construction); and the communicative skills (asking questions, discussion, reporting, graphing...)[33]

In using the inquiry approach, Schwab points out only three main functions of the laboratory: the first one is the replacement of illustrations only of conclusions by illustrations of problem situations; secondly, it provides occasions for an invitation to the conduct of miniature but exemplary programs of inquiry; the third one is that it erases the artificial distinction between classroom and laboratory, between mind and hand.[34]

3) Ways of Using the Laboratory

The laboratory approach provides the students with a learning situation somewhat in contrast and opposition to the demonstration method. Laboratory techniques have been set up in such a way that there are maximum pupil activities and where the potentialities for learning are high.[35] For this reason, too often laboratory work degenerates into mere busy work on the part of the student.[36]

However, the result achieved by the laboratory does not depend on the amount of "students' busy work,"[37] but it depends upon the way the laboratory is used. The way the laboratory is used depends on the assumed position of the teacher in the teaching-learning process. The teacher may take either one of the two opposed positions or a compromise with some position between the two extremes.

> At one extreme, the teacher assumes a position as the dispenser of knowledge with the laboratory serving the function of drill (reinforcement) or verification.
> At the opposite extreme, the teacher assumes the position of a guide to learning and the laboratory as a place where knowledge is discovered.[38]

The first one is the traditional teacher, the second one uses the modern approach of problem-solving to teach inquiry and discovery. The position of the teacher in the laboratory teaching process can become apparent if one considers the common steps in the process of problem solving in the means of securing information through the laboratory:

1. Statement of problem
2. Formulation of hypotheses
3. Developing a working plan
4. Performing the activity
5. Gathering of data
6. Formulating of conclusions.[39]

It is necessary that all of these steps are taken into consideration. Schwab considers only three steps (problem, method and answer) which serve as criteria for three different levels of openness and permissiveness for laboratory inquiry. At the first level only the answer is open, at the second level both answer and method and at the third level, all factors: problem, method and answer are left open to the students' investigation.[40]

However, if we consider the sequence of the six steps in the securing of information, there are five degrees of freedom available to the teacher; the more steps the students can carry out, the higher the degree of freedom of the procedure followed by the teacher. In procedure I, students carry only two steps, 4 and 5, and they have the least freedom in their laboratory activities. The teacher states the problem, formulates the hypotheses, sets up the working plan, and draws the conclusions (steps 1, 2, 3, 6) from the data gathered by students after they perform the experiment (steps 5, 4).

TABLE 12

DEGREES OF FREEDOM AVAILABLE TO THE TEACHER USING THE LABORATORY

	Steps in Procedure	I	II	III	IV	V
1.	Statement of Problem	T	T	T	T	P
2.	Hypotheses	T	T	T	P	P
3.	Working Plan	T	T	P	P	P
4.	Performance	P	P	P	P	P
5.	Data Gathering	P	P	P	P	P
6.	Conclusion	T	P	P	P	P

T--Teacher P--Pupil

More freedom is given to the students in Procedure II where the students go on to formulate the conclusions. In Procedure III, they can also decide their working plan (step 4). In the last two procedures, IV and V, the teacher gives the students the opportunity to formulate the hypotheses (Procedure IV) and also to state their own problem (Procedure V). These two procedures give students practice in the scientific method of problem-solving; the last one (Procedure V) is used for individual research of scientists.

Procedures I and II identify themselves with the traditional use of the laboratory, regarding the laboratory as a place to verify previously known facts (II) and to learn manipulative skills (I).

For these reasons, the teacher, in supervising or guiding the laboratory, should try to proceed to the procedure of a higher degree of freedom, i.e., from I toward V. However, before taking the next superior procedure, the teacher should have evidence that most of his students are performing a good job of successful laboratory work.

4) Suggestions for Using the Laboratory Approach

Many factors contribute to the effectiveness of laboratory work. Students can learn more valuable things in the laboratory only under favorable conditions. It is strongly suggested that the teacher make careful plans for each laboratory session, use open-ended questions, direct orientation before and discussion after the laboratory session. He should know the general and specific rules of laboratory safety to protect his students from possible accidents because he is the one that is officially responsible for the students' safety during the laboratory session. Suggestions are discussed in details in the following lines:

a. The laboratory manual. For a class of large size (over twenty), the teacher may need the laboratory manuals to help him direct the work. These manuals, if used, should be well prepared, and written in such a way that problems proposed for study have a minimum of explicit instruction. They are called open-ended experiments[41] where students have opportunities for real "experimentation." A higher degree of freedom is available to the teacher in using the laboratory.

b. Orientation and discussion. An orientation session is necessary at the beginning of the school year. It is important for the teacher to give explanations and recommendations to the students regarding the laboratory work.

He first states the objective of the laboratory work; this is an opportunity for them to perform their own experiments, exactly like a scientist would use the laboratory for his scientific research. Then, he shows them how to use the laboratory manual and the best way to write a laboratory report. He also acquaints the students with the laboratory safety rules that are essential to be kept in mind every laboratory session.

Discussions are also needed after every laboratory session. Laboratory guides where students perform the assigned tasks do not give enough information. Students usually need further information to explain their observations. This is the time they learn through sharing knowledge with their peers, or through receiving it from the teacher; in the laboratory they learn through discovering or pursuing individual inquiry.[42] All these new concepts of learning experiences they can apply for one laboratory session.

Hence, the discussion clarifies the students' observations in the laboratory that may not be clear to them.

The teacher, in participating and leading the discussion, can also get feedback of his teaching through observing students' interaction and questions.

Follow-up activities such as extra reading, science projects, tests, and demonstrations are important in motivating the students in laboratory work. The teacher's presence is needed.

"The need for the teacher to ascertain the accuracy of the learned concepts, to correct misconceptions and to promote maximum learning is usually greater than in a conventional course."[43]

c. Laboratory safety. The teacher should be sure the students understand the laboratory safety rules and emphasize the importance of respecting these rules. The danger of possible accidents must be treated seriously: safety should be kept in mind all the time, not only in the laboratory, but also at home, play and work; research shows that fatal accidents at home rank second to highway deaths,[44] and it has been suggested that a number of pioneer chemists died as young men due to inhaling poisonous chemicals.[45] Also, forty per cent of the accidents occurred among students who were above average in scientific inquisitiveness.[46]

Conclusion

There is no way to compare the demonstration method and the laboratory approach. The suitability of the method to be employed by the teacher is determined by the objectives of the course and the conditions under which the science course is being taught. Each method has its own advantages.

Due to the limited number of laboratories and equipment available in Vietnamese secondary schools at the present time, it is suggested that the priority in using laboratory is for students of second cycle. But as soon as the schools can provide enough facilities and equipment, younger students of the first cycle should also be given the opportunity to engage in laboratory experimentation.

Nevertheless, both can be used with success by a good teacher who is capable of good planning and who is aware of the level of his students as well as the availability of the laboratory and material in his school.

FOOTNOTES FOR CHAPTER V

[1]Alexander Joseph and others, Teaching High School Science: A Sourcebook for the Physical Sciences (New York: Harcourt, Brace and World, Inc., 1961), p. xxx introduction.

[2]Nathan S. Washton, Science Teaching in the Secondary School (New York: Harper and Brothers, 1961), p. 214.

[3]*Ibid*., p. 217.

[4]Robert B. Sund and Leslie W. Trowbridge, Teaching Science by Inquiry in the Secondary School (Columbus, Ohio: Charles E. Merrill Books, Inc., 1967), p. 10.

[5]Vietnam (Republic), Ministry of Education, Situation de l'enseignement au Vietnam, 1969-1970 (second semester), (Saigon, Vietnam: Ministry of Education, 1970), p. 3.

[6]Secondary schools in Vietnam function with two shifts of classes: morning classes from 7:30 a.m. to 11:30 a.m. or 12:30 p.m.; afternoon classes from 1:30 p.m. to 5:30 p.m. or 6:30 p.m.; Monday through Saturday.

[7]Washton, *op. cit*., p. 214.

[8]Sund, *op. cit*., p. 112.

[9]Walter A. Thurber and Alfred T. Collette, Teaching Science in Today's Secondary School, 2nd ed. (Boston: Allyn and Bacon, Inc., 1965), p. 130.

[10]*Ibid*., p. 130.

[11]George C. Pimentel, ed., Chemistry, An Experimental Science (CHEMS) (San Francisco: Freedman and Co., 1967), p. 188.

[12]John Richardson, Science Teaching in Secondary Schools (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1957), p. 78.

[13]Physical Science for Nonscience Student (PSNS) Project Staff, An Approach to Physical Science (New York: John Wiley and Sons, Inc., 1969), pp. 421-28.

[14]Thurber, op. cit., p. 132.

[15]Ibid., p. 133.

[16]Richardson, op. cit., pp. 80-82.

[17]Washton, op. cit., p. 216.

[18]Sund, op. cit., p. 117.

[19]Nathan S. Washton, Teaching Science Creatively in the Secondary Schools (Philadelphia: W. B. Saunders Co., 1967), p. 117.

[20]Sund, op. cit., pp. 117-18.

[21]R. Will Burnett, Teaching Science in the Secondary School (New York: Rinehart and Co., 1957), p. 200.

[22]Sund, op. cit., p. 118.

[23]Van Valkenburg, Nooger and Neville, Basic Electricity (5 vol.) and Basic Electronics (6 vol.) (New York: Rider Publisher, Inc., 1953-55 and 1955-59).

[24]Van Valkenburg and others, Basic Electronics (New York: Rider, 1955), Vol. 1, pp. 24-33.

[25]Paul F. Brandwein, Fletcher G. Watson, Paul E. Blackwood, Teaching High School Science: A Book of Methods (New York: Harcourt, Brace and Co., 1958), pp. 476-77.

[26]Arthur G. Hoff, Secondary School Science Teaching (Philadelphia: Blakiston Co., 1947), p. 159.

[27]Alfred Novak, "Scientific Inquiry in the Laboratory," The American Biology Teacher, Vol. 25, No. 5, May, 1963, pp. 342-46.

[28]Robert H. Carleton, "Physics Hazard, Math Hazard or Teacher Hazard," The Science Teacher, XXII (September, 1955), 175.

[29]National Academy of Sciences, National Research Council, Guidelines for Development of Programs in Science Instruction (Washington, D.C., 1963), p. 3.

[30]Eugene C. Lee, New Developments in Science Teaching (Belmont, Calif.: Wadsworth Publishing Co., Inc., 1967), p. 48.

[31] Milton O. Pella, "The Laboratory and Science Teaching," The Science Teacher, XXVIII (September, 1961), 29.

[32] Ibid., p. 29.

[33] Sund, op. cit., pp. 93-95.

[34] Schwab, op. cit., pp. 52-53.

[35] Elwood D. Heiss, Ellsworth S. Obourn, Charles W. Hoffman, Modern Science Teaching (New York: McMillan Co., 1950), p. 117.

[36] Ibid., p. 117.

[37] George W. Hunter, Science Teaching at Junior and Senior High School Level (New York: American Book Co., 1934), p. 171.

[38] Pella, op. cit., p. 31.

[39] Ibid., p. 235.

[40] Schwab, op. cit., p. 55.

[41] Sund, op. cit., p. 98.

[42] Lawrence W. Downey, The Secondary Phase of Education (New York: Blaisdell, 1965), pp. 24-26.

[43] Sund, op. cit., p. 101.

[44] George M. Rawlins, Jr., "Safety in High School Chemistry," School Science and Mathematics, Oct., 1964, pp. 608-12.

[45] Walter Wingo, "More Chemists Die Young," Science Newsletter, LXXXIV (September, 1963), 199.

[46] Robert D. Macomber, "Chemistry Accidents in High School," Journal of Chemical Education, XXXVIII (July, 1961), 367-68.

CHAPTER VI

AUDIO-VISUAL MEDIA AS TOOLS FOR IMPROVING SCIENCE TEACHING IN VIETNAM

Introduction and Classification of Audio-Visual Media

Students learn science through seeing, hearing, smelling, tasting and touching. Thus, the odors of chemicals in the laboratory, of roses in the garden, the taste of sugar or vinegar are typical examples of how students make use of their five senses in learning science. Real things found inside or outside of the classroom provide the best resources for science teaching.

However, it is not possible to provide at all times first-hand experiences. Teachers in Saigon cannot afford to take their students to the plateaus of Dalat to contemplate majestic pines. A biology student cannot watch a bud while it opens. A physics student cannot see the movement of particles inside a semi-conductor tube.

