THE STATUS OF PHYSICS TEACHING IN THE ARMENIAN SECONDARY SCHOOLS OF LEBANON

by

Hovhannes H. Havounjian

Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Arts in the
Education Department of the
American University of Beirut
Beirut, Lebanon
June, 1968

THE AMERICAN UNIVERSITY OF BEIRUT

Thesis Title:

THE STATUS OF PHYSICS TEACHING IN THE ARMENIAN SECONDARY SCHOOLS OF LEBANON

by

Hovhannes H. Havounjian

Approved:

Wadi' D. Haddad

Dr. Wadi' D. Haddad, Advisor

Yakub Namek

Dr. Yakub Namek, Member of Committee

G. Za'rour

Dr. George Za'rour, Member of Committee

Date of Thesis Presentation: May 28, 1968

STATUS OF PHYSICS TEACHING

HAVOUNJIAN

ACKNOWLEDGMENTS

In the preparation of this thesis valuable help was extended to me by various sources. I am particularly indebted to the professors of Science Education at the Education Department for their guidance and invaluable suggestions throughout the preparation of the thesis.

I am grateful to the School Directors of the fourteen Armenian Secondary Schools of Lebanon that assisted me to carry out the research by providing data about the schools and encouraging the teachers to answer the questionnaires addressed to them. My gratitude is also extended to the sample of Physics Teachers that willingly devoted some of their valuable time to respond to the Questionnaires, without which it was impossible to complete my work.

I must also express my gratitude to the administeration of the Armenian Evangelical Secondary School in Bourj Hamoud for the schedule arrangements that enabled me to meet with my advisors. In particular, the facilities of the office were of great help in mimeographing the questionnaires and typing of the thesis itself. I am obliged to the two secretaries of the school that mimeographed the questionnaires and typed the final copy of the thesis. Finally, I want to thank the group of my Senior Students that worked diligently and scrupulously to tabulate the responses of the questionnaires.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF GRAPHS

CHAPTER I

INTRODUCTION

A. Background

My eight years of experience as a physics teacher in two Armenian Secondary Schools of Lebanon have revealed to me some aspects of teaching which have not received due consideration by educators. The aspect I am refering to can be defined as a problem. The following graphic representation of the problem will be submitted. The school as an educational institution is comprised of three elements; the material, the human, and the functional. The material element - consisting of buildings, equipment, and devices - is the setting for the educational process. The human element - consisting of the teaching staff and the student body - act out the educative process. The functional element - generated by policies, programs, and plans - actuates the educational process. A continual reconstruction of these elements would be a necessary condition for the integral functioning of the educative process.

Such a graphic presentation of the school helps in discerning three sets of variables. Moreover, it would enable us to realize that these variables, although classified into three categories, are not independent of each other. The relation between these three sets of factors may not necessarily be one of cause and effect, but certainly it is one of concomitant variation.

To shed more light on the problem, let us illustrate an aspect of the problem. The psychological principles and techniques acquired by a teacher are not of great effect in a traditional educational system; on the other hand, modifying or improving a program will not, of itself, achieve much, if it were not carried

out by competent teachers. In the beginning of my career I was struck by the fact that some teachers with Normal Diploma, and still others having done graduate work in education, were caught in the routines of the traditional webb. As for myself, even though I was regarded as the torch-bearer of progressive education in the schools where I taught, I find the task too heavy to be carried by individual teachers. To use a simile, it is like putting new cloths on old rags.

For the last decade - particularly the last three years - most of the Armenian Secondary Schools of Lebanon were involved in extensive reorganization of their curricula. The reorganization of the curriculum was mainly along lines of adapting it to the Lebanese Baccalaureate Program.

A cursory examination of the programs and schedules of the Armenian Secondary Schools of Lebanon would reveal that the majority have not adopted the Baccalaureate Program in the form issued by the government. Only in the sixth grade are the programs approximating the official one. In some of the schools, the only palpable step that has been taken is the use of text-books written by the teachers involved in the Baccalaureate Program. In others, it is put in the hands of teachers who boast about several years of teaching experience.

The transition period through which almost all of the Armenian Secondary Schools are passing - some have just begun, others are heading towards stability - provides an ideal background exhibiting all the conditions of the problem stated at the beginning. My direct involvement in the reorganization of the curriculum of two schools, and the first hand information I can get from the rest, provides me with insight and practical access to information to investigate this problem. This is why I would be considering the Armenian Secondary Schools. Another factor limiting the problem is that I will confine my investigation mainly to the teaching of Physics.

In preparation for my research - and as part of it - I

have taken the following preliminary steps. I have consulted some of my friends who are physics teachers in the Armenian secondary schools. We have discussed their practical problems and my theoretical inquiries. We have considered the text-books they use, the tests they prepare, the Audio-visual materials they use, and the laboratory apparatus they utilize. In addition to these personal contacts, I have perused some pertinent literature. I could not find any literature expressly on the teaching of physics in the Armenian Secondary Schools of Lebanon. Few writings that have some pertinence to the problem, have approached it from the vantage point of unwarranted assumptions and speculative conjecture. However, there were several M. A. theses written about the subject of science teaching that were of particular help. Some of these were helpful in choosing the tools of my research, others provided me with guide-lines for the format in presenting the results of my research. A list of some of these theses will be included in the bibliography.

B.- Purpose and Significance

The purpose of this research would be to investigate the ramifications of the problem presented at the first section of this chapter. The investigation will be by shedding light on the three elements of the educative process: the material, the human, and the functional. Specifically, the purpose of this study is to survey the status of physics teaching in the Armenian Secondary Schools of Lebanon. This purpose is realized in determining the following:

1. Teachers' education and experience
2. Physics programs
3. Physics teaching methods
4. Physics facilities used in schools
5. Evaluative schemes in the teaching of physics

I do not claim that the picture of physics teaching in the Armenian Secondary Schools of Lebanon reached at by this project will have photographic accuracy or microscopic detail. But, because the focus of attention is on the teacher as he actually is, it will reveal in true perspective all the important parts. This picture will expose the elements of physics teaching in the Armenian Secondary Schools of Lebanon as they actually are.

This presentation of teaching physics in the Armenian Secondary Schools of Lebanon by the hard facts furnished as a result of the research, would serve as standard to re-evaluate unwarranted assumptions; approving some and discarding others. It will also help in the formulating and sifting of new hypotheses, having the relevant observations based on hard data.

To conclude, two beneficial points can be attributed to this project. Its results may serve as a guide for further investigations. It might also be used as a plan to produce desirable changes and build better educational institutions.

CHAPTER II

PROCEDURE

A.- Population

Armenian Secondary Schools of Lebanon are located at centers where the community's cultural life is thriving best. It is no coincidence that these schools are near other centers of the community. Most of the Armenian Orthodox Secondary Schools are located near cultural centers or political party clubs. All of the Armenian Evangelical Secondary Schools have a church on the campus. Exceptions are the two Catholic Senior Secondary Schools that have moved outside the community centers.

There are eighteen Armenian Secondary Schools in Lebanon of which twelve have full secondary status. The rest are Junior High Schools or intermediate schools preparing for the Brevet. The following tables illustrate the different faces of the schools.

TABLE 1

DISTRIBUTION OF THE SCHOOLS ACCORDING TO LOCATION

Location	Junior High Schools	Secondary Schools
Beirut City	2	5
Suburb of Beirut (Hazmieh)		2
Bourj Hamoud	3	2
Jounieh		1
Dbayeh		1
Anjar		1
Tripoli	1	

TABLE 2

DISTRIBUTIONS OF THE SCHOOLS ACCORDING TO DENOMINATION

Denomination	Junior High Schools	Secondary Schools
Orthodox	2	5
Catholic	2	2
Protestant	2	5

TABLE 3

SPONSORSHIP OF THE SCHOOLS

	Junior High Schools	Secondary Schools
Orthodox Schools		
Armenian Orthodox Prelacy	1	2
Armenian General Benevolent Union		2
Private	1	1
Catholic Schools		
Armenian Catholic Diocese of Lebanon	2	2
Protestant Schools		
Armenian Evangelical Union of the Near East	1	4
Other Religious Organizations	1	1

All of the Orthodox Armenian Secondary Schools of Lebanon are named after the benefactors that have donated a

substantial sum of money for the construction of the school building, e.g., "Hamazkain (All national) Neshan Palanjian College". Even the schools sponsored by the Armenian General Benevolent Union are named after specific benefactors, e.g., "A.G.B.U. Hovagimian Manougian Secondary School for Boys". Of the two Catholic senior secondary schools, the boys' school is called "Mekhitarist College" after the Mekhitarist Fathers of Vienna, and the girls' school is called "Hripsimiantz", after the forty virgin saints that were persecuted by the last heathen king of Ancient Armenia. Most of the Armenian evangelical secondary schools are named according to their locations, e.g., "Armenian Evangelical Secondary School of Anjar."

Most of these schools were visited by the investigator. Almost all of them do not have more than one building, with at least two floors to accomodate the school. Their campuses are not sufficiently spacious. In some cases there was hardly enough room for a basketball court. Almost all of the full-fledged secondary schools had their auditorium, library, and laboratory. These three facilities were commonly found near one another, usually at the basement or the top floor of the buildings. Apparently, these facilities were not put to effective use in the majority of the schools. Two of the eighteen secondary schools had regular boarding facilities. Twelve of the eighteen Armenian Secondary Schools of Lebanon are co-educational. On the average, the students enter the secondary cycle at the age of 13-14 and graduate at the age 18-19.

The foregoing was background information about the Armenian Secondary Schools of Lebanon. All eighteen of them were contacted, but only fourteen of them responded to the questionnaire that was addressed to the office of the principal. The two junior high schools declining to respond apologized on ground that they were recently organized and could not provide the requested information. There was also one full-fledged secondary school

which was unwilling to disclose the requested information. Moreover, it was decided that information collected from the fourteen schools was sufficient to present an adequate picture of the Armenian Secondary Schools.