In those cases just mentioned, either the actual resources are very expensive or physically so constituted that they cannot lend themselves to direct sensory observations. It is then that teachers must provide substitutes for real experiences. These substitutes are commonly called "audio-visual aids" (or AV materials). Most of these substitutes predominantly involve vision and/or hearing.

The great variety of audio-visual materials suggests a systematic classification which allows us to see the relation of one kind of audio-visual material to another.

A practical classification based on the type of sensory channel involved in the use of these audio-visual materials includes:

a) Materials addressing only to vision. Photo prints, flat pictures, chalkboards, flannel boards, magnetic boards, posters, charts, diagrams, maps, slides, overhead transparencies, silent films fall under this category.

b) Materials addressing only to hearing. Radio programs, discs (monoaural or stereo), magnetic tape recordings which are easy to edit and convenient to use.

c) Materials involving both vision and hearing. These include sound motion pictures and television programs.

Other classifications stress more the respective position of each of the audio-visual materials in the pedagogic complex. The most original of these belonged to Dale[1] who arranged them in terms of concreteness and abstractness into a cone--the "Cone of Experience"--whose top is occupied by the most abstract of these experiences and whose bottom is occupied by the most concrete ones.

From the bottom, the three first levels involve "Doing" in order of decreasing directness:

(1) Direct, Purposeful Experiences

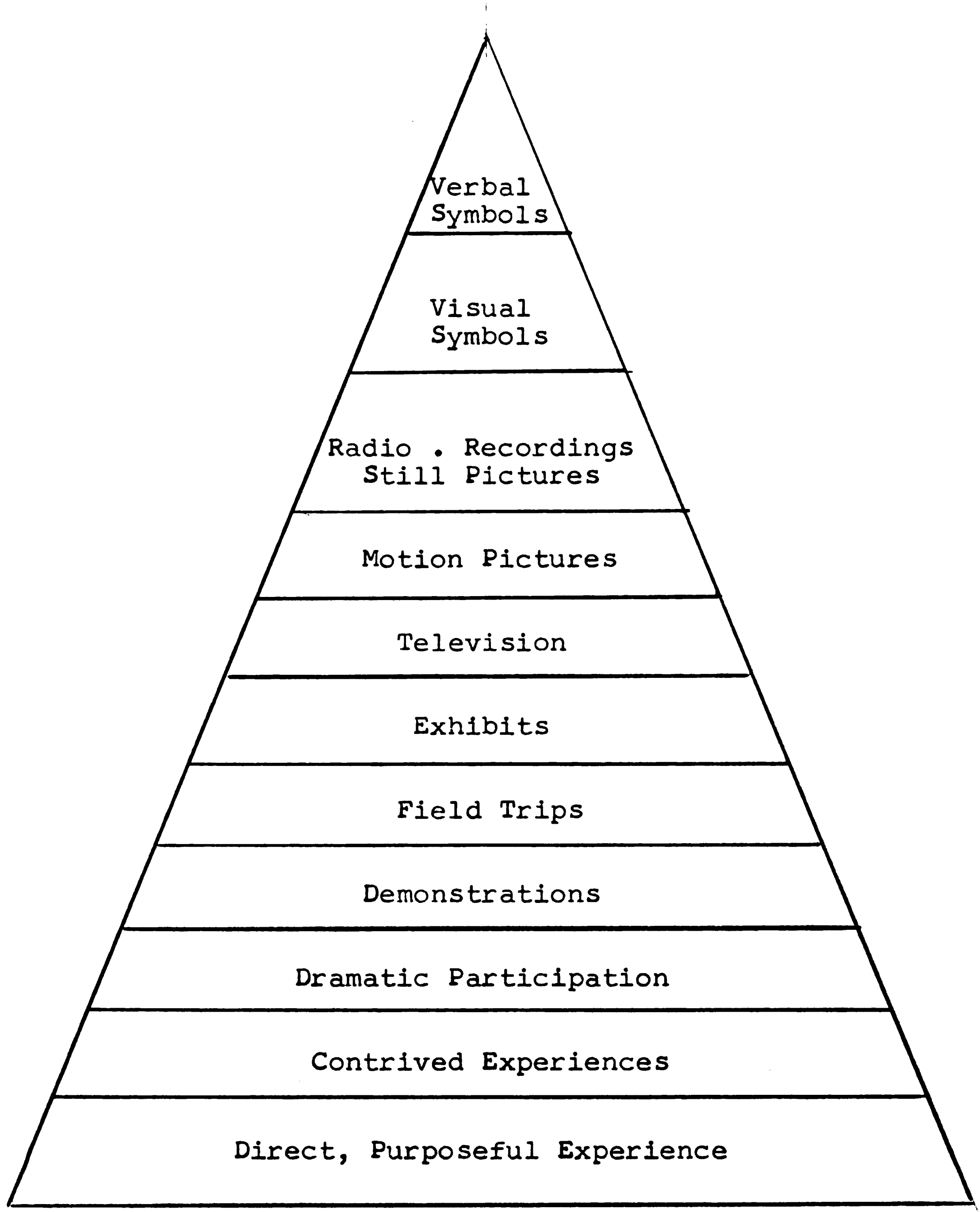


Fig. 1: Dale's Cone of Experience

(2) Contrived Experiences

(3) Dramatized Experiences

The next five levels involve "Observing" in order of decreasing directness:

(4) Demonstrations

(5) Field Trips

(6) Exhibits

(7) Television/Motion Pictures

(8) Recordings--Radio--Still Pictures

The two last levels involve "Symbolizing" in order of increasing abstractness:

(9) Visual Symbols

(10) Verbal Symbols.

Characteristics of Audio-Visual Media

Science teaching as well as other teaching activities involves communication between students and teacher.

In order to improve this communication teachers should first understand the structure and functions of a basic communication process. A good communication model has been proposed by Shannon in his "Mathematical Theory of Communication."[2]

The function of the information source (see Figure 2) in this model consists of selecting a desired message, which may be words, visual symbols or music.

The transmitter--men and machines in symbiosis--encodes the message, i.e., changes this message into the signal which is actually sent over the communication channel to the receiver.

> In the case of telephony, the channel is a wire, the signal a varying electrical current on this wire; the transmitter is a set of devices (telephone transmitter, etc.) which change the sound pressure of the voice into the varying electrical current.
>
> In telegraphy, the transmitter codes written words into sequences of interrupted currents of varying lengths (dots, dashes, spaces).
>
> In oral speech, the information source is the brain, the transmitter is the voice mechanism producing the varying sound pressure (the signal) which is transmitted through the air (the channel).
>
> In radio, the channel is simply space (or the aether, if anyone still prefers that antiquated and misleading word), and the signal is the electromagnetic wave which is transmitted.[3]

The receiver acts like an inverse transmitter, decodes the message (i.e., changes the transmitted signal back into a message), and hands this message on to the destination.

"When I talk to you my brain is the information source, yours the destination; my vocal system is the transmitter, and your ear and the associated eighth nerve is the receiver."[4]

Unfortunately, while being transmitted certain things are added to the signal which were not intended by the information source. These undesirable additions may be distortions of sound (in telephony) or static (in radio), or distortions in shape or shading of picture (television), or errors in transmission (telegraphy or facsimile), etc.

All of these changes in the transmitted signal are called noise.

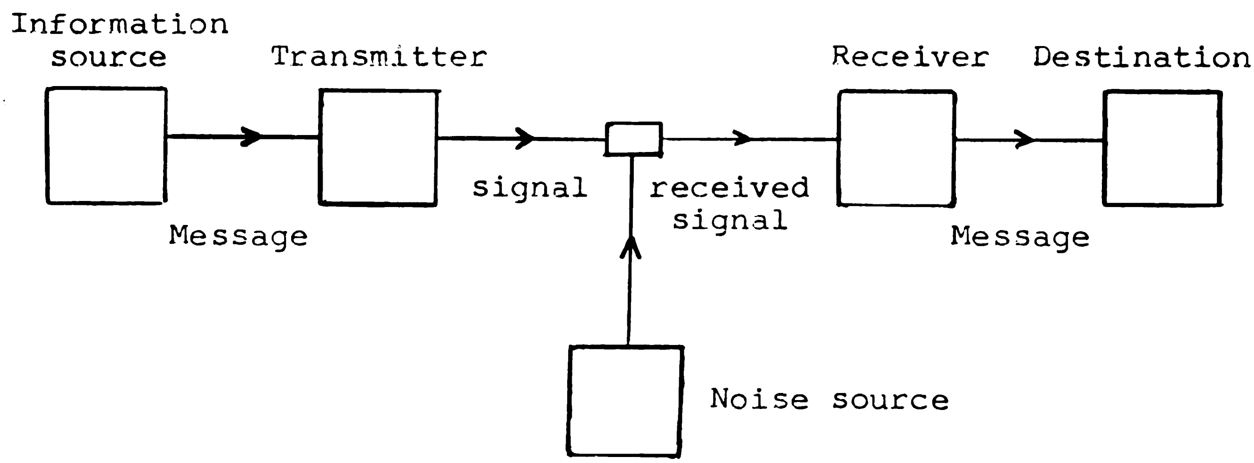


Fig. 2. Shannon-Weaver Communication Model

In the diagram of the transmission of an audio-visual message described above one can see that a channel clear of any noise would be an ideal condition for the transmission of an undistorted message. Unfortunately, such an ideal channel rarely exists in practice, and one would always find some noise or interference in any kind of learning situation.

There are two types of interference to classroom learning:

a) Extra-school interference brought about by home life, commercial and entertainment media (public radio and television programs, movies).

b) "Within classroom" interference, arising from psychological barriers generated within the classroom itself. Wittich and Schuller[5] listed these barriers as follows:

verbalism, referent confusion, day dreaming, limited perception and physical discomfort.

Both of these interference types lie in the channel area and hinder clear classroom communications. It is the task of the teacher to clarify the channel area of these hindrances. He must

> . . . bear the burden of achieving clarity in classroom communications, and he must be ever alert for such interference. The teacher must not only recognize interference possibilities, but also must know the means by which a clear channel of communication may be established and maintained with efficiency, for he is usually the only one who can improve the nature and strength of the messages or remove the barriers to receiving these messages. As long as messages are transmitted with clarity, as long as they are transmitted unchanged or uninterrupted by interfering factors, pupil-teacher communications will proceed efficiently.[6]

If the teacher fails to understand the basic communication process itself, the existence of barriers to it and the means by which these barriers may be removed, he is the only person who must be accountable for those aspects of classroom failures such as pupil non-participation in learning activities, low level of comprehension and eventual school drop-out. We shall see that a large proportion of classroom failures due to poor communications between teachers and students can be avoided by improving teaching practices through utilization of audio-visual media in the classroom.

Contributions of Audio-Visual Media to Pedagogy

What can we say about audio-visual media as a whole? Do they actually improve learning? An important body of research[7] on this subject has confirmed the fact that instruction can be significantly improved through the proper selection and use of audio-visual materials in teaching. These are the following claims made by audio-visual theoreticians and practitioners:

> 1. They supply a concrete basis for conceptual thinking and hence reduce meaningless word-responses of students.
> 2. They have a high degree of interest for students.
> 3. They make learning more permanent.
> 4. They offer a reality of experience which stimulates self-activity on the part of pupils.
> 5. They develop a continuity of thought; this is especially true of motion pictures.
> 6. They contribute to growth of meaning and hence to vocabulary development.
> 7. They provide experiences not easily obtained through other materials and contributed to the efficiency, depth, and variety of learning.[8]

These seven fundamental points are shaped in a rather condensed form. In what follows, we will therefore elaborate more on some points, re-state some others or add possible implications which may be drawn from each of these points, wherever necessary. Audio-visual materials, if wisely used, can do the following:

a) <u>Audio-visual materials arouse the students' interest</u>.

Educational psychologists insist that the most effective learning takes place when the learner is interested or wants to learn. The old saying "You can lead a horse to water, but you cannot make it drink" can also be applied to the learning act. One may expose a child to a learning situation but one cannot make the child learn unless he is really interested and wants to learn.

Interest may arise from innate drives or from environmental experiences. It is an innate tendency to be curious, to explore, to perceive and to know. Children out of curiosity like to look at new objects and strange things. Thus, the whole array of audio-visual media--slides, filmstrips, posters, charts, motion pictures--can best arouse their curiosity or help to satisfy it. Moreover, these aids can offer to children opportunities to find out or do things for themselves: an opportunity to touch a model, to press a button, or to fix a sandpaper item on the flannel board.

Audio-visual materials are so effective in arousing interest that many teachers make the mistake of over stimulating the class and of turning the lesson into mere entertainment. This can be avoided by making use of a few carefully selected pictures or objects, suitable for the purpose of the lesson, thereby helping the students not to be confused by a flood of new concrete experiences--this is especially applied to motion pictures, field trips--but to concentrate only upon the lesson of the day.

One may also say with Dale:

> Properly utilized, the involvement that many sensory techniques foster contributes invaluably to the learning experience. Indeed, one of our continual concerns is to transform those experiences that can be merely observing into experiences that also involve doing (covert as well as overt doing).[9]

b) Audio-visual media make learning more meaningful.

Research on the psychology of learning has shown that "meaningful materials and meaningful tasks are learned more readily than nonsense materials and more readily than tasks not understood by the learner."[10] Audio-visual materials, by adding picture and sound, make words stand for something and give meaning to facts and concepts that are vague when stated only in words.

A teacher verbally attempts to give his students an idea of an animal they have not seen before. He gives them its height, describes its color, head, legs, ears and some other characteristics. Each of the students will conceive a different concept of the animal and none of them will be able to form the correct image of the animal. Under such situation, verbalism is helpless and can be confusing. Then, audio-visual materials fit the role and play it effectively.

For the same purposes of giving meaning to facts and concepts, audio-visual materials can bring the faraway in time and place into the classroom or enlarge what is too small to see with the naked eye. In doing so, they reduce verbalism, a very frequent interference to effective classroom communication.

"Hence, they offer the best anecdote available for the disease of verbalism, which plagues contemporary learning situations."[11] And it is reasonable to conclude that: "If they offered this and nothing else audio-visual materials would be entitled to a place of importance in education."[12]

c) <u>Audio-visual media make learning permanent</u>.

When we have taken interest in a topic and have understood it clearly, we are likely to remember it for a long time, hence, to make it permanent. Other things being equal, material will be remembered in proportion as it is meaningful.

d) <u>Audio-visual media allow a broader perception of the world</u>.

Although direct experience is the basis of all effective learning, the world of learning is such that it cannot be lived on a direct sensory level. A real thing may be too complex, too big or too small, too fast or too slow. Learning through a model, a film or a filmstrip is much easier and more convenient than learning through direct experience that much of the time is not possible.

A model of a factory is often more helpful from the point of view of study than a visit to its various departments and sections spread over a large area. We often make use of models to emphasize the key points or basic mechanisms by leaving out distracting details.

Real things may be too far to see. Students of the eleventh grade in Vietnam, while studying "Copper" cannot afford to go to Sudbury, Canada, to visit one of the world's largest copper and nickel factories. Transportation facilities, time limits, leadership are the common obstacles to world travels. A sound-motion picture would be satisfactory for them to know about the processes of preliminary treatment of the ore, purification, molding and solidification of copper before it is delivered to the customers.

Lippmann points out that,

> man has invented ways of seeing what no naked eye could see, of hearing what no ear could hear, of weighing immense masses and infinitesimal ones, of counting and separating more items than he can individually remember. He is learning to see with his mind vast portions of the world that he could never see, touch, hear, or remember. Gradually, he makes for himself a trustworthy picture inside his head of the world beyond reach.[13]

Audio-visual media help us not only to see things that are limited by physical obstacles, but also those that are limited by time. Film reconstruction can give a vivid image of how our ancestors have lived and fought for independence and liberty, of how great civilizations of the past have decayed and died.

Limitation of Audio-Visual Media

The limitation common to all audio-visual media is their lack of reality.

Flat pictures (photographs, drawings, ...) have only two dimensions. Students who have never seen a tri-dimensional object represented by the picture may not be able to add the third dimension to it. Besides, flat pictures lack motion. This lack of motion explains why students prefer watching a movie rather than looking at the pictures in a book.

Models not only suffer from size distortion but may also give wrong impressions due to the nature of the materials of which they are constructed. No type of material however perfect and closely similar to human muscle, can convey a true image of a human heart--vibrant, pulsating.

Sounds can also be distorted. Recording equipments are limited by their range of sounds, which may not cover the whole range found in nature. Too high or too low a frequency vibration may be lost during recording or reproduction. Moreover, cheap equipment usually found in public schools is even less faithful in reproduction. It results in sounds which may be identifiable to a person who has already known them but can be a cause of confusion to others.

Important Considerations Regarding the Use of Audio-Visual Materials in Classrooms

(Guidelines for Selection and Use of Audio-Visual Material in Teaching)

Audio-visual instruction should not be regarded as a method of teaching in itself. Audio-visual materials are of value only when they fit into the instruction process in general. One of the fundamental goals of science teaching should be the incorporation of all devices--including audio-visual media which may help the students learn better every science topic.

Audio-visual materials usually do not serve as substitutes for first hand experiences in any event. Laboratory experiments are needed to illustrate scientific principles and concepts. A film on Interference of Light can only serve as a supplementary introduction to the experiment on light interference in the laboratory, but can never replace the experiments themselves. A visit to a dairy farm involving eventual students' participation in the farm activities (milk extraction, etc.) should be preferred to a filmstrip on the topic.

Another important consideration to be made here is to be certain that students can really benefit the most from a specific audio-visual medium. Diagrams or charts may be difficult to interpret unless teachers give extra help. Even pictures, to be readable by students, sometimes require cues from teachers.

The presence of a teacher in a classroom is always necessary for the teaching process despite the claims that some day modern technology could entirely replace teachers. Technology has its own limitations and one of the chief limitations of technology or modern gadgetry is that it cannot inspire and stimulate students. It is the task of the teacher to inspire his students, to instill in them enthusiasm for learning. The modern school always needs those kinds of teachers, teachers who can stimulate students, who are constantly seeking better means to improve their teaching procedures.

Audio-Visual Materials for Science Teaching

In this section, we will discuss those audio-visual materials which are now available in Vietnam, or which will be available in a very near future. Other audio-visual materials whose utilization has been proved to be efficient for science teaching in other countries will also be presented.

1) Motion Picture Films

Motion picture films constitute a most valuable device in science teaching since they achieve closeness to reality more than any of the other audio-visual media.

The chief values of motion picture films (besides being good substitution for reality) could be stated as follows:

> 1. Motion of plants and animals in their natural environments can be shown.
> 2. Motion of processes too slow to be seen normally may be viewed.
> 3. Motion of processes too rapid to be seen normally may be viewed.
> 4. Motion of objects too minute to be seen without a microscope can be shown.
> 5. Operations and actions too complex to be understood easily may be explained by animation.[14]

Motion picture films are available in almost all scientific subjects. Although most of the films produced for school use are 16 mm in width, major film companies have also developed 8 mm sound films which produce bright, sharp pictures and are run on less expensive projectors.

Most classroom films now have sound. Old silent films have recently found a voice with the invention of magnetic stripe on film on which a sound track may be recorded as it is on a tape recorder. It is now possible to add magnetic sound to film of all sizes.

Another development in motion picture film is the film loop. This consists of a continuous loop of film contained in a cartridge which protects it from dust and fingerprints. The film loop needs no rewinding and is always ready for showing. Simple and relatively inexpensive cartridge-loading projectors are portable and easy to operate. Most film loops are silent and run for only three or four minutes, so they are quite inexpensive. They are used to show experiments or phenomena, usually dealing with a single concept[15] which students would not ordinarily see in the classroom. Students can replay the short loop as often as they wish, thus giving them the opportunity to view the contents of the loop as often as it is necessary. Quality of single concept film loops can be increased every year because they wear out each year and producers have to re-edit. Longer sound film loops (of 20 to 30 minutes) are also becoming available.

a) Ways of using films. There are several ways of using films in science teaching besides providing vicarious experiences to students. Film can be used for introducing a science unit, obtaining information during the unit, and reviewing and summarizing.

When used to introduce a science unit, the main purpose of the film is to arouse interest in the science topic to be studied and setting problems to be solved. Therefore, the film to be used for this purpose should be general in nature. It should deal with situations and materials already familiar to pupils, calling attention to the phenomenon they have already known and awakening their curiosity about it.

Since most films contain both general and specific information, only the portion of the film that shows the general information should be shown to the students whenever the film is used to introduce a unit of science.

Films can also be used to obtain many kinds of information during the unit. They can help the children to answer questions to solve problems, and to check previous experiments, reading, discussion and conclusions.

A film may sometimes provide a satisfactory substitute for a field trip. When teachers do not have adequate facilities and apparatus for performing experiments and demonstrations, could they use a film related to the topic of these demonstrations or experiments?

This answer could be partially found in Smith's[16]

comparison between teacher demonstrations and related motion-picture films. Three sections of general science in each of five schools were involved in this study. The three films used were: Magnetism, Simple Machines and Properties of Water. Smith found that sound motion pictures and teacher demonstrations are equally successful in teaching and that the intelligence quotient of the students has no influence on the effectiveness of either method.

When films are used as summarizing and reviewing the important understandings of the science topic, they help students get a clearer and more vivid picture of the facts and phenomena they have learned and read about because films operate in real life situation in proper proportion and environment.

b) Suggestions for using films in science teaching. The science teacher should have specific objectives in showing a particular film. He should acknowledge those objectives to students so that students will look upon the film as a learning situation and not simply as a means of entertainment.

Previewing the film is an important step in the selection of the film to be shown. In previewing the film, the teacher becomes completely familiar with its content. He then decides whether the whole or only a part of the film should be shown, and which parts may be complicated or important enough to warrant repeating.

> [He] may determine what preparation pupils need to benefit from viewing the film. He may decide upon preliminary experiments to be provided. He may list words that need careful introduction. He is able to decide upon follow-up activities that should come immediately after the showing.[17]

In selecting the film, the science teacher should try to answer these questions: Is the film suitable for the students' grade level or ability? Is the film too simple or too complicated? Does the content of the film bear directly upon the science topic being studied, and will it yield the desired information or produce the intended effect?

The major criteria for selecting a film for classroom science teachers should be:

> What does this film offer in presentation of content, illustrations, and explanations that go beyond what is possible for the science teacher to do in a given period? For example, the biology teacher cannot show in a 45-minute period how changes occur in a seedling over a period of three months. This can be shown very effectively by a motion picture film within a few minutes. The chemistry teacher may wish to demonstrate the formation of crystals of a particular salt. The physics teacher may wish to have animated pictures of nuclear fission. The earth science teacher is concerned with portraying significant changes in the face of the earth. How can a volcano or an earthquake be demonstrated as effectively as with actual motion picture films? How can the science teacher portray a falling meteor, a solar eclipse, and other natural phenomena as well as they are depicted in good education motion picture films?[18]

Extensive use should be made of science films which depict processes that are not easily studied. For example, a plant's growth from seed to fruit, which take months in actuality, can be shown by time-lapse photography in minutes.

Other actions can be shown in slow motion--the beating of the heart or a rapid chemical change.

Much of the value of a film results from follow-up activities taking place right after the film has been shown. The answers to the questions assigned to individuals and small groups can be given and put on the chalkboard in a logical sequence. Discussion is an important part of the follow-up. Discussion is needed to establish understandings, to develop relationships and to draw conclusions. During the follow-up discussion, new questions may be raised and will lead to further study in the same science topic or exploration into a new one.

The teacher "may be surprised by some of the attitudes fostered by the film--effects which he never anticipated but which emerged during the discussion."[19]

He then has a great flexibility to decide the kind of activities needed, either further reading, written reports, field trips or other films, and possibly a second showing of the film.

2) Slides and Filmstrips

Filmstrips and slides could be used in place of motion pictures whenever motion is not necessary for the understanding of concepts and science principles. The suggestions for using films are also applicable for using filmstrips and slides.

There are many advantages in using slides and filmstrips in science teaching. They are first of all relatively inexpensive. Moreover, slides or filmstrips projectors not only are less expensive than movie projectors, but they are easy to operate and there is less chance of anything going wrong with them.

In addition, filmstrip or slide viewers which do not need a screen are now available and they could well serve as tools for individualized instruction. Another important advantage of slides is that they can be easily produced by students and teachers alike. Only a reliable 35 mm camera is required to produce beautiful, relatively inexpensive slides. With tripod and inexpensive close-up lens, teachers are able to make close-up pictures of rocks, flowers, insects, leaves, etc. They may also copy posters, charts, diagrams, pictures.

The use of slides and filmstrips along with tape recorders could adequately achieve most of the purposes of science teaching. This is an example of an inexpensive multi-media approach, which most of the developing countries could afford.