TABLE 4

DISTRIBUTION OF RESPONDING SCHOOLS

	JUNIOR HIGH SCHOOLS			SECONDARY SCHOOLS		
	Orthodox	Catholic	Protestant	Orthodox	Catholic	Protestant
Beirut				3		3
Hazmieh				1		
Bourj Hamoud		1	1	1		1
Jounieh					1	
Dbayeh						1
Ainjar						1
Tripoli			1			

B.- Development of Questionnaires

Two questionnaires constituted the main tools of collecting data. The first questionnaire is designed to analyze the background of physics teaching in the Armenian Secondary Schools of Lebanon and to reveal some trends since 1960. It includes items to be checked and blanks to be filled by the cooperation of

the office of the principal. It inquires about programs adopted in the schools, and the language in which the courses are conducted. It asks the number of students in a class section, and the number of physics teachers with specified qualifications. It also asks the number of physics periods per week and the number of students who passed external examinations. (A copy of this questionnaire appears in appendix I).

The second questionnaire is intended to expose the teaching of physics as actually practiced under existing conditions of the Armenian Secondary Schools of Lebanon. Specifically, the questionnaire is designed to elicit the following ramifications of the problem.

I. Teachers' academic background
   A. Diplomas
   B. Training
   C. Experience

II. Program for the teaching of physics
   A. Curriculum and schedule for physics
   B. Lesson plan for physics teaching

III. Teaching Methods
   A. Lecture-Discussion
   B. Demonstration
   C. Experimentation
   D. Problem solving
   E. Student reports
   F. Project work

IV. Activities related to the teaching of physics
   A. Discussion and recitation in class
   B. Individual and group experiments
   C. Demonstrations and exhibitions
   D. Library research and reporting
   E. Problem solving and preparing of home-work
   F. Excursions and visits to places of scientific interest

V. Equipment related to the teaching of physics
   A. Laboratory apparatus
   B. Demonstration devices
   C. Audio-Visual aids
   D. Models and Kits
   E. Textbooks and encyclopedias

VI. Evaluative schemes for the teaching of physics
   A. Kinds of school test
   B. Sources of difficulty in teaching physics

A pilot questionnaire was devised on a trial basis. To check the validity of that questionnaire, the investigator administrated it personally to three of his colleagues and compared their responses against their teaching background. On the whole, the questionnaire reflected the teaching practices of his friends as he had known them to be. However, many of the items had to be modified or omitted because their discriminating power was very low. The questionnaire was then cast into its final form. The questions were made as direct and personal - though not subjective - as possible. The content of the questions were based on concrete grounds; always refering to practical situations and actual practices. (A copy of this questionnaire appears in Appendix II).

To simplify the tabulation and interpretation of the results, care was taken to standardize the responses. This was done by considering only five alternative responses to a question from which to choose. Provision was made to respond to each choice according to five level scales. These levels of response are expressed by the following degrees of frequency: never, rarely, sometimes, usually, always. To minimize the time needed to answer the questionnaire, the following code was devised to stand for these levels.

1 for never
2 for rarely
3 for sometimes
4 for usually
5 for always

The purpose of introducing these five frequency levels was to increase the sensitivity of the questionnaire as a device to probe, and also to increase the reliability of its results by diminishing irresponsible and haphazard checking of the items.

C. Administration of Questionnaire

The administration of the two questionnaires was carried out along two patterns.

1. Pattern A

The questionnaires addressed to the principal's office, together with the introductory letters, and the physics teachers' questionnaires with explanatory letters that accompany them, were carried personally to the principal of the school. At this personal visit, the purpose of the project was explained and the principal's permission and cooperation was requested. Specifically, the principal was asked to fill in the questionnaire addressed to his office, and to see to it that the physics teachers get a sample of the other type of questionnaire and answer it in a two weeks time. In the case when a physics teacher was a friend of the investigator, the questionnaire was handed directly to him. After a time lapse of one week, calls were made by the investigator to remind the subjects of filling the questionnaire and to inquire if any help is needed. Further inquiries were made to see if everything was going well with the filling of the questionnaire and to thank the principal and the physics teachers for their cooperation.

2. Pattern B

In a few cases, when a certain school was located in a remote place, and/or the principal was not known personally to the experimenter, intermediaries that had close connections with them were sought. The envelopes addressed to such schools were sent through this third person. The necessary explanations were given to him, hoping that he will transmit them to the concerned persons. To ascertain that the questionnaires had arrived, and to see if

questions about them existed, a telephone call was made to each of such schools.

D. Method of analysis

Data obtained from the first questionnaire pertaining to the school's program, physics teachers, and the student body were tabulated. Inferences were made to show trends since 1960, and the present status was evaluated. To compare the trends in certain related factors their variation was graphed on the same coordinate system. In some of the questions where definite numbers were asked for, e.g., number of students in class or number of physics periods per week, the total as well as the average was tabulated.

The questionnaire addressed to the physics teachers constitutes the main source of data. The findings of this questionnaire were also tabulated and analyzed to draw inferences. Because of the nature of the project, the method of analysis consists of descriptive statistics, i.e. arranging the responses in frequency tables and computing the percentages of responses. In some cases, to find out if any correlation exists between certain factors, Pearson's product-moment correlation coefficient was used.

CHAPTER III

RESULTS

A. Background information about the Armenian Secondary Schools of Lebanon

1. Presentation of responding Armenian Secondary Schools of Lebanon.

The Armenian Secondary Schools of Lebanon are located mainly in and near the capital. Five are found in the city proper, one in a suburb, and four in Bourj Hamoud, a town adjacent to it. Of the remaining four schools, two are located in the near-by towns of Jounieh and Dbayeh; the other two are spread in far off Tripoli and Bekaa. These places are centers of Armenian community life; exceptions being the schools at Hazmieh and Dbayeh which have been chosen for their calm and beautiful sites. A complete list of the responding schools with their full names and locations is to be found in Appendix III.

2. Type of programs and kind of languages in use.

About one fifth of the schools apparently follow the official syllabus verbatim. In another fifth of the schools, the principals are responsible for planning the program, who, in most cases, have admitted no other possibility than following the Lebanese Baccalaureate Program. The planning body which is responsible for planning the programs of the largest faction of the schools is the Armenian Evangelical Educational Council. (Table 5).

It is manifested from Table 6 and Graph 1 that throughout the passing years more than one type of program was followed. In the beginning of the period, the program most commonly practiced was the American High School type program. Second came the Special Armenian Program[1]. These were followed by the remaining three types of programs, Lebanese Baccalaureate, French Baccalaureate, and General Certificate of Education. At present, the Lebanese Baccalaureate Program leads in practice, leaving the other types of programs far behind.

This brings us to the second major inference; that throughout these years there have been variations in the adoption of the different types of programs, and that these variations have occured in opposite senses and at different rates. For the first four years, the frequency of adoption of the Lebanese Baccalaureate Program was at low constant level. An initial boost was given during 1964-1965 which was accelerated in 1965-1966. As for the American High School type program, its application has been decreasing year after year. The General Certificate of Education Program, which has not been much used in the past, has been totally eliminated. The French Baccalaureate Program has been one of the oldest programs practiced by a few Armenian Secondary Schools.

---

[1] The program refered to as Special Armenian Program is the program devised by the Armenian Schools to meet the needs and interests of the Armenian Community. As to its form and content it can be said that it has undergone continual change throughout the years. It must not be considered as a program over and against the other types of programs; rather, it is complementary to the other programs which are followed. It is eclectic in nature, including elements from the other types of programs. The most distinguishing element of the Special Armenian Program is its preoccupation with Armenian historical and cultural affairs - particularly Armenian language and religion. As for the sciences, the most salient concern has been the use of general science textbooks written in Armenian. Another concern has been the emphasis on technical skills and practical applications.

TABLE 5

PLANNING OF THE PRESENT PROGRAM

Planning Source	Number of Schools	Percent of Schools
Armenian National Educational Council	1	7.1
Armenian Evangelical Educational Council	4	28.6
A.G.B.U. Educational Council	2	14.3
Program Committee	1	7.1
Principal of School	3	21.4
Official Syllabus	3	21.4

TABLE 6

PROPORTION OF SCHOOLS FOLLOWING DIFFERENT TYPES OF PROGRAMS

Types of Programs	A		B		C		D		E	
	No.	%	No.	%	No.	%	No.	%	No.	%
1960-1961	2	14.3	2	14.3	2	14.3	7	50	4	28.6
1961-1962	2	14.3	2	14.3	2	14.3	7	50	4	28.6
1962-1963	2	14.3	2	14.3	1	7.1	6	42.9	5	35.7
1963-1964	2	14.3	2	14.3	1	7.1	6	42.9	5	35.7
1964-1965	5	35.7	3	21.4	1	7.1	5	35.7	4	28.6
1965-1966	10	71.4	3	21.4	0	0	3	21.4	2	14.3
1966-1967	12	85.7	3	21.4	0	0	2	14.3	3	21.4

Key:
A stands for Lebanese Baccalaureate Program.
B stands for French Baccalaureate Program.
C stands for General Certificate of education.
D stands for American High School Type Program.
E stands for Special Armenian Program.

Probably it is to be practiced for more years to come. Now it ranks second among all the programs. As for the Special Armenian Program, its use can be compared to a buffer program producing stabilizing elements as a reaction to the inequilibrium produced by external demands. This is why its profile shows non-uniform variation. As seen in Graph 1 on page 17(a), its variation had a lowest ebb in 1965, causing much concern among intellectual circles. The renewed interest in this program as depicted in the graph can be attributed to this concern.