3) Three-Dimensional Materials: Models, Mock-ups

Models are replicas of real things except the size. Mock-ups are working models of an apparatus or a machine.

Materials that are too small or invisible for study can be visualized through the use of models. An atom, a molecule would be difficult to teach in a meaningful manner without the use of models.

Other materials, not necessarily too large or too small, would teach us very little when we examine them as they appear. Thus, merely observing a human eye teaches us nothing about its functions. We should use enlarged models together with drawings, diagrams, or charts that show the hidden organs, muscles, tissues, nerve connection and processes.

A real storage battery cannot show the parts of the apparatus that produce electricity but an appropriately labeled cut-away model could.

Models for science teaching can be purchased from scientific supply companies. However, students and teacher can make their own models or mock-ups. Thus, models of electronic structures of the elements or of any molecular or crystalline structure could be constituted by using cork balls for atoms and double ended pins to join them.[20]

A model that demonstrates nuclear fission can be made with a series of mouse traps.[21] School-made models are less expensive than commercial models. Moreover, specific situations require specific models which supply companies could not provide.

For example, an earth science teacher may prepare a relief model of the area within the school surroundings, which he could not get from commercial companies.

Students who make their own model for learning have opportunities to develop their artistic aptitudes and practice scientific thinking and reasoning.

Students should know how to choose the right kind of modeling material in making their models. Thus, in the biological and earth sciences, modeling clay would be very useful. It may be used for figurines illustrating evolutionary development, for models of anatomical structures, and for illustrations of land forms. Mechanical models are usually made of wood and metal. Supplies of these materials and the tools needed to work with them should be a part of every science classroom.

When models and mock-ups are used for science teaching, their limitations should be clearly stated.[22]

Cornthwaite points to the possible danger which may result from the teaching of the solar system with a model constituted of baling wire for the orbits and clay models for planets and their satellites.[23]

Not only the differences between the model and the reality it represents must be made clear, but the likenesses between the contrived experience and the real thing must be emphasized as well. This is what Dale has pointed out:

> In contrived situations we resort to an analogy, and "all analogies are dangerous." But without them, much of our thinking would be impossible. Though analogies are dangerous, they are necessary. We can make good use of analogies offered by contrived experiences if we prevent misconceptions by reminding students of both the similarities and the differences between the contrivance and the real thing.[24]

4) <u>Charts, Maps, Posters</u>

The <u>chart</u> is "a generic term for any systematic arrangement effect in graphic or pictorial form, presenting for convenient reference comparisons of quantity distribution, trends, summaries, etc."[25]

Scientific charts are relatively inexpensive and stimulating for learning. They are used when certain science topics or concepts are to be taught regularly and pictures or illustrations of the concepts are desirable. The following are some examples of charts which can be used for science teaching purposes: The Periodic Table, the various systems of common plants and animals that are studied in a science or biology class, the microscopic world of molds, the bacteria that cause disease, simple machines.

A wide variety of charts are available from scientific supply houses and educational publishers. But the teacher and students in science classes can profitably make their own charts. In making charts as well as in purchasing them from commercial sources, one must pay attention to the design of the chart, which should be well-balanced and attractive in order to be effective.

The following is an example of highly attractive charts for boring science topics:

> a blank periodic chart painted on plexiglas was equipped with electric circuits, a bulb being placed in each space of the periodic chart. Separate circuits were provided for groups of elements, for columns of elements, for each of the rows and for each

> of the single elements. Thus, for purposes of discussion before a class, individual elements or groups could be highlighted by throwing the appropriate switches.[26]

Making <u>maps</u> and <u>posters</u> could well serve as individual student projects. The poster is a pictorial design which should have eye appeal and communicate a major scientific principle or concept in seconds. Examples of posters which could be made by science students are the following:

> The Human Digestive System, Circulation of Blood, the Nervous System in a Frog, the Life History of the Grasshopper, the Electromotive Series, the Alkaline Earth Metals, Radioactive Decay, Ionization of Salts, the Electromagnetic Spectrum, How Machines Work, Photosynthesis, Food for the World, Purification of Water, Making a Radio Receiver, Principles of Direct Current, and Applications of the Electromagnet.[27]

5) <u>Chalkboard</u>

When the material to be presented to students is not to be used on a permanent basis, the chalkboard technique is appropriate.

The chalkboard may be used to write down chemical equations and formulas or to visualize scientific concepts through illustration. The reasons why effective teaching could be made by having students solve science problems on the chalkboard are given by Washton:

> In physics and chemistry classes where consideration is given to problems such as gas laws, calorimetry, and other topics that require the use of mathematics, it is effective teaching to call on the students to solve problems by writing on the chalkboard.
>
> This procedure enables the teacher to evaluate the learning of a sample of a class by having perhaps

> five to six pupils work at the board. It also permits the teacher to make a rapid diagnosis of what specific part or parts of the problem may cause undue difficulty in learning situation. While the pupils are working at the board, the remaining members of the class should be working at their desks. It is likely that student error on the board may also appear at the desks of other students. Thus, the science teacher can use the board work by some students as a basis for correction to help all students understand the way of solving the problem.[28]

Several suggestions could be made regarding the use of the chalkboard in science teaching:

a) Avoid overloading the board with too much information--chemical reactions, formulas, principles, drawings, etc. Use an eraser as often as possible.

b) Teachers can save a lot of time by using templates of frequently drawn objects such as bunsen burners, beakers, flasks, condensers, etc. These templates can be made easily from plywood or heavy cardboard.

Science teachers should also investigate modern techniques of using the chalkboard. The topic is thoroughly described in Wittich and Schuller's book.[29]

c) Colored chalk should be used for clarity, emphasis and contrast. However, too many colors may distract students from the learning task.

6) <u>Overhead Projectors</u>

The overhead projector is one of the most versatile audio-visual media for teaching purposes. It can be used as a chalkboard (for this reason, it is called the "lighted chalkboard") if equipped with transparent plastic sheets on which the teacher writes information with a grease pencil.

The writing can be erased easily with a dry cloth so that the same plastic sheet may be used over and over again.

Permanent "transparencies" for the overhead projector can be easily prepared by using different techniques.[30] They are also commercially available.

To make their presentation effective teachers may use several techniques that are impossible with slides or filmstrips.

1. The use of a pointer--visible on the screen--focuses the students' attention on a particular detail in the transparency.

2. Teachers can add details or underline important statements on the transparency during projection by using a grease pencil.

3. The teacher can control the rate of presenting information by various masking and revealing techniques.[31] The simplest of these techniques consists of covering the transparency with a piece of cardboard and then exposing one item at a time.

4. Scientific processes or complex ideas are better understood by using overlay techniques. These techniques consist of superimposing several additional transparencies on a base transparency so that one step of the process or one component of the complex idea is shown at a time.

Instances of using overlays could be found on teaching photosynthesis, water cycle, etc.

5. Teachers can simulate motion on parts of a transparency by using the effect of polarized light with a polaroid spinner or a polaroid sheet. Motion of electrons in an electric circuit could be seen on the screen with this technique.

Also, the impression of gears rotating, liquids flowing, gases exploding could be imparted to students with this technique.

The overhead projector is most useful when it is used for lecture demonstration purposes, especially before a large audience.

A series of articles in the Science Teacher on the use of the overhead projector in the teaching of chemistry has been published. The first part describes fourteen simple devices which can be made inexpensively by the teacher and which can be used to perform over 1000 different experiments viewed through the overhead projector.[32]

The potentialities of the overhead projector are enormous, and the author hopes its use will be generalized in a near future in all Vietnamese schools.

Planning the Use of Audio-Visual Media in Vietnamese Schools

The need of using audio-visual media in Vietnamese schools is urgent, due to the critical shortage of teachers suffered by the schools all over the country. Moreover, the lack of scientific equipment and facilities for "decent" laboratory teaching calls more for the use of simulated experiments which can best be provided by audio-visual media.

How can we go about planning a program of using audio-visual media in Vietnamese schools--for science teaching as well as for other subject area teaching? The use of audio-visual media in Vietnamese schools is impossible unless some preliminary conditions are met. In other words, we must overcome some problems inherent to the integration of audio-visual media into schools so that the use of such media becomes not only possible but also inevitable. Let's therefore discuss these problems first before proposing a plan of equipping Vietnamese schools with audio-visual materials and equipment.

1) Classroom Structures

The major part of school buildings in Vietnam are old and non-fitted to the use of audio-visual media. But this does not mean that we should avoid using them: we could if we would, if we would look at the problem more realistically. What we ought to do is to know how to differentiate between minor problems and major problems. Major problems in this case are "electricity" problems as well as "acoustics" problems. We ought to make sure that we always have good electric installations, because such installations are prerequisite to good lighting and good acoustics. To correct for bad acoustics--the room is not soundproof enough, for example--we can add a curtain here and there or nail cheap soundproof material to the walls. As example of minor problems, let's cite the fact of not having a curtain to control for the darkness of the room or a good screen for the projection of audio-visual projections--motion pictures, slides and filmstrips. These are not important big problems and yet, many teachers found in them reasons for not using audio-visual media.

Problems can also arise in new buildings. In building new classrooms, we must prefer triangular classrooms[33] to quadrangular or square ones, since the former give a better angle of vision. We can find here an example of subordination of architecture to technical necessity. Another idea which is useful in building new classrooms is the use of mobile partitions between classrooms so that when it is necessary, we can overlap many classrooms into one, in case we need to address a large audience with appropriate audio-visual instruments such as overhead or slide projectors, etc. This constitutes the best building procedure to alleviate teacher shortage since it enables one teacher to give a course to four classes when necessary.

2) <u>The Problem of the Curriculum</u>

There is the question as to whether we should adapt audio-visual methods to existing curricula or to completely change curricula so that they can give room to audio-visual methods. Up until now, in developing countries and even in some developed countries, teachers use audio-visual media as minor auxiliaries to the teaching process as a whole and not as an integral part of the "whole." In the future we should not be content with teaching traditional programs with new media or methods but if necessary we should also revise our traditional curriculum so that it can easily lend itself to the use of new media of learning and teaching, i.e., to make audio-visual media a part of the "whole."

3) Schedule Problems

As individualized instruction is part of the new trends of modern learning, the century-old concept of 60-minute class periods is somewhat outdated. The typical example in showing the absolute incompatibility with new media of instruction can be found in language laboratory sessions[34] where it takes much more time than traditional class periods to go through the complete process in which the professor first delivers a brief lecture on the day's lesson and immediately lets the students apply right away what they have heard by practicing with the machines under the supervision of a foreign language laboratory assistant. After a period of practice, the students will see the professor appearing again for answering questions raised by students concerning their difficulties encountered during their self-practice period, or for continuing on a new unit of the lesson. The cycle can be repeated again and again for two or three hours.

Rigidity in the schedule usually serves as a magnificent excuse for teachers for not using audio-visual media and often we hear people say: "I do not have the time to use audio-visual media during my schedule." And this is often true, especially for those schedules which are restricted to special timetables such as radio or TV programs. Unless schools are wealthy enough--and most Vietnamese schools are not--to afford tape recorders and videotape recorders to tape radio or TV programs so that they can be played back later in the classrooms, flexibility in scheduling classes should be given more consideration.

Another solution to the problems of scheduling is to encourage students to go and see films or to listen to good educational radio and TV programs at home and to discuss them later in class. This may be a good solution to Vietnam, since most students in the urban areas can afford at least a radio set at their home or can go to a free movie sponsored by various agencies: foreign embassies, international agencies, etc.

4) Financial Problems and the Problem of Efficiency

These are fundamental problems. Consideration must be given to results, i.e., the effectiveness obtained in using audio-visual media. It is no use to spend large sums of money if there are no meaningful returns as a result of these expenditures and it is no use to resort to attractive and pleasant methods if traditional methods can give the same of better learning results. Thus a study should be made to see whether it is more economical and workable to use tape recorders than radio programs or whether it is better to use single concept films rather than expensive television network programs.

But on what basis can we evaluate the cost effectiveness of audio-visual media? The answer to this question was found by Knirk,[35] who suggested that one should minimize the output (fulfillment of stated goal of one's systems). In other words, the output must outweigh the input in order to get some effectiveness in a given system. This is a scientific approach to solve problems in the audio-visual field.

The financing of equipment should also be planned at the school or community level or sometimes at the national level. The financing of equipment must also be accompanied by the financing of the production and the distribution of audio-visual materials. This involves not only the class and the teacher but the industrial sector of the whole country as well.