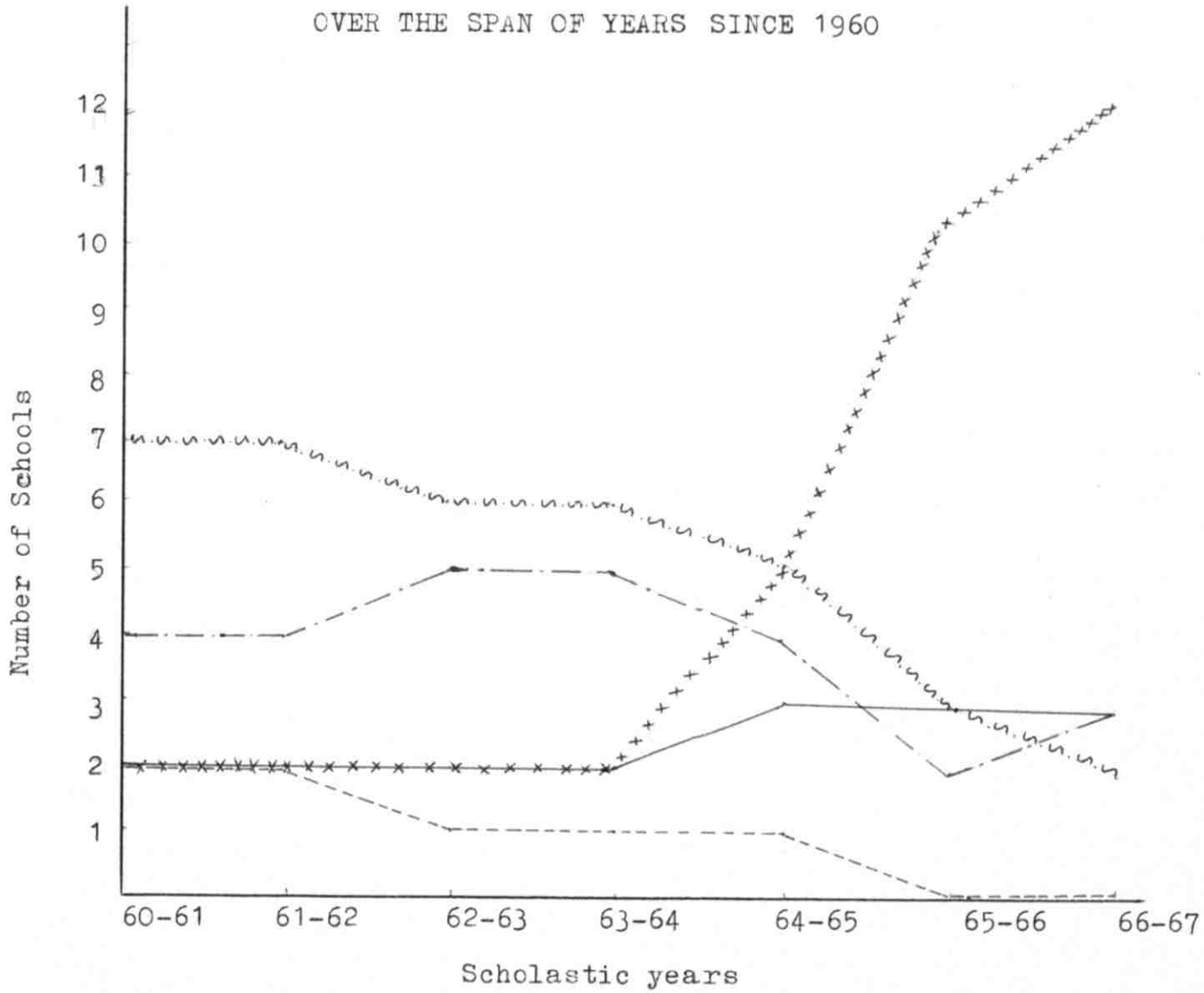
As for the language in which physics is taught it can be said that teaching is mostly done in English. This is particularly so in the upper secondary grades where four-fifths of the schools teach in English. (Table 7). The picture changes in the first secondary class. This might be due to the fact that the students of this class are not quite capable of understanding texts in foreign languages. This is why three schools conduct general science courses in Armenian, and one school teaches in Arabic. As expected the schools following the French Baccalaureate Program teach in French.

3. Students in relation to class sections and external examinations.

For all the grades, the number of physics classes available has been on the increase throughout the years. (Table 8). On the other hand, more schools have established arts sections in the upper two grades to accomodate the weak students - especially those that will not continue their education. As for the average number of students in each class section, it has not undergone any significant change. Although, it was apparent from the initial data that some of the classes had been divided into two or more sections. This was particularly observed in the lower grades. However, it can be observed from the table that the number of students per grade decreases with higher grades.

GRAPH 1

GRAPH OF THE DIFFERENT TYPES OF PROGRAMS
OVER THE SPAN OF YEARS SINCE 1960



Key:

- – – – – – General Certificate of Education
- × × × × × Lebanese Baccalaureate
- ——— French Baccalaureate
- ∽∽∽∽ American High School
- — · — · — Special Armenian

TABLE 7

LANGUAGE IN WHICH PHYSICS IS TAUGHT
IN DIFFERENT SCHOOLS

	Armenian		Arabic		English		French	
	No.	%	No.	%	No.	%	No.	%
I	3	33.3	1	11.1	3	33.3	2	22.2
II	1	9.1	0	0	8	72.9	2	18.1
III	0	0	0	0	11	78.6	3	21.4
IV	0	0	0	0	11	84.6	2	15.4
V	0	0	0	0	9	81.8	2	18.2
VI	0	0	0	0	8	80.0	2	20.0

TABLE 8

NUMBER OF THE DIFFERENT CLASSES
AND AVERAGE NUMBER OF STUDENTS IN EACH CLASS SECTION

Years	1960-61		1961-62		1962-63		1963-64		1964-65		1965-66		1966-67	
Classes	No.	Av.	No.	Av.	No.	Av.	No.	Av.	No.	Av.	No.	Av.	No.	Av.
I	12	29	12	28	11	30	12	30	14	29	14	31	14	29
II	11	30	12	35	12	32	11	25	13	29	13	31	13	31
III	11	27	12	26	12	27	12	28	13	25	13	26	13	27
IV	10	26	12	24	12	23	12	23	11	28	12	24	12	27
V(Arts)	3	10	4	11	5	11	5	10	5	9	6	17	8	14
V (Sc.)	8	18	10	20	10	22	10	19	10	15	11	15	11	14
VI(Arts)	2	14	5	9	5	11	5	14	5	19	6	10	7	17
VI (Sc.)	6	13	8	15	9	16	9	20	9	18	9	18	10	15

The achievement of the students in the external examinations has been difficult to assess. The main reason for this being the evasive response of the schools and the incomplete data they provided. A second attempt to secure complete information was to no avail, and it was doomed tactless - and unwise - to press hard on such a sensitive issue. As a practical resolution of the difficulty, such obscure data were interpreted in a most optimum manner. The results of the external examinations, as derived in this manner, are recorded in Table 9. It is to be noted that the General Certificate of Education examination results are excluded from the table. The reason for this being that the schools could not provide definite, reliable numbers.

The first thing to be inferred from the table is that the degree of involvement of the Armenian Secondary Schools of Lebanon has not been the same with respect to the different kinds of examinations. More schools - and more students - have achieved success in the American University of Beirut Entrance Examinations, followed, in decreasing order of success, by Lebanese Baccalaureate, French Baccalaureate, and Lebanese Brevet. It is to be remarked that schools concerned about the Baccalaureate Examinations are more than those concerned about the Brevet examinations. This tendency has been encouraged because Brevet is not a prerequiste to the Baccalaureate Examinations. The schools that prepared for the Brevet Exams were almost wholly Junior High Schools.

A second factor discerned from the results is that in general there has been an increase in the number of schools involved, and the percentage of students passing in the different kinds of examinations - with the exception of the French Baccalaureate Examinations. Especially is this noticeable in the Lebanese Baccalaureate and the A.U.B. Entrance Examinations. As for the Lebanese Brevet Exams, there has been a pronounced boost in 1966. The rate of success in the A.U.B. Entrance Exams has maintained the same high value throughout the years.

TABLE 9

NUMBER OF SCHOOLS INVOLVED AND PROPORTION OF STUDENTS THAT HAVE SUCCESSFULLY PASSED IN EXTERNAL EXAMINATIONS

	1960-1961			1961-1962			1962-1963			1963-1964			1964-1965			1965-1966			1966-1967		
	Number	Proportion	Percent	Number	Proportion	Percent	Number	Proportion	Percent	Number	Proportion	Percent	Number	Proportion	Percent	Number	Proportion	Percent	Number	Proportion	Percent
Lebanese Brevet	1	1/10	10.0	1	3/10	33.3	2	5/22	22.7	1	5/25	20.0	1	11/28	42.8	1	10/22	45.5	3	36/59	61.0
Lebanese Baccalaureate	2	5/16	31.2	1	3/18	16.7	2	14/32	43.8	2	20/39	51.3	2	15/28	53.6	4	27/50	54.0	4	34/48	70.8
French Baccalaureate	2	10/35	28.6	2	10/40	25.0	2	11/37	29.7	1	6/30	20.0	-	--	---	-	--	---	1	6/20	30.0
A.U.B. Entrance Exam.	3	34/47	72.3	4	57/69	82.6	4	62/72	86.1	6	126/153	82.4	7	118/154	76.6	8	136/168	80.9	8	157/192	81.8

4. Extent of physics and general science teaching

The teaching of physics has been an integral part of the curriculum of the Armenian Secondary Schools of Lebanon throughout the years. However, there has been a marked concern for physics teaching beginning with the year 1965. Table 10 shows the extent of physics teaching before 1965 and after it. Three points have to be remarked:

a) The number of physics periods increased with increasing grade level.
b) The number of physics periods have increased after 1965.
c) The number of physics periods taught in the arts sections has remained at the same low level.

It is not a coincidence that the year 1965 witnessed the adoption of the Baccalaureate Program in many of the Armenian Secondary Schools of Lebanon. This change, among other effects, might have implied more serious concern for the teaching of physics.

As for the teaching of general science, more of the schools are teaching general science than physics in the first two secondary classes. About four times as many schools teach general science as they do physics in these classes. (Refer to the table 10). Moreover, the average of the general science periods is slightly more than the average of the physics periods, although, this difference is getting diminished year by year.

B. Teachers' academic background

1. Qualifications of teachers engaged in physics teaching

As expected, the number of physics teachers has been increasing year by year. This increase was brought about by the fact that more schools achieved secondary status by having additional classes year by year. Other factors involved include the increase in the number of students enrolled in these schools which at times has necessitated the division of classes into sections. Also, it must be mentioned that, on the whole, the numbers of physics periods taught per week in each class has been on the increase. Throughout the years, the number of part-time teachers has been more than the number of full-time teachers. However, rate of increase of full-time teachers is more than that of part-time teachers. (Table 11).

As to the distribution of teachers regarding their degrees, about a third are Bachelors in Physics. These are followed by Bachelors in Mathematics, Teaching Group, and other fields at almost the same proportion. The diploma-level teachers have, on the average, constituted about one quarter of the physics teachers. (Table 11).