5) <u>Production Problems</u>

In Vietnam, the Ministry of National Education is the leading producer of films or radio programs. The national education system requires a good organization, from the production of educational documents up to their use.

However, we cannot heavily and solely rely on government enterprises, whose characteristics are red tape and rigidity. We must, therefore, create an organization at the school level, wherein teachers can get help from technicians or other experienced teachers in their local production[36] of audio-visual materials (transparencies, slides, etc.) for their use in classrooms, whenever needed materials cannot be provided by government agencies or commercial companies.

6) Distribution Problems

In developing countries such as Vietnam, the distribution system is not reliable. Due to the slowness of transportation systems created by the poor quality of roads and railways, by the difficulties created by the war, audio-visual materials are not sent out on time, so that teachers are not well informed and consequently ill-prepared when they finally come.

One solution to the distribution problem that seems to be realizable is the joint effort with the local university. All the high schools in the province and the local community will combine their funds to establish a common audio-visual center located in the university campus, whose main job is to purchase any audio-visual materials which can be useful to all these high schools and the university itself. The distribution must be left to the care of the university transportation system, whose buses can serve as mobile media centers.[37] These buses will regularly visit each high school in the province at specified times, and provide materials the schools need.

7) Human Problems

One weakness of developing countries is the lack of teachers. Classes are entrusted to people that are not fully qualified.[38] This has a bad consequence in that teachers are considered as non-professional or as second-rate job holders. The rising of audio-visual methods and techniques permits the rehabilitation of teachers and makes them professional people.[39]

We must see that all teachers are able at least to use audio-visual materials and equipment and eventually to produce them as well. In this fashion, only well-trained people can be rightly considered as true teachers, who not only can use audio-visual materials to perfect their teaching but also can plan the use of audio-visual material, i.e., to decide which of these materials used at a certain period of time will produce the maximum effect on student learning performance. All this knowledge needs thorough training, which makes teachers become professionals in their own career.

The training can be done in several ways and can be applied to every country, developing as well as developed countries: on the one hand, make teachers take courses in audio-visual media in colleges of education; on the other hand, teachers can be trained at home or in the school through radio programs, or television.

In Vietnam where no courses in audio-visual instruction are offered, either through radio or in universities, we have to send qualified teachers abroad to learn about new audio-visual media so that they become potential trainers for future generations of teachers at home.

Another efficient way consists of inviting qualified educators from developed countries to establish local training at home. Such type of training has been underway in some Asiatic countries[40] and gave good results. This kind of training is successful since the national trainees, being at their home country, do not develop adjustment problems they will encounter if they were transferred outside of the country, and which may interfere with their studies.

8) The Priority Problems

Education cannot be unrelated to social environments. Each society has its own needs, and in trying to fulfill those needs, it must set a scale of priority according to the urgency of a given need.

Thus, in a rural country like Vietnam where cars are considered a luxury, and schools do not have enough classrooms for children, it is unrealistic to give priority to such costly programs as buying teaching machines or closed-circuit television. Instead of giving children costly teaching machines, we can develop a program of using textbooks in programmed forms which can lead to the same learning results but at a much lower cost.

A Plan for Equipping Vietnamese Schools with Audio-Visual Instruments

Usually in most countries--especially in developing countries--there are not any systematic plans to equip schools with audio-visual instruments. One day, a teacher buys a cassette tape recorder for his class. His successor, the following year, puts the cassette recorder aside and buys a slide projector, because he may think that this single visual medium can serve most of his teaching purposes. Thus, personal likes and dislikes of individual teachers causes money wasting and consequently, administrative distrust in the use of audio-visual media in schools.

Students sometimes buy books which are not relevant to their needs, but which attract them because of the attractiveness. In the same manner, some teachers insufficiently informed about apparatus were led by the salesman's talk to buy handsome apparatus, which does not necessarily meet the school needs.

Therefore, in order to avoid fund wasting, we must have a competent "research officer"--specialist in audio-visual equipment and materials--in the school administration structure, to approve or reject any purchase of new equipment.

There must be also cooperation between teachers and producers of audio-visual equipment. The producers must ask the teachers what they need and what they expect from the materials to be used. Of course, teachers should reject the idea of requiring ideal apparatus from manufacturers.

In choosing equipment, one must pay attention to their size, which must correspond or correlate to the size of those students who will use them. Other things being equal, smaller apparatus should be preferred to larger because of ease in handling them and using them in the classroom. Thus, slide cube projectors and slide cube cartridges do not take much space and so, should be preferred to tray slide projectors which are much bulkier.

The after-sale maintenance of the equipment should be given an important place in the best use of audio-visual methods. We must always look for apparatus having components which can be easily replaceable and which can be easily obtainable in the market. Thus SLR cameras having screw thread mount (Pentax Practica type) should be preferred to others, because of the wide range of lenses[41] having that screw thread mount.

We cannot afford not to have a systematic plan for school equipment. Teachers' needs of apparatus must be thoroughly discussed with the competent research officer and voting is necessary in case there are conflicts as to the priority in buying such and such equipment instead of another.

At the present time, our primary schools are so poor that it is a luxury in considering an audio-visual plan for them. Attention is rather turned to secondary schools to try to establish the standard equipment for them for a five year plan: every secondary school in Vietnam should include in its equipment the following:

1. One 16 mm projector for the whole school
2. Two record players for the whole school
3. One tape recorder for each unit of six classrooms
4. One slide projector and one screen for each unit of six classrooms
5. One overhead projector for each unit of six classrooms
6. One radio set for each unit of six classrooms.

This can be restated as follows: every school has one movie projector and two record players; for each unit of six classrooms, there are one slide projector, one overhead projector, one tape recorder and one radio set.

The number in each category was determined on the basis of the frequency with which each is supposed to be used during the school year and on the average school budget that a typical secondary school in Vietnam can afford to buy such equipment.

FOOTNOTES FOR CHAPTER VI

[1]Edgard Dale, Audio-Visual Methods in Teaching (revised ed., New York: The Dryden Press, Inc., September, 1955), pp. 42-56.

[2]Claude E. Shannon and Warren Weaver, The Mathematical Theory of Communication (Urbana, Illinois: The University of Illinois Press, 1964).

[3]Ibid., p. 7.

[4]Ibid., p. 7.

[5]Walter Arno Wittich and Charles Francis Schuller, Audio-Visual Materials: Their Nature and Use (4th ed., New York: Harper and Row, Publisher), pp. 16-25.

[6]Ibid., p. 15.

[7]Research publications in the Audio-Visual field can be found in such reviews as the Audio-Visual Communication Review of the National Education Association. Also in its 1950 edition, the Encyclopedia of Educational Research analyzes 120 significant research studies in audio-visual education.

[8]Charles F. Hoban, James D. Finn and Edgar Dale, "Audio-Visual Materials," in Encyclopedia of Educational Research, ed. by Walter S. Monroe (rev. ed., New York: Macmillan Co., 1950), p. 84.

[9]Dale, op. cit., p. 66.

[10]Ernest Hilgard, Theories of Learning (New York: Appleton-Century-Crofts, 1956), p. 407.

[11]Dale, op. cit., p. 66.

[12]Ibid., p. 66.

[13]Walter Lippmann, Public Opinion (New York: Macmillan Co., 1949), pp. 16, 29.

[14]Sam S. Blanc, "Vitalizing the Classroom: Slides, Filmstrips, and Films," School Science and Mathematics, LIII (April, 1953), 257.

[15]Elwood E. Miller, "Single Concept Film: Criteria for Clipping," Audio-Visual Instruction, XII (January, 1967), 36-38.

[16]Herbert A. Smith, "Determination of the Relative Effectiveness of Sound Motion Pictures and Equivalent Teacher Demonstrations in Ninth-Grade General Science," Science Education, XXXIII (April, 1949), 214-21.

[17]Walter A. Thurber and Alfred T. Collette, Teaching Science in Today's Secondary Schools (2nd ed., Boston: Allyn and Bacon, Inc., 1965), p. 198.

[18]Nathan S. Washton, Science Teaching in the Secondary School (New York, Evanston and London: Harper and Row, Publishers, Inc., 1961), p. 235.

[19]Dale, op. cit., p. 225.

[20]Norman Davidson, "Corkball Experiment on Crystalline and Molecular Structure," Journal of Chemical Education, XXIX (May, 1952), 249-50.

[21]W. H. Slabaugh, "A Lecture Demonstration of Nuclear Energy," Journal of Chemical Education, XXV (December, 1948), 679.

[22]Wittich and Schuller, op. cit., pp. 171-92.

[23]D. L. Cornthwaite, "The Solar System," Baltimore Bulletin of Education, XXIX (March-May, 1951), p. 43.

[24]Dale, op. cit., p. 120.

[25]Carter V. Good, ed., Dictionary of Education (2nd ed., New York, Toronto, London: McGraw-Hill Book Co., 1959), p. 86.

[26]John S. Richardson, Science Teaching in Secondary Schools (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1957), p. 313.

[27]Washton, op. cit., p. 234.

[28]Ibid., p. 232.

[29]Wittich and Schuller, op. cit., pp. 73-91.

[30]The book, Techniques for Producing Visual Instructional Media, by Ed Minor and Harvey R. Frye (New York: McGraw-Hill Book Co., 1970), describes various ways of producing overhead transparencies.

[31]Jerrold E. Kemp, Planning and Producing Audiovisual Materials (San Francisco, Calif.: Chandler Publishing Company, 1963), p. 103.

[32]Hubert N. Alyea, "Tested Overhead Projection Series," The Science Teacher, XXIX (March, April, September, October, November, December, 1962), 28-31, 10-15, 14-21, 14-21, 14-19, 44-51.

[33]Alan S. Neal, "Viewing Conditions for Classroom TV: An Objective Study," Audio-Visual Instruction, XIII (September, 1968), 707-709.

[34]H. A. Woods, "Problems of the Foreign Language Lab Director," Audio-Visual Instruction, XIII (May, 1968), 457.

[35]Frederick G. Knirk, "Technology and Curriculum Planning: Cost-Effectiveness of Instruction," Audio-Visual Instruction, XIII (March, 1968), 261.

[36]Larry Coleman, "Local Production, In-Service Training, One Approach," Audio-Visual Instruction, XIII (April, 1968), 345.

[37]Henry F. Cote, "A Mobile Media Center," Audio-Visual Instruction, XIII (September, 1968), 724-25.

[38]N. Ronald Gould, "The Overall Perspective," Education Panorama, XI, No. 3 (1970), 4.

[39]Clarence O. Bergeson, "New Directions for Education--Education for Technology," Audio-Visual Instruction, XII (June-July, 1967), 572-75.

[40]Phil C. Lange, "The Feasibility for Programmed Learning for Developing Countries," Audio-Visual Instruction, XV (April, 1970), 65.

[41]Bob Schwalberg, "New SLR with 1/2,000-Sec Top Speed," Popular Photography, September, 1970, p. 56.

CHAPTER VII

RESEARCH AS A MEANS FOR IMPROVING SCIENCE EDUCATION IN VIETNAM

For serious teachers and curriculum planners, research and experimentation as well as appraisal and evaluation are important processes since they are closely related to effective teaching and instructional planning.

Before delving into the topic, some definitions of terms seem necessary:

Research may be defined as an "approach to a comprehension of the universe along a broad thoroughfare of organized knowledge solidly established on observation and experiment imbedded in a matrix of theory."[1]

Experimentation is a specific research procedure involving the testing of a specific idea or procedure to determine whether it has the desired results in practice. Most classroom researches which are fruitful have been under experimentation form.

Curriculum innovations and changes may be based either on practical experience or on the suggestions of specialists. On the other hand, they may be brought about by experiments conducted in classrooms or school buildings. Both of these situations can be considered as research situations. In the latter, research consists of actual testing by the people involved in the change while in the former, it consists of research reports.