The differential expansion of the different sorts of physics teachers exhibits an interesting picture. Surprisingly enough, the most pronounced increase has been with respect to teachers holding Sophomore Diplomas or Bachelor's Degrees in Teaching Group. On the other hand, almost no increase is noted in the number of teachers with Baccalaureate II Diploma and B.S. Degrees in fields other than physics and mathematics. Teachers with B.S. in physics have been steadily on the increase. As for the teachers with a B.S. in mathematics their number is decidedly increased in 1965. This last observation might be again an outgrowth of the adoption of the Baccalaureate Program. The last thing to mention, although not the least as to its effect

TABLE 10

NUMBERS OF PHYSICS AND GENERAL SCIENCE PERIODS TAUGHT PER WEEK

	Before 1965			After 1965		
Physics Classes	Number of Classes	Total Periods	Average Periods	Number of Classes	Total Periods	Average Periods
I	3	5	1.7	3	7	2.3
II	5	10	2.0	7	15	2.1
III	12	31	2.6	13	34	2.6
IV	12	34	2.8	12	37	3.1
V(Arts)	2	4	2.0	3	6	2.0
V (Sc.)	10	38	3.8	10	43	4.3
VI(Arts)	2	4	2.0	3	6	2.0
VI(Sc.)	10	42	4.2	10	50	5.0
General Science Classes						
I	13	30	2.3	12	29	2.4
II	12	31	2.1	11	28	2.5

TABLE 11

QUALIFICATIONS OF THE PHYSICS TEACHERS

Qualifications	1960-1961	1961-1962	1962-1963	1963-1964	1964-1965	1965-1966	1966-1967
Full Time Physics Teachers	7	8	10	8	11	11	11
Part Time Physics Teachers	13	12	11	15	13	17	18
Teachers with B.S. in Physics	7	7	8	8	6	9	9
Teachers with B.S. in Mathematics	3	3	3	3	4	5	4
Teachers with B.S. in Other Fields	3	3	3	4	4	3	3
Teachers with B.A. Teaching Group	3	3	2	2	4	5	5
Teachers with Baccalaureate II	2	2	2	3	3	2	3
Teachers with Sophomore Diploma	2	2	2	3	3	4	5
Teachers with Normal Diploma	5	5	4	4	5	6	7

on the educative process, in that a substantial number of teachers are holding Normal Diplomas; and this number is rather on the increase.

As for this year (that is 1967-1968) about two-thirds of the teachers in the Armenian Secondary Schools of Lebanon are holders of Bachelor's Degrees; and of these about two fifths are in physics. Next come the Bachelors in engineering and mathematics. (Refer to Table 12). The relatively high percentage of Bachelors of mathematics is most probably due to the demands of the Baccalaureate Program. Another point to be remarked, is that only one teaching group major is involved in the teaching of physics. This might be a reflection of two aspects of the teaching of physics. It seems that little emphasis is laid on integrated comprehensive teaching, and also that not much importance is given to the psychological aspects of teaching.

The percentage of teachers with Master's Degree is rather low, and the present ones are in fields other than physics. On the other hand, a high percentage of diploma level teachers are appointed. This might also be a reflection of the above mentioned condition as well as of budget deficiencies.

It is apparent from table 13 that most of the teachers are young; about two thirds having been graduated after 1960. This could be attributed to the recent concern of the schools for the Baccalaureate Program, and the consequent stress to pass in physics.

2. Nature of teacher involvements in the teaching of physics

About two-fifths of the physics teachers are novices; having from one to three years of experience. In particular, fifty percent of the teachers of the Vth and VIth secondary Baccalaureate Physics are also novices. (Table 14).

As for the classes in which a given teacher teaches, it is apparent from Table 15 that at present there are no prefered class

TABLE 12

DISTRIBUTION OF TEACHERS WITH RESPECT TO DEGREES AND DIPLOMAS HELD

Educational Levels	Number	Percent
Diploma	5	21.7
Sophomore	4	17.3
Baccalaureate II	1	4.3
Bachelor	16	69.6
Physics	6	26.1
Engineering	3	13.0
Chemistry	2	8.7
Mathematics	3	13.0
Group	1	4.3
Business	1	4.3
Master	2	8.7
Mathematics	1	4.3
Archaeology	1	4.3

TABLE 13

YEAR OF GRADUATION OF TEACHERS

	Number	Percent
Before 1960	7	30.4
After 1960	16	69.6

TABLE 14

NUMBER OF YEARS TEACHING PHYSICS

Experience of Teachers	1-to-3 years		4-to-9 years		10-to-19 years	
	No.	%	No.	%	No.	%
General Physics Program	10	43.5	6	26.1	7	30.4
Baccalaureate Physics Program	6	26.1	3	13	3	13

combinations. In the past, there have been several, e.g. the class combinations (I, II, III), (IV, V, VI), and (II, III, IV, V, VI). If we take the'other' class combinations also into account, the following class combinations would be found emerging: They are; (I, II), (I, II, III, IV), (V, VI).

The upper four classes of the secondary cycle are taught mainly by Bachelors while the last two are exclusively taught by them. (Table 16). Also, half of the teachers of the second secondary class are Bachelors; of the rest, two-thirds are diploma holders and one-third have Master's Degree. Half of the teachers of the first secondary physics or general science courses are on the Diploma level, one-third on the Bachelor's level and one-sixth on the Master's level. The reason why the teachers with Master's Degrees are teaching in the lower grades is that their major is in fields other than physics. The schools have made a remarkable choice in appointing these teachers to the lower grades.

It has been found that the teaching load of most physics teachers includes, in addition to physics, mathematics and other sciences. (Table 17). At present the combination of teaching physics and mathematics is becoming stronger. This is due to more mathematics majors teaching physics also. This again is a reflection of the analytic and formal approach to the teaching of physics. The third most common combination is that of physics with miscellaneous subjects. This is practiced mainly by the teachers of the first three secondary classes. Finally, it is to be noted that only one teacher is teaching solely physics.

3. Means of self-improvement employed by different teachers

Regular reading of scientific journals, followed by reading of recent reference books, are the two means of self improvement that most of the teachers are engaged in. The 1-to-3-years experienced teachers lead in these means of self-improvement followed by the 10-to-19-years experienced teachers.

TABLE 15

SIGNIFICANT CLASS COMBINATIONS FOR TEACHING PHYSICS[1]

Class Combination	At Present		In the Past	
	No.	%	No.	%
I. II.	3	15	0	0
I. II. III.	0	0	3	15
I. II. III. IV.	3	15	1	5
III. IV.	3	15	2	10
IV. V. VI.	3	15	4	20
III. IV. V. VI.	3	15	3	15
II. III. IV. V. VI.	0	0	3	15
Other,	5	25	4	20

[1] The twenty teachers that have taught for more than one year have been considered.

TABLE 16

DISTRIBUTION OF DEGREES OR DIPLOMAS IN THE DIFFERENT CLASSES

	I		II		III		IV		V		VI	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Diploma	3	50	4	33.3	4	25	2	13.3	0	0	0	0
Bachelor	2	33.3	6	50	10	62.5	12	80	11	100	11	100
Master	1	16.7	2	16.7	2	12.5	1	6.7	0	0	0	0

TABLE 17

SUBJECT COMBINATIONS FOR PHYSICS TEACHERS[1]

Subject Combination	At Present		In the Past	
	No.	%	No.	%
Physics	1	5	1	5
Physics + Other Sciences	3	15	2	10
Physics + Mathematics	5	25	1	5
Physics + Maths. + Science	8	40	12	60
Physics + Miscellaneous subjects	3	15	4	20

[1]The twenty teachers that have taught for more than one year have been considered.

TABLE 18

MEANS OF SELF-IMPROVEMENT EMPLOYED BY DIFFERENT TEACHERS

Experience of Teachers (Years)	1-3		4-9		10-19		1-19	
Kind of Self improvement	No.	%	No.	%	No.	%	No.	%
(a)	1	4.3	1	4.3	0	0	2	8.7
(b)	0	0	0	0	0	0	0	0
(c)	0	0	2	8.7	0	0	2	8.7
(d)	0	0	1	4.3	3	13.0	4	17.3
(e)	2	8.7	2	8.7	1	4.3	5	21.7
(f)	0	0	0	0	0	0	0	0
(g)	0	0	0	0	0	0	0	0
(h)	8	34.7	5	21.7	6	26.1	19	82.5
(i)	7	30.4	4	17.3	5	21.7	16	69.5
(j)	1	4.3	0	0	0	0	1	4.3

Key:

(a) Teacher training courses.
(b) Graduate study in physics
(c) Graduate study in education.
(d) Conference of science teachers.
(e) In-service training with consultants.
(f) Summer Institutes for science teachers.
(g) Refreshing physics courses from a college.
(h) Regular reading of scientific journals.
(i) Reading of recent reference books.
(j) Graduate work in mathematics.

The third frequently practiced means of self-improvement is the in-service training with consultants. This is practiced equally by the three categories of teachers. Mostly experienced teachers have taken part in conferences on science Education. Only two teachers of the 4-9 years experience category were engaged in graduate work in education. Surprisingly enough, no teacher is found taking physics courses. (Table 18).

C. Methods and practices in physics teaching

1. Program followed in teaching

More than half of the teachers are following the Lebanese Baccalaureate Program in full. Most probably this program has been forced on the teachers experienced in non-baccalaureate physics programs. Some of these have apparently been replaced by newcomers. (Table 19). The second largest group of teachers are those following a program as prescribed by the school administration. This could be the outcome of at least two alternative passibilities. It might be that some teachers are not well versed in the Baccalaureate Program, or, taking the previous conditions of the school into consideration, the administration might have improvised a transitional program to suit the level of the students. Furthermore, only about one fifth of the teachers devise their own programs, or have their say in the reconstruction of the physics curriculum.

2. Composition and use of lesson plans

Admittedly, all of the teachers have utilized a sort of lesson plan in their teaching of physics. As manifested in Table 20, no strong preference is shown to any one of the different types of lesson plans presented. It is interesting to find out

TABLE 19

PROGRAMS FOLLOWED BY PHYSICS TEACHERS

Years of Experience	1-3		4-9		10-19		1-19	
Kinds of Program	No.	%	No.	%	No.	%	No.	%
(a)	6	26.2	3	13.0	5	21.7	14	60.9
(b)	2	8.7	2	8.7	1	4.3	5	21.7
(c)	0	0	1	4.3	0	0	1	4.3
(d)	1	4.3	1	4.3	1	4.3	3	13.0

Key:
(a) I follow the Lebanese Baccalaureate Program in full.
(b) I follow the program as prescribed by the school administration
(c) I devise my own program according to my possibilities
(d) I devise a program to suit the needs and abilities of the students.

TABLE 20

FREQUENCY OF USING DIFFERENT TYPES OF LESSON PLANS

Types of Lesson Plans	Number	Percent
Yearly	4	17.3
Term	5	21.7
Monthly	2	8.6
Weekly	6	26.2
Daily	6	26.2

that the monthly lesson plan is followed the least. The yearly and term lesson plans are apparently utilized to a considerable extent; but one wonders what would these look like... It is encouraging to note that almost half of the teachers use either a daily or a weekly lesson plan. In spite of our expectation that unexperienced teachers should have used daily lesson plans while experienced teachers use only yearly plans, the correlation between the type of lesson plan and the number of years of teaching has been found to be insignificant. The Pearson Product moment correlation came out to be -0.032. We can only conjecture and say that the experienced teachers who are diligently following daily lesson plans did so from the first year of their teaching. On the other hand, those teachers that are not following daily lesson plans now probably did not do so in the past, and it is highly improbable that they are going to do so in the future.

It can be infered from Table 21 that a large percentage of teachers admittedly include in their lesson plans the goals and concepts to be established. One is tempted to surmise that some teachers might have considered goals as items of the Baccalaureate Program, and concepts as generalizations defined in the books. As expected, the vast majority of the teachers include the content of study. An encouraging number of teachers also list the laboratory experiments and class demonstrations with the required equipment in their lesson plans. Although this is not a guarantee that they are going to perform all that is put on paper, yet it signifies that teachers recognize the importance of practical work. However, few teachers have bothered about audio-visual aids. Moreover, deplorably few teachers have considered extra activities and reference materials in their plans. The characteristic overcrowding of the Baccalaureate Program must have cut these activities from their roots.

TABLE 21

ITEMS COMPRISING A LESSON PLAN

	Never-Rarely		Sometimes		Usually-Always	
	No.	%	No.	%	No.	%
(a)	5	21.7	2	8.7	16	69.6
(b)	1	4.3	1	4.3	21	91.3
(c)	7	30.4	6	26.1	10	43.5
(d)	7	30.4	9	39.1	7	30.7
(e)	7	30.4	11	47.8	5	21.7
(f)	14	60.9	7	30.4	2	8.7
(g)	17	73.9	5	21.7	1	4.3
(h)	17	73.9	5	21.7	1	4.3

Key:

(a) = Goals and concepts to be established
(b) = Content of study
(c) = Suggested vocabulary to be established
(d) = Required classroom materials and equipment
(e) = List of demonstrations and experiments
(f) = Audio-visual aids
(g) = Extra activities related to the lesson
(h) = Additional reference materials

3. Techniques practiced in the teaching of physics

Table 22 depicts the applicability of twelve techniques of teaching in all of the six classes of the secondary cycle. The Lecture-Discussion technique is definitely a part of the teaching method. The majority of the teachers in the lower classes have utilized this method, while the frequency of its use has decreased in the upper three classes. A smaller faction of teachers has utilized the Lecture-Demonstration technique. Its use is remarkably pronounced in the third and fourth classes. Apparently, the Lecture-Projection technique is not an integral part of the teaching of physics. It is sometimes used by a few teachers of the upper three classes. The textbook centered discussions constitute the most frequently utilized technique. It is practiced in all classes on an almost equal level. The solving of mathematical problems has also been a major practice in all classes. Its utilization has been low, however, in the first two classes, most probably due to the descriptive nature of general science courses taught in these classes. Interestingly enough, a significant number of teachers have also considered the solution of real life problems. This tendency has been deploringly low in the first two grades. Unfortunately, a very small faction of the teachers have incorporated laboratory experimentation as part of teaching. Practically no school has undertaken individual laboratory experimentation, although there are a few that practice group laboratory experimentation of either two or three-to-four student groups. The common practice regarding laboratory experimentation has been taking the whole class to the laboratory. Even this has been practiced sporadically - most probably when the teacher demonstrated a physics principle. Only one teacher of the third and fourth secondary classes had his students prepare projects of scientific devices. Also, it was encouraging to find out that some teachers at times assigned chosen topics for their students to report on.

TABLE 22

PERCENTAGES OF TEACHERS PRACTICING THE DIFFERENT TECHNIQUES OF TEACHING

	I		II		III		IV		V		VI	
Techniques	Sometimes	Usually-Always	Sometimes	Usually-Always	Sometimes	Usually-Always	Sometimes	Usually-Always	Sometimes	Usually-Always	Sometimes	Usually-Always
Lecture Discussion	0	100	0	72.7	13.3	60.0	20	46.7	18.2	54.5	16.7	50.0
Lecture Demonstration	28.6	28.6	27.3	27.3	26.6	33.3	46.7	40.0	27.3	27.3	50.0	25.0
Lecture Projection	0	0	0	0	6.7	0	13.3	0	18.2	0	25.0	0
Textbook Discussions	0	85.7	9.1	54.5	13.3	66.7	13.3	60.0	9.1	72.7	16.7	66.7
Mathematical Problems	0	57.1	18.2	68.6	20.0	73.3	20.0	80.0	27.3	72.7	16.7	66.7
Real-Life Problems	28.6	14.3	36.4	0	20.0	33.3	13.3	33.3	18.2	45.5	8.3	33.3
Individual Lab. Exp.	0	0	18.2	0	6.7	6.7	6.7	0	9.1	0	8.3	0
Group of Two Experiments	14.3	0	9.1	9.1	13.3	13.3	0	6.7	0	18.2	0	16.7
Group of 3-5 Experiments	14.3	0	18.2	0	26.7	0	13.3	13.3	9.1	0	16.7	8.3
Whole Class Experiments	28.6	0	27.3	18.2	0	20.0	26.7	20.0	27.3	18.2	25.0	16.7
Student Projects	0	0	0	0	6.7	0	0	6.7	0	0	0	0
Reports On Topics	0	0	0	0	13.3	0	20	0	27.3	9.1	25.0	0

4. Beginning and ending of the physics periods

Two ways of beginning the physics period were utilized more frequently than the rest. They are reviewing the material of the previous lesson, and stating the general outline of the day's lesson. (Table 23). Both of these ways are in line with the formalism and systematization prevailing in the Baccalaureate Program. It is note-worthy that a substantial number of teachers ask a puzzle or a question for introducing the lesson. This might be their attempt to motivate and interest the students. However, very few teachers performed demonstrations to raise interest.

The physics periods were ended usually either by summarizing the materials discussed in class or solving numerical applications about them. (Table 24). On the other hand, few teachers quiz the students right after the explanations. This might be attributed to shortage of time, or to the assumption on the part of teachers that learning is a tedious process involving assimilation by drill.

5. Laboratory experimentation in the teaching of physics

Regular laboratory periods during the course is not an integrated part of the teaching of physics. Those teachers that usually had their students perform experiments did so at any appropriate time during the discussion period. Another suitable time for laboratory experiments, as inferred from Table 25, was at the end of a unit of study to test the theoretical materials studied. Those teachers that took their students sporadically to the laboratory did so at the end of the study of certain topics which were probably considered difficult to be fixed in the minds of the students.

The procedure most frequently practiced in the laboratory experiments was the authoritarian type of experimentation. It consisted of having the students gather around the experimentation

TABLE 23

WAYS TO BEGIN THE PHYSICS PERIOD

	Never-Rarely		Sometimes		Usually-Always	
	No	%	No.	%	No.	%
(a)	2	8.7	6	26.1	15	65.2
(b)	7	30.4	7	30.4	9	39.1
(c)	11	47.8	10	43.5	2	8.7
(d)	5	21.7	5	21.7	13	56.5
(e)	11	47.8	9	39.1	3	13.0
(f)	18	78.3	3	13.0	2	8.7

Key:
(a) = Review the material of the previous lesson
(b) = Ask a puzzle or a question related to the lesson
(c) = Relate an event or an anecdote bearing on the lesson
(d) = State the general outline of the day's lesson
(e) = Perform a demonstration to raise interest
(f) = Other method

TABLE 24

WAYS TO END THE PHYSICS PERIOD

	Never-Rarely		Sometimes		Usually-Always	
	No.	%	No.	%	No.	%
(a)	1	4.3	6	26.1	16	69.6
(b)	3	13.0	7	30.4	13	56.5
(c)	1	4.3	5	21.7	17	73.9
(d)	15	65.2	8	34.7	0	0
(e)	19	82.6	3	13.0	1	4.3

Key:
(a) = Summarize the materials discussed
(b) = Consider an illustrative example
(c) = Solve a numerical application
(d) = Quiz the students on the material taught
(e) = Other method

TABLE 25

PERFORMANCE OF LABORATORY EXPERIMENTS

	Never-Rarely		Sometimes		Usually-Always	
	No.	%	No.	%	No.	%
(a)	13	56.5	8	34.7	2	8.7
(b)	13	56.5	3	13	7	30.4
(c)	16	69.6	3	13	4	17.3
(d)	10	43.5	6	26.1	7	30.4
(e)	19	82.6	2	8.7	2	8.7

Key:
(a) = At the end of a topic to fix in the minds of students the materials previously studied
(b) = At the end of a unit to test the theoretical materials studied previously.
(c) = Before starting a new topic to introduce the subject and get the students involved in it.
(d) = At appropriate time during the discussion period
(e) = At regular periods during the course, irrespective of the teoretical study.

TABLE 26

PROCEDURE IN LABORATORY EXPERIMENTATION

	Never-Rarely		Sometimes		Usually-Always	
	No.	%	No.	%	No.	%
(a)	21	91.3	2	8.7	0	0
(b)	5	81.7	2	8.7	16	69.6
(c)	22	95.6	1	4.3	0	0
(d)	20	86.9	1	4.3	2	8.7

Key:
(a) = The teacher performs a trial experiment and the students repeat it by themselves.
(b) = The students gather around the experimental set-up watching the teacher demonstrate the experiment, taking occasional notes of the procedure
(c) = The students set up the apparatus and perform the experiments individually. They depend mostly on their lab. manuals, with little help from the teacher.
(d) = The students are provided with the necessary apparatus and are allowed individually to cope with the problems of the topic under study. The teacher is around to assist the students.

set-up and observe the teacher "demonstrate" the experiment; taking occasional notes of the procedure. (See Table 26 for the high percentage of teachers following this procedure). On the other hand, it is encouraging to find out that a few teachers are following a truly scientific method of experimentation. This method consisted of providing the students with the necessary apparatus and allowing them to cope individually with the concepts and problems of the topic under study. The teachers would only assist the students when needs be.