Types of Research

In this chapter, emphasis will be put upon research in which teachers are directly involved. The most familiar researches of this type fall under the category: action research. The term "action research" means that an individual teacher undertakes research to improve his own teaching practices. In this type of research, action and research cannot be separated one from another. Action research can be done by a single individual or by a group of individuals pursuing the same interests. The latter case of multi-investigator approach to research is called cooperative parallel research. The advantages of such an approach to research are studied by Grobman:

> There has been considerable experience in cooperative research efforts within a single project, where different investigators at project headquarters pursue different aspects of the same problem. Under such an arrangement one investigation complements the others, information can be easily shared, and the same experimental groups can be used. For example, the Harvard Project Physics research bibliography reflects a variety of related studies by different investigators at the Project headquarters, each looking into a different but related aspect of the problem of creating and implementing a senior high school physics curriculum.[2]

All research has in common a systematic investigation for more adequate answers to questions or problems, and depending on the kinds of problems tackled, the purposes for the enterprise, the subjects involved, the methodologies employed, and the ultimate applications or generalizations, distinctions among various types of research are made--experimental research, analytic research, descriptive research, and historical research.[3] It has been common practice to separate action research from basic research. The distinctions seem to be primarily in the end purposes and in the individuals involved, but not in the operations involved in the research process nor in the data collecting techniques. Action research generally has for aims, modifications in the professional practices of the researchers themselves while basic research usually aims at the discovery of basic generalizations or truths which the researcher hopes practitioners will apply to their activities. Thus, the chief characteristic of basic research is aiming at broader generalizations and wider application. To make the distinction clearer between those two types of research, Oliver has made up the following comparison table:

A Comparison of Research Types

Action Research

1. Study is <u>within</u> a curriculum.
2. Goal: To improve practices. Investigate to help oneself and co-workers in action.
3. Improved <u>practice</u> building.
4. Take a situation "as is" in the complicated psychosociological climate of school activities.
5. Research generally cooperative effort by all affected by the attempts. "Involvement" is the key.
6. Participants too interested in outcomes to be easily objective; frequently internalize the experience.

7. Teacher "finds" by trying out; thus users participate.
8. Design changed as study develops and indicates a need for a different attack or assumption.
9. Participants study a particular existing "whole population."
10. Results affect people who engage in the activities; they learn what happens in this situation.

Basic Research

1. Study is about the curriculum.
2. Goal: To find the "truth" that will result in broad applicability. Investigate to help others.
3. Theory building. Involves hypothesis to test whether an idea will work.
4. Control the situation to rule out as many variables as possible. Seek to increase confidence in the results by keeping it "pure," that is, remote from the actual situation.
5. Research usually done by an individual or by a small study team of "outsiders."
6. Researchers try to attack problems objectively.
7. Researcher "finds"; teacher then tries it out. Thus users observe.
8. Research kept rigidly to design and, thus, to high degree of precision.
9. Participants seek a "random sample" in order to generalize with more confidence.
10. Results affect others to the extent that they read about it, understand it, and seek to make changes accordingly. Presumably applicable to all similar situations.[4]

For the classroom science teacher concerned with improving the quality of his teaching methods and procedures, the practical need is to use the most appropriate research methodologies in attacking science education problems, and to acquire skills in the research process. Thus, this chapter deals with these following problems:

How can teachers develop necessary competence in educational research processes?

What is the rationale for systematic research in science education? What are needed research topics in this area?

The Understanding of the Research Process and the Developing of Necessary Skills

The aims of research as a process are many: discovering and testing new ideas or practices, establishing causal relationships, or searching for the nature of a particular problem. No clear demarcation line exists between different phases--or steps--of this process; sometimes one phase flows back and forth into another.

As in a problem-solving process, the following phases of a research process can be identified as follows:

1) Recognize a problem.
2) State the problem in clear and concise terms.
3) Formulate hypotheses related to the problem under study.
4) Identify or develop instruments for measuring the variables in the hypotheses.
5) Select a design allowing for the testing of the hypotheses.
6) Choose a data-analysis plan consistent with the design.
7) Collect the data.
8) Analyze the data.
9) Make conclusions based on data.[5]

However, it is only in a controlled laboratory situation that parallelism between problem-solving process and research process is observed. In the classroom situation, the process flow for research usually differs from problem-solving process.

Circumstances leading to classroom research are varied in origins. Some day, a teacher may feel unhappy about a particular aspect of a certain teaching situation and may find ways of improving it. Another teacher may get so excited about several possibilities of solving a problem in his area that he decides to try them out. In the first case, the preliminary phase of the research process may include a clear statement of the problem and its limitations and the proposal of hypotheses concerning the solution of the problem. In the second case, the problem is more clearly defined. In the actual testing phase, one may soon realize that the problem was not clearly analyzed and that further revision is essential before the hypotheses can be reformulated and tested.

Thus, classroom research can be better understood and carried out if it is viewed as a flexible process, subjected to readjustments, and not an orderly-rigid process to be followed step by step. In order to enhance the research validity, great care should be given to different operations in each step of the research process.

Rationale for Systematic Research in Science Education in Vietnam

In order to determine what research is needed for science education in Vietnam, it is first necessary to identify the areas in which current and previous research have concentrated.

In Vietnam, educational research has been conducted by the Directorate of Teacher Education and the Thu-Duc pilot comprehensive high school as well as by the Education Science Institute.[6] Most researches conducted by these organizations belong to the following types: 1) Status studies, 2) Method studies.

In the area of Science Education, status studies encompass surveys of current practices in teaching particular science subjects; surveys of teacher supply and demand; content analyses of science textbooks; determination of trends relative to the content and the teaching of science. Thus, status studies give a picture of the present state of science teaching and other things pertaining to it. Comparisons which are made between periodical reports reveal progress or changes that have occurred in the past and may suggest changes in the future.

Method studies concentrate for the most part upon comparison between teaching methods: traditional method (lecture method) vs. discovery-inquiry method; laboratory vs. demonstration.

These studies describing present status, teaching procedures are certainly valuable. But their very limited nature--impossible replications, low internal and external validity--does not allow for broad application of the research results.

If a sound body of knowledge about science education is to be developed, what new approaches ought to be used? The principal purpose of educational research is the establishment of reliable predictive systems based upon laws and principles applicable to the basic problem of maximizing learning in the schools. But the development of laws and principles which govern effective teaching and learning of science will require research far more basic and meaningfully significant than most previous and current researches.

Suggested Areas for Science Education Research in Vietnam

The "whole problem" of teaching and learning of science is a complex one, due to all the teacher-pupil complex interactions, the vast domain to be considered and the extreme variety of teaching-learning environments. It is therefore a much easier task to deal--instead of with the whole problem--with specific aspects of the "whole" and draw from them principles which are more general in character. And then, bit by bit, a science of science education can be constructed from the peacemeal combination of these discovered principles.

Specific areas in science education which need more research include:

1) <u>Cognitive learning in science</u>: The learning process includes both the readiness of each learner and the structure of the subject. Teaching is then the procedure by which we facilitate this learning. A continual study of the complex processes involved in the learning of sciences provides an adequate basis on which to define, investigate or appraise science-teaching methods.

In order to understand these learning processes, close cooperation between practical educators and research psychologists is necessary. For example, in the United States, from 1890 to 1920, experimental psychologists who did research on intellectual development, or on problems fundamental to the understanding of intellectual learning in schools, helped a great deal in the shaping of educational developments, theories and methods.

A large body of literature related to how people (or children) think has been developed by Russell, Bruner and Vinacke in the United States.[7]

Piaget in Geneva has tried to investigate the ways children learn in schools.[8] One flaw in Piaget's work is that he provides so little information about the individual child: his intellectual ability, sex, age, school background, socio-economic status and other less obvious attributes. However, he has the merit of pointing out that studies of the thinking processes of young children are easier than those dealing with adolescents. Young children are so candid, open and revealing in their thoughts and actions that conclusions regarding how they learn are likely to be valid. Studies on adolescents' thinking processes are more complicated due to the partial (or total) lack of those qualities found in younger children. Although young children and adolescents do not learn in exactly the same manner, inferences drawn from studies with young children may shed light on what to investigate and how to proceed with older children.

Since learning processes are so complex, a stepwise approach to research in Science Education is recommended. First, a detailed study of a few children might suggest plausible hypotheses about the ways children learn specific aspects of science. Second, test these hypotheses using larger groups of children.

Reports of such exploratory experiments must be made with enough detail so that other experimenters could understand and replicate them if they wish. The vocabulary used in describing the processes involved must be defined in operational terms.

Difficulties of the research in the area of cognitive learning in science pertain to the difficulty that arises in the defining and the studying of such general aspects as "critical thinking," "scientific attitudes and methods," etc. In order to avoid those difficulties dealing with the "too general," let's limit ourselves to the study of specific aspects or tasks of learning such as those involved with specific scientific principles, giving thereby more stable and meaningful results.

2) Planning and operating science courses: Effective planning of science courses needs a complete understanding of how children learn science concepts, which most teachers do not have. But such a complete knowledge of science learning processes is not available from research. The task of researchers in this area--designing of planning schemes for science courses--is therefore to apply the principles of existing knowledge about the learning processes to the designing of such schemes. Such researches are justified by the urgent need of teachers of having "some framework which will aid them in making explicit in advance the objectives of each day's classroom activities, the nature of the experiences to be used to evoke the desired learning, and the behavior reactions sought from pupils as overt evidence that learning has occurred."[9]

Several other suggestions regarding other aspects of this research area are made by Watson and Cooley:

> A second problem to investigate is whether or not teachers can design such plans with validity and use them effectively. Another research approach would be to test the ability of other teachers to read the script and visualize the pupil behaviors. If formats can be found which are psychologically sound and do, in fact, facilitate the planning of lessons, and if the resulting plans are intelligible to science teachers, such formats will certainly contribute to the improvement of the teaching of science. Since we can write poetry, music, and

> modern dance in symbols, surely we should be able to write at least a rudimentary description of teaching.[10]

3) Evaluation of learning outcomes: Thorough investigation should be pursued. The need for research in this area was stressed by Reiner:

> A great deal of research remains to be done in evaluation in science teaching. Evaluation is broader in scope than measurement or testing. Problems in science evaluation, some new and many old, were presented in connection with objectives in learning. Special programs such as the activity and core types present new problems. Evaluating pupils of various age and ability levels present both new and old problems. Testing techniques, norms, validity, and reliability require study and experimentation. . . . Research in science evaluation requires the writing of tests, their use, and a careful analysis of the obtained results. This is a very laborious project and is best accomplished by committees pooling and sharing resources of information, talent, and secretarial help.[11]

4) Teacher personality and student personality: Another area in science education which needs research is related to the effect of teacher's personality on science learning in secondary school. Differences in teacher personality allow us to do comparative studies to establish criteria for effective teaching in terms of good teacher personality variables. Such studies have been listed in an annotated bibliography set up by Dumas and Tiedeman.[12] But much remains to be done in this area.

Another topic for research is the career development of teachers. One approach is to follow the procedures which were used in studying the career development of scientists. One may also think of using autobiographies of experienced science teachers as preliminary exploratory studies. However, rarely do we see such science analogs of "How Children Fail."[13] Attitudes of science teachers toward their career--whether they choose their teaching career for economic reasons or for love of science teaching--may have important repercussion on students' performance in science learning; such studies of effects of attitudes of teachers on student learning were done by Taylor[14] in 1957.

As teachers may differ in personalities, so do the students. There are students who learn science at a faster rate than others, and these are also the "future scientists"--those who may embrace a scientific career later on--and the "non-scientists"--those who just need a minimum of science knowledge to survive in this modern world. Topics for research on this area--student's personality--would include, for example, possible answers to this question: How and why can we distinguish between the future scientists and the non-scientists in our schools or in their home environments.

FOOTNOTES FOR CHAPTER VII

[1]Palmer O. Johnson, "Introductory Remarks at Opening of the Symposium on Educational Research," in First Annual Phi Delta Kappa Symposium on Educational Research, ed. by Frank W. Banghart (Bloomington, Ill.: Phi Delta Kappa, Inc., 1960), p. xv.

[2]Hulda Grobman, "Cooperative Parallel Research," The Science Teacher, XXXVII (February, 1970), 39.

[3]Gilbert Sax, Empirical Foundations of Educational Research (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1968), pp. 35-37. See also, Deobold B. Van Dalen, Understanding Educational Research: An Introduction (rev. ed., New York: McGraw-Hill Book Co., 1966), pp. 176-202.

[4]Albert I. Oliver, Curriculum Improvement: A Guide to Problems, Principles and Procedures (New York: Dodd, Mead and Company, 1965), pp. 80-81.

[5]Adapted from David J. Fox, The Research Process in Education (New York: Holt, Rinehart and Winston, Inc., 1969), p. 30.

[6]Vietnam (Republic), Ministry of Education, Educational Developments 1968-1970 (Saigon, Vietnam: Ministry of Education), p. 45.

[7]See J. S. Bruner, J. Goodnow and G. A. Austin, The Study of Thinking (New York: John Wiley and Sons, Inc., 1956). See also David H. Russell, Children's Thinking (Boston: Ginn and Co., 1956), and William E. Vinacke, The Psychology of Thinking (New York: McGraw-Hill Book Co., 1952).