As to the effects of laboratory experimentation, two-thirds of the teachers definitely admit that laboratory experiments help the students gain insight into the scientific reasoning. Second largest group of teachers declare that laboratory experiments prove to be a source of joy to the students. Very few teachers express negative views on laboratory experimentation; like proving to be a failure or causing frustrations to those involved. A substantial number admit the positive effect of the laboratory on the mastery of technical skills and on the initiation to the habits of the physicist. (Table 27).

6. Utilities in the teaching of physics

(a) Library

As it is manifested from Table 28, the library is not used effectively in the teaching of physics. Its meagre contribution has been in supplying science digests and magazines as well as recent reference books to provide up-to-date ideas and latest inventions.

(b) Mathematics

Most of the teachers reserve an important place to mathematics in the teaching of physics. (Table 29). According to more than half of the teachers, the mathematical rules and operations are studied before beginning the study of physics. For an almost equal

TABLE 27

EFFECTS OF THE LABORATORY EXPERIMENTS

	Never-Rarely		Sometimes		Usually-Always	
	No.	%	No.	%	No.	%
(a)	7	30.4	8	34.7	8	34.7
(b)	23	100	0	0	0	0
(c)	21	91.3	2	8.7	0	0
(d)	21	91.3	0	0	2	8.7
(e)	5	21.7	2	8.7	16	69.6
(f)	13	56.5	7	30.4	3	13.0
(g)	9	39.1	8	34.7	6	26.1

Key:
(a) = Prove to be a source of joy to the students
(b) = Prove to be a failure
(c) = Cause frustration to those involved
(d) = Increase the puzzles, rather than answer the questions of students.
(e) =Help the students gain insight into the scientific reasoning
(f) = Help the students gain mastery over technical skills
(g) = Initiate the students to the habits of the physicist

TABLE 28

UTILIZATION OF THE LIBRARY FOR TEACHING PHYSICS

	Never-Rarely		Sometimes		Usually-Always	
	No.	%	No.	%	No.	%
(a)	19	82.6	3	13.0	1	4.3
(b)	19	82.6	2	8.7	2	8.7
(c)	14	60.9	5	21.7	4	17.3
(d)	14	60.9	3	13.0	6	26.1

Key:
(a) = The library is used for book research and reporting
(b) = The library is used to consult encyclopedias and do-it-yourself books
(c) = The library is used to supplement the text material with the up-to-date version of recent books
(d) = The library is used to peruse science digest and magazines for latest inventions and discoveries.

number of teachers, mathematical treatment is indispensible to the teaching of physics. Still for a similar group, the mathematical treatment of physics is a part of the laboratory work. Only a small percent of teachers consider the possibility of teaching physics without analytical methods.

(c) Lecture

Presumable, the lecture method is not used as part of everyday practice of physics teachers. Its use is primarily for the purpose of introducing a new topic, and, to a lesser extent, to supplement inadequate textbook material. (For the percentage of teachers using the lecture method for different ends refer to Table 30). It is to be remarked that few teachers have bothered about specialists illustrate certain aspects of modern physics.

(d) Demonstration

The demonstration method has been utilized to raise interest for the subject and to allure the students into advanced treatment of the subject. The demonstrations performed by the teacher were rarely done for the purpose of exhibiting phenomena that the students are not likely to meet, or performing experiments that the students are not able to do. (Table 31).

TABLE 29

PLACE OF MATHEMATICS IN THE TEACHING OF PHYSICS

	Never-Rarely		Sometimes		Usually-Always	
	No.	%	No.	%	No.	%
(a)	5	21.7	6	26.1	12	52.2
(b)	6	26.1	6	26.1	11	47.8
(c)	10	43.5	7	30.4	6	26.1
(d)	9	39.1	3	13	11	47.8

Key:
(a) = The mathematical rules and operations are studied before beginning the study of physics
(b) = The physical processes and phenomena are studied simultaneously with the pertinent mathematical operations.
(c) = The physical phenomena are studied qualitatively first-prior to mathematical treatment
(d) = The mathematical treatment of physics must be inseparably related to laboratory work.

TABLE 30

APPROPRIATENESS OF THE LECTURE METHOD IN THE TEACHING OF PHYSICS

	Never-Rarely		Sometimes		Usually-Always	
	No.	%	No.	%	No.	%
(a)	4	17.3	1	4.3	18	78.3
(b)	4	17.3	8	34.7	11	47.8
(c)	19	82.6	4	17.3	0	0
(d)	18	78.3	2	8.7	3	13

Key:
(a) = At the beginning of a course; to introduce the new subject since the students are not in a postition to work by themselves.
(b) = When the textbook material is not adequate and I have to supplement it
(c) = When a specialist is to impart information on a certain aspect of modern physics which is not available easily
(d) = Almost always, since my superior knowledge and technique warrants efficiency and perfection

7. Nature of assignments used in the teaching of physics

(a) Home-work

The preoccupation of most teachers in assigning home-work is the assimilation and application by the students of the material taught in class. (Table 32). It is encouraging to realize that only the smallest faction of teachers consider home-work as an exercise for drill. On the other hand, some teachers were found to assign home-work for their students in order to do individualized study of the material taught in class.

As to the kind of home-work, more than three-quarters of the teachers assign the questions and exercises found at the end of the chapters. (Table 33). This might be a point against the teachers - particularly those teaching in the junior high schools, i.e., the unwillingness to look for new problems and alternative approaches. Having in mind that the exercises found in the textbooks are patterned after the Baccalaureate Examinations, the teachers have not much latitude of innovation.

(b) Problems

As might have been inferred from the above, there is a definite tendency to assign problems when a certain chapter is finished. However, a surprisingly large number of teachers have assigned problems right after a new concept is studied. (Table 34). As to the kind of assigned problems, almost all the teachers had dealt with the problems found in the text-book at the end of the chapter, although there were some teachers who had devised problems to suit student abilities. (Table 35).

Teachers are apparently divided among themselves as to the functions that the solving of problems would serve. The function admitted most emphatically is the

TABLE 31

RESORTING TO DEMONSTRATIONS IN THE TEACHING OF PHYSICS

	Never-Rarely		Sometimes		Usually-Always	
	No.	%	No.	%	No.	%
(a)	9	39.1	3	13	11	47,8
(b)	14	60.9	7	30.4	2	8.7
(c)	14	60.9	7	30.4	2	8.7
(d)	13	56.5	3	13	7	30.4

Key:
(a) = To introduce the subject to be studied and interest the students in it.
(b) = To exhibit phenomena that the students are not likely to meet.
(c) = To perform experiments that the students are not able to do.
(d) = To end the study of a certain topic; to review things already studied and project them into advanced treatment of the topic.

TABLE 32

REASONS FOR ASSIGNING HOME-WORK

	Never-Rarely		Sometimes		Usually-Always	
	No.	%	No.	%	No.	%
(a)	9	39.1	5	21.7	9	39.1
(b)	2	8.7	4	17.3	17	73.9
(c)	9	39.1	4	17.3	10	43.5
(d)	4	17.3	4	17.3	15	65.2

Key:
(a) = To supply the students with exercises for drill
(b) = To provide opportunity for the students to assimilate the material.
(c) = To provide a chance for the students to do individual study of the material
(d) = To assign written work in order that the student may apply what he has learned in class.

TABLE 33

KIND OF ASSIGNED HOME-WORK

	Never-Rarely		Some times		Usually-Always	
	No.	%	No.	%	No.	%
(a)	2	8.7	3	13	18	78.3
(b)	15	65.2	8	34.7	0	0
(c)	13	56.5	7	30.4	3	13
(d)	13	56.5	8	34.7	2	8.7

Key:
(a) = Questions or exercises at the end of the chapter to be answered
(b) = Certain parts of the subject to be elaborated with the help of reference books
(c) = Improvising a situation in which the student is required to define and solve a problem
(d) = Investigating and reporting on an aspect of everyday life related to the subject under study.

TABLE 34

TIME TO ASSIGN PROBLEMS

	Never-Rarely		Some times		Usually-Always	
	No.	%	No.	%	No.	%
(a)	9	39.1	4	17.3	10	43.5
(b)	5	21.7	3	13	15	65.2
(c)	7	30.4	4	17.3	12	52.2
(d)	11	47.8	9	39.1	3	13

Key:
(a) = At the end of a unit of study
(b) = At the end of each chapter
(c) = Right after a new concept is studied
(d) = Any time during the course of study

TABLE 35

KINDS OF PROBLEMS TACKLED BY STUDENTS

	Never-Rarely		Sometimes		Usually-Always	
	No.	%	No.	%	No.	%
(a)	0	0	3	13	20	86.9
(b)	1	4.3	15	65.2	7	30.4
(c)	19	82.6	4	17.3	0	0
(d)	18	78.3	5	21.7	0	0

Key:
(a) = Problems found in the text-book at the end of chapters
(b) = Problems devised by the teacher to suit his students
(c) = Problems arising from the experience of the students in the laboratory
(d) = Problems perceived and formulated by the students during their course of study

TABLE 36

FUNCTIONS OF PROBLEMS SOLVING

	Never-Rarely		Sometimes		Usually-Always	
	No.	%	No.	%	No.	%
(a)	3	13	7	30.4	13	56.5
(b)	10	43.5	5	21.7	8	34.7
(c)	6	26.1	3	13	14	60.9
(d)	6	26.1	1	4.3	16	69.6

Key:
(a) = Provides concrete situations for the application of abstract ideas
(b) = Makes the learners become involved in hypothetical working situations
(c) = Disciplines the mind by providing drill in quantitative thinking
(d) = Provides operational situations for the understanding of physical concepts

providing of operational situations for the understanding of concepts. (Table 36). Moreover, a large number of teachers believe that the solving of problems disciplines the mind by providing drill in quantitative thinking.

D. Teaching aids and activities for the teaching of physics

1. Choice of text-books

The first thing to note is the widespread usage of French books translated into English in all the classes of the secondary cycle. (Table 37). As for the Anglo-American books, their use is pronounced in the third, fourth and fifth secondary classes. They are in use whenever external official examinations are not a pressing factor. The local books are confined mostly to the first two classes; although they are also used to a certain extent in the sixth class as well.