[8]Jean Piaget and Bärbel Inhelder, The Growth of Logical Thinking from Childhood to Adolescence, translated by Parsons and Milgram (New York: Basic Books, 1958).

[9]Fletcher G. Watson and William W. Cooley, "Needed Research in Science Education," in Rethinking Science Education, Fifty-ninth Yearbook of the National Society for the Study of Education, Part I, ed. by Nelson B. Henry (Chicago, Illinois: The University of Chicago Press, 1960), p. 303.

[10]*Ibid.*, pp. 303-304.

[11]William B. Reiner, "Needed Research in Evaluation in Science Teaching," *Science Education*, XXXVII (February, 1953), 69.

[12]S. J. Dumas and D. V. Tiedeman, "Teacher Competence: An Annotated Bibliography," *Journal of Experimental Education*, XIX (1950), 101-218.

[13]John Holt, *How Children Fail* (New York: Pitman Publishing Corporation, 1964).

[14]Thomas Wayne Taylor, "Relationships between Growth in Interest and Achievement of High-School Science Students and Science Teacher Attitudes, Preparation, and Experience," doctoral thesis (Denton, Texas: North Texas State College, 1957).

CHAPTER VIII

CONCLUSION

The "dramatic increase of new knowledge in science"[1] more or less forces science teachers to renew their background in science to keep them up to date. This could be achieved through teachers' frequenting science libraries or taking courses at neighboring universities.

However, mere possession of knowledge is not enough to secure good teaching. Modern methods of teaching science, making use of new findings in psychology and of latest innovations in educational technology, should also be considered by serious science teachers. Those teachers who are constantly seeking systematic ways to improve their instructional methods and procedures--for example, through teachers' participation at summer workshops or in various in-service teacher training programs--are likely to grow and add dignity to their profession more than those who just rely upon a good teaching personality.

Thus, in our modern times, personality is not enough. As John Dewey says:

> Here is the answer to those who decry pedagogical study on the ground that success in teaching and in moral direction of pupils is often not in any direct ratio to knowledge of educational principles.

> Here is "A" who is much more successful than "B" in teaching, awakening the enthusiasm of his students for learning, inspiring them morally by personal example and contact, and yet relatively ignorant of educational history, psychology approved methods, etc., which "B" possesses in abundant measure. The facts are admitted. But what is overlooked by the objector is that the successes of such individuals tend to be born and to die with them: beneficial consequences extend only to those pupils who have personal contact with such gifted teachers. No one can measure the waste and loss that have come from the fact that the contributions of such men and women in the past have been thus confined, and the only way by which we can prevent such waste in the future is by methods which enable us to make an analysis of what the gifted teacher does intuitively, so that something accruing from his work can be communicated to others. . . .
>
> The existence of scientific method protects us also from a danger that attends the operations of men of unusual power; the danger of slavish imitation partisanship, and such jealous devotion to them and their work as to get in the way of further progress.
>
> Anybody can notice today that the effect of an original and powerful teacher is not all to the good. Those influenced by him often show a one-sided interest; they tend to form schools, and to become impervious to other problems and truths; they incline to swear by the words of their master and to go on repeating his thoughts after him, and often without the spirit and insight that originally made them significant. Observation also shows that these results happen oftenest in those subjects in which scientific method is least developed. Where these methods are of longer standing students adopt methods rather than merely results, and employ them with flexibility rather than in literal reproduction. . . .
>
> Command of scientific methods and systematized subject-matter liberates individuals; it enables them to see new problems, devise new procedures, and, in general, makes for diversification rather than for set uniformity. But at the same time these diversifications have a cumulative effect in an advance shared by all workers in the fields.[2]

Those new media and methods discussed in this study provide the Vietnamese science teacher in the secondary school with necessary tools to improve his daily teaching. Which tools he would use under a particular situation depends on whether they suit his teaching purpose or not:

> How should you teach? No one can tell you exactly. To beginning teachers, I usually say, "Here are twenty ways in which you can approach topics in science. Which one would you choose?" Of course, this is a simplification, because there must be unlimited ways of teaching. Part of the infinite variety depends on the materials used--the specimens, models, pictures, and apparatus; part depends on the immediate goal that the teacher has in mind. Sometimes he wants pupils to develop technical skills for a world based on technology. Sometimes he is concerned that they gain insight into the methods of the practising scientist. Sometimes he insists that the new generation fashion a literacy in current scientific thought, or, to speak plainly, that pupils must know things. Some teachers encourage their scholars to be self-reliant and independent by making research possible. Some link science with the machines of our age. Others pioneer with new devices and new methods. In truth, no one teacher always teaches in one way. He uses different methods with different topics at different times with different students. Your teaching ways will be of your own choosing and of your own decision. Teaching is what you make it.[3]

To help the science teacher in accurately determining his choice of media or methods a thorough understanding of instructional objectives[4] is necessary. Furthermore, specific instructional objectives should always be in line with the teacher's philosophy and general goals of education. Thus, armed with well-defined goals in mind, the science teacher is more likely to be successful in his work, since he knows where to go and how to reach his destination--using suitable media and methods. In using new media and methods, teachers should also strive to avoid this common pitfall:

becoming method-oriented rather than problem-oriented. The danger of becoming method-oriented has been revealed by John R. Platt in these following terms:

> To paraphrase an old saying, Beware of the man of one method or one instrument, either experimental or theoretical. He tends to become method-oriented rather than problem-oriented. The method-oriented man is shackled; the problem-oriented man is at least reaching freely toward what is most important.[5]

He went on further, offering a cure for the method-orientation disease:

"Strong inference redirects a man to problem-orientation, but it requires him to be willing repeatedly to put aside his last methods and teach himself new ones."[6]

In summary, a science teacher who knows how to keep abreast of latest developments in his field, who possesses specific educational objectives in mind and the necessary skills and techniques to achieve these objectives, who is problem-oriented instead of method-oriented, and finally, who forges himself into a dynamic personality which may inspire and stimulate his students, merits to be called a professional science teacher.

> It is not the possession of a degree or of a state certificate, or even of this or that particular skill or bit of knowledge that distinguishes the professional teacher from sub-standard teachers of science. The professional science teacher is distinguished rather by overall pattern of preparation, thought, and action: by what he knows about students and science and education; by what he can do to encourage and enhance learning; by what he believes about the relationships between himself, his students, the school, the local and world communities, and scientific enterprise; and, above all, by what he does and does not do.[7]

FOOTNOTES FOR CHAPTER VIII

[1]Joseph D. Novak, "Importance of Conceptual Schemes for Science Teaching," The Science Teacher, XXXI (October, 1964), 10.

[2]John Dewey, The Sources of a Science of Education (New York: Horace Liveright, 1929), pp. 10-13.

[3]Norman B. Massey, Patterns for the Teaching of Science (Toronto: McMillan Co. of Canada, Ltd., 1965), p. 3.

[4]R. F. Mager, Preparing Instructional Objectives (Palo Alto, California: Fearon Publishers, 1962). The topic of instructional goals is also well treated in the book written by W. James Popham and Eva L. Baker, Establishing Instructional Goals (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1970).

[5]John R. Platt, "Strong Inference," Science, CILVI, No. 3642, 351.

[6]Ibid., p. 351.

[7]National Science Teachers Association, Annual Self-Inventory for Science Teachers in Secondary Schools (1st ed., Washington, D.C., July 18, 1970), p. 1.

BIBLIOGRAPHY

Alyea, Hubert N. "Tested Overhead Projection Series." _The Science Teacher_, XXIX (March, April, September, October, November, December, 1962), 28-31, 10-16, 14-21, 14-21, 14-21, 44-51.

Association for Science Education. _Teaching Science at the Secondary Stage_. London, England: John Murray, 1967.

Barnard, J. Darrell. "Teaching High School Science." _What Research Says to the Teacher_, No. 10. Washington, D.C.: National Education Association, 1956.

Bergeson, Clarence O. "New Directions for Education--Education for Technology." _Audio-Visual Instruction_, XII (June-July, 1967), 572-75.

Blanc, Sam S. "Vitalizing the Classroom: Slides, Filmstrips, and Films." _School Science and Mathematics_, LIII (April, 1953), 255-58.

Bloom, Benjamin S., ed. _Taxonomy of Educational Objectives. Handbook I: Cognitive Domain_. New York: Longmans, Green and Co., 1956.

Brandwein, Paul F.; Watson, Fletcher G.; and Blackwood, Paul E. _Teaching High-School Science: A Book of Methods_. New York: Harcourt, Brace and Co., 1958.

Bruner, J. S.; Goodnow, J.; and Austin, G. A. _The Study of Thinking_. New York: John Wiley and Sons, Inc., 1956.

Burnett, R. Will. _Teaching Science in the Secondary Schools_. New York: Rinehart and Co., Inc., 1957.

Buttinger, Joseph. _The Smaller Dragon: A Political History of Vietnam_. New York: Frederic A. Praeger, 1958.

Carleton, Robert H. "Physics Hazard, Math Hazard or Teacher Hazard." _The Science Teacher_, XXII (September, 1955), 173-75.

Coleman, Larry. "Local Production, In-service Training, One Approach." Audio-Visual Instruction, XIII (April, 1968), 345-47.

Comité de l'Asie Française. "L'enseignement superieur en Indochine." L'Asie Française, January-April, 1918, pp. 28-30.

Cornthwaite, D. L. "The Solar System." Baltimore Bulletin of Education, XXIX (March-May, 1951), 43.

Cote, Henry F. "A Mobile Media Center." Audio-Visual Instruction, XIII (September, 1968), 724-25.

Dale, Edgar. Audio-Visual Methods in Teaching. Rev. ed. New York: The Dryden Press, September, 1955.

Đặng, Nghiêm. Vietnam: Politics and Public Administration. Honolulu: East-West Center Press, 1966.

Davidson, Norman. "Corkball Experiment on Crystalline and Molecular Structure." Journal of Chemical Education, XXIX (May, 1952), 249-50.

Dewey, John. The Sources of a Science of Education. New York: Horace Liveright, 1929.

Downey, Lawrence W. The Secondary Phase of Education. New York: Blaisdell, 1965.

Dumas, S. J., and Tiedeman, D. V. "Teacher Competence: An Annotated Bibliography." Journal of Experimental Education, XIX (1950), 101-21.

Duncanson, Dennis J. Government and Revolution in Vietnam. New York and London: Oxford University Press, 1968.

Ennis, Robert H. "Concept of Critical Thinking." Harvard Educational Review, XXXII, No. 1 (1962), 81-111.

Ennis, Thomas E. French Policy and Developments in Indochina. Chicago: The University of Chicago Press, 1936.

Fall, Bernard B. The Two Viet-Nams. 2nd ed. New York: Frederick A. Praeger, 1967.

Fox, David J. The Research Process in Education. New York: Holt, Rinehart and Winston, Inc., 1969.

Freedman, Florence B., and Berg, Esther L. Classroom Teacher's Guide to Audio-Visual Material. New York: Chilton Books/Educational Division, 1967.

Garnier, Jacques. "La Conquête." Histoire Populaire des Colonies Françaises: L'Indochine. Edited by Albert De Pouvourville. Paris: Editions du Vélin d'Or, 1932.

Good, Carter V., ed. Dictionary of Education. 2nd ed. New York, Toronto, London: McGraw-Hill Co., 1959.

Gould, Ronald. "The Overall Perspective." Education Panorama, XI, No. 3 (1970), 4.

Gourdon, Henri. "L'Oeuvre Sociale et Intellectuelle." Un Empire Colonial Francais: l'Indochine. II. Edited by M. Georges Maspero. Paris et Bruxelles: Editions G. Van Oest, 1930.

Grobman, Hulda. "Cooperative Parallel Research." The Science Teacher, XXXVII (February, 1970), 38-40.

Heiss, Elwood D.; Obourn, Ellsworth S.; and Hoffman, Charles W. Modern Science Teaching. New York: Macmillan Co., 1950.

Henry, Nelson B., ed. Science Education in American Schools, Forty-sixth Yearbook, Part I, National Society for the Study of Education. Chicago: The University of Chicago Press, 1947.

Hilgart, Ernest. Theories of Learning. New York: Appleton-Century-Crofts, 1956.

Hoban, Charles F.; Finn, James D.; and Dale, Edgar. "Audio-Visual Materials" in Encyclopedia of Educational Research. Ed. by Walter S. Monroe. Rev. ed. New York: Macmillan Co., 1950, pp. 84-97.