About two-thirds of the teachers consider the text-books as providing only the general outline of the course. This attitude was particularly apparent among the teachers of junior high schools. In addition to this attitude, there is an equally emphatic tendency supported by half of the teachers that the assigned text-book is a satisfactory source of knowledge, and no subject material is to be omitted from it and no new material is to be added to it. (Table 38). Both the prevalent practices point to the rigidity and bookishness of the teaching of physics.

2. Apparatus employed for demonstration and experimentation purposes

It is clear from Table 39 that not all the apparatus (nineteen in number) presented in the questionnaire (Appendix II) were utilized by the teachers. The devices most commonly used

TABLE 37

PERCENTAGES OF THE DIFFERENT KINDS OF BOOKS USED PER CLASS

Kind of Books: / Classes	Lebanese		Anglo-American		French		French (in English)	
	No.	%	No.	%	No.	%	No.	%
I	3	50.0	1	16.7	0	0	2	33.3
II	3	27.2	2	18.2	2	18.2	4	36.3
III	2	11.8	6	35.3	3	17.6	6	35.2
IV	1	6.6	5	33.3	3	20.0	6	40.0
V	1	7.6	4	30.8	2	15.4	6	46.1
VI	3	20.0	3	20.0	2	13.3	7	46.7

TABLE 38

ATTITUDE TOWARDS TEXT-BOOK

	Never-Rarely		Sometimes		Usually-Always	
	No.	%	No.	%	No.	%
(a)	7	30.4	6	26.1	10	43.5
(b)	4	7.3	5	21.7	14	60.9
(c)	20	86.9	2	8.7	1	4.3
(d)	21	91.3	1	4.3	1	4.3

Key:

(a) = The assigned text-book is a satisfactory source of knowledge, no subject material is omitted from it and no new material added to it

(b) = The text-book provides the general outline of the course; the teacher refers to it and the students study certain parts of it

(c) = There is no one text-book; there are many reference books which the students consult to supplement the lecture notes delivered by the teacher

(d) = The students prepare their own text-book based on any/all of the activities such as; demonstrations by the teacher, individual laboratory work, group excursion into scientific and technological places, and solving practical problems.

for experimentation purposes include, in the order of decreasing use, thermometers, spring balances, rheostats, barometers, inclined planes, microscopes, calorimeters, optical discs, transformers, and, to a very small extent, wheatstone bridges and spectroscopes. Likewise, the devices most frequently used for demonstrations include, in the order of decreasing use; thermometers, spring balances, optical disks, rheostats, barometers, inclined planes, microscopes, tuning forks, calorimeters, transformers and, to a very small extent, wheatstone bridges and telescopes.

Comparison of the two series of devices used in experimentation and demonstration reveals two points:

(a) The devices employed in experimentation are almost identical with those employed for demonstration. Furthermore, the order of frequency of using them is almost the same for demonstration and experimentation purposes. This can be attributed to the demonstrational character of most of the laboratory experiments.

(b) The apparatus commonly utilized by physics teachers are almost wholly related to classical physics. Practically no use is made of modern equipment. In the majority of the laboratories visited by the experimentor, modern equipment such as sonometers, episcopes, geiger counters, radiometers, and oscilloscopes were not found. This again signifies the neglect of modern physics.

3. Audio-visual aids and extra-curricular activities

Very few teachers have employed the audio-visual aids considered, i.e., scientific films, film strips, models, kits, charts, and diagrams. (Table 40). The drawing of diagrams on the blackboard, was the most common practice. Most of the drawings were made with white chalk, and only about one-third of the teachers utilized colored chalks as part of their everyday teaching practice.

TABLE 39

APPARATUS USED FOR DEMONSTRATION AND EXPERIMENTATION PURPOSES

	A.- EXPERIMENTATION				B.- DEMONSTRATION			
	Sometimes		Usually-Always		Sometimes		Usually-Always	
	No.	%	No.	%	No.	%	No.	%
Sonometer	1	4.3	0	0	0	0	0	0
Barometer	7	30.4	7	30.4	7	30.4	7	30.4
Rheostat	4	17.3	9	39.1	3	13.0	8	34.7
Transformer	3	13.0	7	30.4	4	17.3	6	26.1
Optical Disk	4	17.3	7	30.4	4	17.3	8	34.7
Microscope	6	26.1	7	30.4	4	17.3	7	30.4
Episcope	2	8.7	0	0	1	4.3	0	0
Rectifier	3	13.0	2	8.7	0	0	3	13.0
Inclined Plane	6	26.1	7	30.4	4	17.3	7	30.4
Tuning Fork	3	13.0	5	21.7	0	0	7	30.4
Wheatstone	1	4.3	3	13.0	2	8.7	5	21.7
Spectroscope	1	4.3	3	13.0	2	8.7	1	4.3
Telescope	4	17.3	1	4.3	2	8.7	5	21.7
Calorimeter	4	17.3	7	30.4	5	21.7	6	26.1
Geiger Counter	1	4.3	2	8.7	0	0	0	0
Radiometer	1	4.3	0	0	1	4.3	0	0
Spring Balance	6	26.1	8	34.7	5	21.7	8	34.7
Oscilloscope	1	4.3	1	4.3	0	0	0	0
Thermometer	5	21.7	11	47.8	5	21.7	11	47.8

As manifested in Table 41, only two of the eight extracurricular activities considered were definitely incorporated to some extent into physics teaching. (A complete statement of the extracurricular activities considered is given in item (III,6) of the questionnaire found in Appendix II). The two extracurricular activities that were most frequently carried out, consisted of organizing science clubs and arranging bulletin boards. Other activities that have received sporadic attention include scientific knowledge contests and visits to scientific and technological exhibitions.

E. Evaluation schemes

1. Applicability of different types of tests to the six secondary classes

Four types of tests were presented in questions (1) and (2) in Part IV of the questionnaire addressed to the teachers. The four types of tests considered were objective, subjective, quantitative, and practical. To define these tests by revealing the subcategories that fall under them, the second question was formulated. These subcategories are as follows:-

(a) Objective tests: fill in the blanks, multiple choice, true or false, matching.

(b) Subjective tests: question de cours, explanatory topic, definition of concepts, theoretical proofs.

(c) Quantitative tests: numerical applications, hypothetical problems, experimental problems, real-life problems.

(d) Practical tests: performance of particular experiments, operating scientific devices, identifying the parts of a model, drawing diagrams.

TABLE 40

AUDIO-VISUAL AIDS IN THE TEACHING OF PHYSICS

	Never-Rarely		Sometimes		Usually-Always	
	No.	%	No.	%	No.	%
(a)	16	69.6	3	13	4	17.3
(b)	13	56.5	6	26.1	4	17.3
(c)	12	52.2	7	30.4	4	17.3
(d)	3	13	1	4.3	19	82.6
(e)	5	21.7	10	43.5	8	34.7

Key:
(a) = Scientific films and film strips
(b) = Models and kits of scientific devices
(c) = Charts and diagrams of scientific devices
(d) = Diagram drawn on the blackboard with white chalk
(e) = Diagram drawn on the blackboard with colored chalk

TABLE 41

EXTRACURRICULAR ACTIVITIES RELATED TO THE TEACHING OF PHYSICS

	Never-Rarely		Sometimes		Usually-Always	
	No.	%	No.	%	No.	%
(a)	17	73.9	6	26.1	0	0
(b)	20	86.9	3	13.0	0	0
(c)	19	82.6	3	13.0	1	4.3
(d)	12	52.2	9	39.1	2	8.7
(e)	21	91.3	0	0	2	8.7
(f)	17	73.9	3	13.0	7	30.4
(g)	13	56.5	3	13.0	7	30.4
(h)	22	95.6	1	4.3	0	0

Key:
(a) = Visit scientific and technological exhibitions
(b) = Bisit industrial and technological institutions
(c) = Make scientific devices and instruments
(d) = General knowledge contests on scientific topics
(e) = Organize a yearly science fair
(f) = Organize a science club
(g) = Arrange bulletin boards
(h) = Complete scientific kits

Due to irregularities in the responses of several teachers to this question, it was not possible to infer definitely what actually went into the construction of the different types of tests that were administered by the teachers. Imperfect as the results of this question were, it might be helpful to mention some of the salient points:

(a) Matching items were usually missing from objective tests.

(b) Theoretical proofs were given little consideration in subjective tests.

(c) Real life problems and to a certain extent hypothetical problems were missing from quantitative tests.

(d) Performing of experiments and drawing of diagrams constituted the main part of the practical tests.

Bearing these points in mind we can make the following inferences from Table 42;

(1) Subjective tests are by far the most frequently used test, followed by quantitative tests to a certain degree.

(2) The objective tests are used to a certain extent mainly in the lower grades.

(3) The practical tests are not incorporated into the evaluation scheme of most of the teachers. At best, they are used sporadically by some teachers.

(4) A certain variation of frequency in the use of the different types of tests is discerned through the different grades.

2. Factors for the evaluation of students

As revealed from Table 43 some factors have by far more weight than the rest in evaluating the students, irrespective of class levels. The factors having more weight of evaluation are arranged in decreasing order as follows;

TABLE 42

PERCENTAGE OF TEACHERS USING THE FOUR TYPES OF TESTS

Types of Tests	Objective		Subjective		Quantitative		Practical	
Classes	Sometimes	Usually-Always	Sometimes	Usually-Always	Sometimes	Usually-Always	Sometimes	Usually-Always
I	42.9	28.6	28.6	42.9	0	14.3	28.6	0
II	18.2	27.3	27.3	63.6	18.2	27.3	18.2	9.1
III	20.0	0	20.0	73.3	33.3	40.0	26.6	6.7
IV	0	26.6	20.0	73.3	13.3	66.7	26.7	6.7
V	9.1	9.1	9.1	90.0	27.3	72.7	27.3	27.3
VI	8.3	8.3	16.7	75.0	25.0	75.0	33.3	16.7

(a) Clear definition of concepts and generalizations.
(b) Cogent and systematic presentation of a topic.
(c) Correct solution of mathematical problems.
(d) Ready memorization of factual and theoretical data.
(e) Neat and regular preparation of homework.

On the other hand the factors having the least evaluative value are, as might have been expected (1) skill and orderliness in laboratory work, and (2) originality and technique in making science projects.