Hoff, Arthur G. Secondary-School Science Teaching. Philadelphia: Blakiston Co., 1947.

Holt, John. How Children Fail. New York: Pitman Publishing Corporation, 1964.

Hunter, George W. Science Teaching at Junior and Senior High School Level. New York: American Book Co., 1934.

Johnson, Palmer O. "Introductory Remarks at Opening of the Symposium on Educational Research." First Annual Phi Delta Kappa Symposium on Educational Research, ed. by Frank W. Banghart. Bloomington, Illinois: Phi Delta Kappa, Inc., pp. xv-xvi.

Joseph, Alexander, and others. Teaching High-School Science: A Sourcebook for the Physical Sciences. New York: Harcourt, Brace and World, Inc., 1961.

Kemp, Jerold E. Planning and Producing Audio-Visual Materials. San Francisco, Calif.: Chandler Publishing Co., 1963.

Kim, Trần Trong. Vietnam Su-Luoc. Saigon, Vietnam: Tân Việt, 1958.

Knirk, Frederick G. "Technology and Curriculum Planning: Cost-Effectiveness of Instruction." Audio-Visual Instruction, XIII (March, 1968), 260-62.

Krathwohl, David R.; Bloom, Benjamin S.; and Masia, Bertram B. Taxonomy of Educational Objectives, Handbook II: Affective Domain. New York: David McKay Company, Inc., 1964.

Kuslan, Louis I., and Stone, A. Harris. Teaching Children Science: an Inquiry Approach. Belmont, California: Wadsworth Publishing Company, Inc., 1968.

Lange, Phil C. "The Feasibility for Programmed Learning for Developing Countries." Audio-Visual Instruction, XV (April, 1970), 65-67.

Lee, Eugene C. New Developments in Science Teaching. Belmont, California: Wadsworth Publishing Co., Inc., 1967.

Lippmann, Walter. Public Opinion. New York: Macmillan Co., 1949.

Macomber, Robert D. "Chemistry Accidents in High School." Journal of Chemical Education, XXXVIII (July, 1961), 367-68.

Mager, R. F. Preparing Instructional Objectives. Palo Alto, California: Fearon Publishers, 1962.

Massey, Norman B. Patterns for the Teaching of Science. Toronto: Macmillan Co. of Canada, Ltd., 1965.

McLuhan, Marshall. Understanding Media: the Extension of Man. 2nd ed. New York: New American Library, 1964.

Miller, Elwood E. "Single Concept Film: Criteria for Clipping." Audio-Visual Instruction, XII (January, 1967), 36-38.

Mills, Lester, and Dean, Peter M. Problem-Solving Methods in Science Teaching. New York: Bureau of Publications, Teachers College, Columbia University, 1960.

Minor, Ed, and Frye, Harvey R. Techniques for Producing Visual Instructional Media. New York: McGraw-Hill Book Co., 1970.

National Academy of Sciences, National Research Council. Guidelines for Development of Programs in Science Instruction. Washington, D.C., 1963.

National Science Teachers Association. Annual Self-Inventory for Science Teachers in Secondary Schools. Washington, D.C., July 18, 1970.

Neal, Alan S. "Viewing Conditions for Classroom TV: An Objective Study." Audio-Visual Instruction, XIII (September, 1968), 707-709.

Norman, Davidson. "Corkball Experiment on Crystalline and Molecular Structure." Journal of Chemical Education, XXIX (May, 1952), 249-50.

Novak, Alfred. "Scientific Inquiry in the Laboratory." The American Biology Teacher, XXV (May, 1963), 342-46.

Novak, Joseph D. "Importance of Conceptual Schemes for Science Teaching." The Science Teacher, XXXI (October, 1964), 10.

Oliver, Albert I. Curriculum Improvement: A Guide to Problems, Principles and Procedures. New York: Dodd, Mead and Company, 1965.

Owen, Archie M. "Selecting Science Textbooks." The Science Teacher, XXIX (November, 1962), 20-23.

Pella, Milton O. "The Laboratory and Science Teaching." The Science Teacher, XXVIII (September, 1961), 20-31.

Physical Science for Nonscience Students (PSNS) staff. *An Approach to Physical Science*. New York: John Wiley and Sons, Inc., 1969.

Piaget, Jean, and Barbel, Inhelder. *The Growth of Logical Thinking from Childhood to Adolescence*, translated by Parsons and Milgram. New York: Basic Books, 1958.

Pimentel, George C., ed. *Chemistry: an Experimental Science* (CHEMS). San Francisco: W. H. Freeman and Company, 1967.

Poirier, M. "La Politique d'Education en Indochine." *L'Asie Française*, June, 1913, 265-71.

Popham, W. James, and Baker, Eva L. *Establishing Instructional Goals*. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1970.

Platt, John R. "Strong Inference." *Science*, CXLVI (October, 1964), 347-53.

Rawlins, Jr., George M. "Safety in High School Chemistry." *School Science and Mathematics*, LXXXIV (October, 1964), 608-12.

Reiner, William B. "Needed Research in Evaluation in Science Teaching." *Science Education*, XXXVII (February, 1953), 61-69.

Richardson, John S. *Science Teaching in Secondary Schools*. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1957.

Russell, David H. *Children's Thinking*. Boston: Ginn and Co., 1956.

Sarraut, Albert. "Les Cinq Pays de l'Union." *Histoire Populaire des Colonies Françaises: l'Indochine*. Edited by Albert De Pouvourville. Paris: Editions du Vélin d'Or, 1932.

Sax, Gilbert. *Empirical Foundations of Educational Research*. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1968.

Schwab, Joseph J. *The Teaching of Science as Enquiry*. Cambridge, Massachusetts: Harvard University Press, 1962.

Schramm, Wilbur. "The Publishing Process," in Lee J. Cronbach, ed. Text Materials in Modern Education. Urbana, Illinois: University of Illinois, 1955, pp. 145-55.

Schwalberg, Bob. "New SLR with 1/2000 sec Top Speed." Popular Photography, September, 1970, pp. 56-60, 164.

Shannon, Claude E., and Weaver, Warren. The Mathematical Theory of Communication. Urbana, Illinois: The University of Illinois Press, 1964.

Slabaugh, W. H. "A Lecture Demonstration of Nuclear Energy." Journal of Chemical Education, XXV (December, 1948), 679-80.

Smith, Edward W.; Krouse, Jr., Stanley W.; and Atkinson, Mark M. The Educator's Encyclopedia. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1961.

Smith, Herbert A. "Determination of the Relative Effectiveness of Sound Motion Pictures and Equivalent Teacher Demonstrations in Ninth Grade General Science." Science Education, XXXIII (April, 1949), 214-22.

Sund, Robert B., and Trowbridge, Leslie W. Teaching Science by Inquiry in the Secondary School. Columbus, Ohio: Charles E. Merrill Books, Inc., 1967.

Taylor, Thomas Wayne. "Relationships between Growth in Interest and Achievement of High School Science Students and Science Teacher Attitudes, Preparation, and Experience." Unpublished Doctoral dissertation. Denton, Texas: Texas State College, 1957.

Thurber, Walter A., and Collette, Alfred T. Teaching Science in Today's Secondary Schools. 2nd ed. Boston: Allyn and Bacon, Inc., 1965.

UNESCO. World Survey of Education, III. New York: International Documents Service, Columbia University Press, 1961.

UNESCO. World Survey of Education, IV. New York: International Documents Service, Columbia University Press, 1966.

Van Dalen, Deobold B. Understanding Educational Research: An Introduction. Rev. ed. New York: McGraw-Hill Book Co., 1966.

Vinacke, William E. The Psychology of Thinking. New York: McGraw-Hill Book Co., 1952.

Vogel, Louis F. "A Spot-check Evaluation Scale for High-School Science Textbooks." The Science Teacher, XVIII (March, 1951), 70-72.

Van Valkenburgh, Nooger, and Neville, Inc. Basic Electricity (5 vol.). New York: Rider Publisher, Inc. (1953-1955).

Van Valkenburgh, Nooger, and Neville, Inc. Basic Electronics (6 volumes). New York: Rider Publisher, Inc. (1955-1959).

Washton, Nathan S. Science Teaching in the Secondary School. New York: Harper and Brothers, 1961.

Washton, Nathan S. Teaching Science Creatively in the Secondary Schools. Philadelphia: W. B. Saunders Co., 1967.

Watson, Fletcher, and Cooley, William W. "Needed Research in Science Education." Rethinking Science Education, Fifty-Ninth Yearbook of the National Society for the Study of Education, Part I., ed. by Nelson B. Henry. Chicago: The University of Chicago Press, 1960.

Whipple, Guy Montrose, ed. Textbook in American Education. Thirtieth Yearbook of the National Society for the Study of Education, Part II. Bloomington, Illinois: Public School Publishing Co., 1931.

Wingo, Walter. "More Chemists Die Young." Science Newsletter, LXXXIV (September 28, 1963), 199.

Wittich, Walter A., and Schuller, Charles F. Audio-Visual Materials: Their Nature and Use. 4th ed. New York: Harper and Row, 1967.

Woods, H. A. "Problems of the Foreign Language Lab Director." Audio-Visual Instruction, XIII (May, 1968), 457-59.

Documents and Government Publications

Direction Générale de l'Instruction Publique. L'Annam Scolaire. Hanoi: Direction Generale de l'Instruction Publique, 1931.

SouthEast Asian Ministers of Education Organization (SEAMEO). Education: the Challenge and Promise of SouthEast Asia. Bangkok, Thailand: SEAMES, c/o Ministry of Education, 1970.

UNESCO. International Yearbook of Education, XXI, 1959. Paris and Geneva: Unesco and International Bureau of Education, 1959, pp. 490-95.

UNESCO. International Yearbook of Education, XXII, 1960. Paris and Geneva: Unesco and International Bureau of Education, 1960, pp. 456-60.

UNESCO. International Yearbook of Education, XXVI, 1964. Paris and Geneva: Unesco and International Bureau of Education, 1964, pp. 382-84.

UNESCO. International Yearbook of Education, XXVII, 1965. Paris and Geneva: Unesco and International Bureau of Education, 1965, pp. 399-403.

UNESCO. International Yearbook of Education, XXIX, 1967. Paris and Geneva: Unesco and International Bureau of Education, 1967, pp. 476-79.

Vietnam (Republic). Annuaire Statistique de l'Enseignement, 1958-1960. Saigon: Ministry of Education, 1960. 126 p.

Vietnam (Republic). Annuaire Statistique de l'Enseignement, 1960-1961. Saigon: Ministry of Education, 1961. 88 p.

Vietnam (Republic). Annuaire Statistique de l'Enseignement, 1961-1962. Saigon: Ministry of Education, 1962. 100 p.

Vietnam (Republic). Annuaire Statistique de l'Enseignement, 1962-1964. Saigon: Ministry of Education, 1964. 96 p.

Vietnam (Republic). Annuaire Statistique de l'Enseignement, 1964-1965. Saigon: Ministry of Education, 1965. 63 p.

Vietnam (Republic). Annuaire Statistique de l'Enseignement, 1965-1967. Saigon: Ministry of Education, 1967. 131 p.

Vietnam (Republic). Annuaire Statistique de l'Enseignement, 1967-1968. Saigon: Ministry of Education, 1968. 64 p.

Vietnam (Republic). Annuaire Statistique de l'Enseignement, 1968-1969. Saigon: Ministry of Education, 1969. 64 p.

Vietnam (Republic). Chương trình Trung học 1965. Saigon: Ministry of Education, 1965. 167 p.

Vietnam (Republic). Chương trình Trung học 1970. Saigon: Ministry of Education, 1970. 207 p.

Vietnam (Republic). Educational Developments 1968-1970. Saigon: Ministry of Education, 1970. 53 p.

Vietnam (Republic). Instructional Materials Center, Vietnam National Innotech Center. Saigon 5: 240 Tran Binh Trong, October, 1970. 12 p.

Vietnam (Republic). Progress of Education in Vietnam During the School-Year 1966-1967. Saigon: Ministry of Education, 1967. 43 p.

Vietnam (Republic). "Report [unpublished] on the UNESCO In-service Training for Book Publication in Asia from September 11 to December 1, 1970." (Typewritten). 4 p.

Vietnam (Republic). Situation de l'Enseignement au Vietnam, 1969-1970 (2nd trimestre). Saigon: Ministry of Education, 1970. 43 p.

Vietnam (Republic). Some Features of the University of Saigon, 1917-1971. Saigon: Ministry of Education, 1970.