In some of the factors, certain variations in evaluative values relative to grade levels have been observed. The first such observation is a surprising one, namely, that interest in and identification with the subject is not highly considered in evaluating students in the lower two classes. As for the neat and regular preparation of homework, they are taken into account mostly in the third and fourth classes. Also in these two classes, the evaluative weight of cogent and systematic presentation of a topics is felt most. As for the correct solution of mathematical problems, its evaluative weight has increased as a function of grade level. The application of scientific principles to real life problems has been undertaken mostly in the third and fifth classes. This last result can be explained by giving two reasons. First the physics program of both classes deal with mechanics, heat, and sound, all of which have easy applications to real life problems. Second, these classes are not terminations of cycles. As a consequence, the teachers can be more flexible and afford the time for such possibilities.

TABLE 43

FACTORS FOR THE EVALUATION OF TEACHING PHYSICS

	I		II		III		IV		V		VI	
Factors	Sometimes	Usually-Always	Sometimes	Usually-Always	Sometimes	Usually-Always	Sometimes	Usually-Always	Sometimes	Usually-Always	Sometimes	Usually-Always
(a)	57.1	0	27.3	29.3	26.6	46.7	26.6	46.7	18.2	45.5	16.7	50.0
(b)	42.9	14.3	45.5	18.2	40.0	33.3	40.0	33.3	18.2	63.6	16.7	58.3
(c)	28.6	42.9	27.3	45.5	33.3	40.0	26.7	40.0	27.3	36.4	16.7	41.7
(d)	14.3	14.3	9.1	18.2	6.7	13.3	6.7	13.3	18.2	18.2	25	16.7
(e)	14.3	0	0	18.2	0	20.0	6.7	20.	18.2	0	16.7	0
(f)	0	57.1	9.1	36.4	6.7	46.7	13.3	53.3	9.1	45.5	16.7	41.7
(g)	0	71.4	18.2	63.6	20.0	66.7	13.3	73.3	0	90.9	0	91.7
(h)	14.3	57.1	9.1	63.6	13.3	73.3	13.3	66.7	9.1	63.6	8.3	66.7
(i)	28.6	42.9	36.4	54.5	33.3	60.0	20.0	66.7	18.2	72.7	16.7	75.0
(j)	42.9	14.3	36.4	18.2	20.0	40.0	26.6	26.6	27.3	36.4	16.7	33.3

Key:

(a) = Interest in and identification with the subject.
(b) = Attentive involvement in class activities.
(c) = Neat and regular preparation of homework.
(d) = Skill and orderliness in laboratory work.
(e) = Originality and technique in making science projects.
(f) = Ready memorization of factual and theoretical data.
(g) = Clear definition of concepts and generalizations.
(h) = Cogent and systematic presentation of a topic.
(i) = Correct solution of mathematical problems.
(j) = Application of scientific principles to real life problems.

3. Sources of difficulty in the learning of physics

A list of ten possible sources of difficulty in the learning of physics were submitted to the attention of the teachers. (For a full statement of these 'sources of difficulty' refer to item (IV,4) of the questionnaire found in Appendix II). Of these ten probable causes, four stand out as major sources of difficulty in all the classes of the secondary cycle. This is definitely inferred from Table 44.

The four sources of difficulty having maximum weight are as follows:

(a) Difficulty in grasping abstract definitions and generalizations.
(b) Inadequate background in mathematical principles and operations.
(c) Inability to apply the mathematical principles to physical problems.
(d) Too little time allowed for laboratory experimentation.

Considering all ten sources of difficulty, it is to be remarked that the brunt of their effect is felt in the second and third grades. Further scrutiny reveals that the effect of the sources of difficulty varies according to class levels. Difficulty in comprehending texts written in foreign languages is most pronounced in the first three grades. Difficulty in grasping abstract definitions and generalizations is the same for all classes, except in the fifth grade where it is apparently the least. Difficulty in distinguishing facts from theory is most pronounced in the third and fourth grades. As mentioned above, inadequate mathematical background and the inability to apply mathematical principles are major sources of difficulty in all the classes - except the first grade. It must also be added, that the latter is of a lesser source of difficulty than the former. It seems that insufficiency of time allotted to physics is not a major complaint except in the third grade. The effect

TABLE 44

SOURCES OF DIFFICULTY IN THE LEARNING OF PHYSICS

Classes:	I		II		III		IV		V		VI	
Sources	Sometimes	Usually-Always	Sometimes	Usually-Always	Sometimes	Usually-Always	Sometimes	Usually-Always	Sometimes	Usually-Always	Sometimes	Usually Always
(a)	14.3	57.1	27.3	45.5	33.3	26.6	20.0	13.3	9.1	9.1	25.0	8.3
(b)	28.6	42.9	27.3	27.3	40.0	20.0	26.6	26.6	18.2	27.3	25.0	33.3
(c)	42.9	14.3	27.3	18.2	33.3	20.0	20.0	20.0	9.1	0	8.3	0
(d)	14.3	28.6	27.3	45.5	33.3	46.7	33.3	33.3	54.5	27.3	50.0	16.7
(e)	28.6	28.6	27.3	36.4	40.0	40.0	26.6	20.0	27.3	27.3	25.0	25.0
(f)	42.9	0	45.5	0	26.6	20.0	20.0	0	18.2	9.1	25.0	0
(g)	28.6	57.1	27.3	36.4	20.0	26.6	13.3	20.0	27.3	27.3	16.7	41.7
(h)	0	14.3	18.2	9.1	20.0	6.7	20.0	0	9.1	9.1	33.3	0
(i)	42.9	0	54.5	0	46.7	6.7	53.3	0	54.5	0	33.3	0
(j)	28.6	0	18.2	0	40.0	6.7	33.3	0	36.4	0	33.3	0

Key:

(a) = Difficulty in comprehending texts written in English (or French).
(b) = Difficulty in grasping abstract definitions and generalizations.
(c) = Difficulty in distinguishing facts from theory.
(d) = Inadequate background in mathematical principles and operations.
(e) = Inability to apply the mathematical principles to physical problems.
(f) = Insufficient time allotted to physics in the schedule.
(g) = Too little time allowed for laboratory experimentation.
(h) = Discontinuity in development of subjects throughout different grades.
(i) = The problems of the text not related to everyday life of students.
(j) = Program dealing with obsolete appliances and uninteresting phenomena.

of too little time being allowed for laboratory experimentation is felt mainly in the first, second and sixth secondary grades. Discontinuity in the development of subjects through different grades has caused the least difficulty and only in the sixth secondary does it become a significant complaint. The last two factors of this list - problems of the text not related to everyday life of students, and program dealing with obsolete appliances and uninteresting phenomena - have an interesting impact. Only one teacher has definitely considered these as sources of difficulty while the majority of teachers regard them as sources of difficulty in some cases only.

F. Observations and suggestions

In this section, the teachers' personal observations and suggestions will be presented in the form they were written in the blank provided at the end of the questionnaire. This part of the questionnaire was designed to serve as an outlet for the subjective and emotional reactions of the teachers. These subjective reactions are considered complementary to the objective responses of the teachers.

1. Changes and trends in the teaching of physics as discerned by teachers through past experience.

   a) "Change to Baccalaureate Program."
   b) "Greater importance is given now to laboratory work and practical problems."
   c) "Physics is becoming more particularized than generalized and more emphasis is put pn problems than the general knowledge of the students..."
   d) "A shift from the general Certificate of Education Program to the Baccalaureate Program. As a consequence, less time devoted to laboratory experimentation."
   e) "The emphasis is being put on audio-visual aids, charts, films and laboratory work; and the stress on problems, specially in Sec. III and IV is diminishing."
   f) (1) "The program or the syllabus of each class is more definite now; the school adheres to a certain program."
      (2) "Less time is being devoted to laboratory experimentation and demonstration, more time to subject matter."
   g) (1) "It [the teaching of physics] has become more experimental."
      (2) " [Everyday life] Technological applications have had a

benevolent effect on the minds of the students."

(3) "Mathematical studies have also improved the efficiency of the scientific mind."

Although there is no consensus as to trends, yet some pronounced changes can be noted.

1. Change to Baccalaureate Program.
2. Less time devoted to laboratory experiments.
3. Audio-visual aids and technological applications are being emphasized.

2. Suggestions for the improvement of physics teaching

a) "Preparation of special films and filmstrips."

b) "Official programs have become obsolete. They have to be revised."

c) "More laboratory periods."

d) "More facilities for laboratory work."

e) "Text and material must be changed."

f) "Concepts in Physics should be well illustrated with examples in the text-books. Some books lack what I mentioned."

g) "Physics is advancing greatly so must its teaching advance in order to reach an up-to-date level."

h) "I would like to see teachers being practical rather than theoretical; not bound to only bookmaterials; giving insight to students to be more creative in thinking rather then produce merely that which is printed in the textbook...

i) "I am satisfied with the present status of Physics teaching so, I foresee no change or improvement in teaching physics.

j) "Note completely. Physics teachers should be encouraged to improve their own knowledge, to keep pace with modern development in physics and teaching technique. Furthermore, the physics program should be more real-to-life and also stress applications."

k) "I am not satisfied with the present status of physics

teaching. We do not have adequate means to create interest in students; particularly we need instruments for demonstration and film show. It will be better for the teacher not to depend on books; specially for the I and II Secondary classes. It is advisable for the physics teacher to be in touch with the mathematics and chemistry teachers."

The following are the most frequently mentioned means of improving the teaching of physics.

1. Modern text-books appealing to students.
2. Better facilities for laboratory experiments.
3. More utilization of films, filmstrips, and other demonstration devices.
4. Self-improvement of teachers.

3. Teachers' appraisal of their satisfaction with their ways of teaching.
   a) "Yes. I do not expect much improvement."
   b) "Yes. Because the students are satisfied with my way of teaching."
   c) "No. We should follow the Baccalaureate Program completely."
   d) "No. Besides the textbook I need a laboratory book to make weekly experiments."
   e) "Yes. Because I like teaching in general and specially teaching physics, so I try my best to make any problem clear to my students."
   f) "Yes. I include definitions, theoretical explanations, problems, and preparation of instruments. Only laboratory facilities are meagre."
   g) "Not exactly. I like to teach physics by demonstrating every topic and allow the students to perform experiments and ask questions."
   h) "Having done my studies in mathematics, I like physics for its applications of mathematics; and this is how I

present it to the students. I would have welcomed an elaborate laboratory for experimentation."

i) "Not completely. I find that more time should be given to relate physics to everybody life, more laboratory experiments. In other words, more motivation is necessary."

j) "No. The laboratory does not have all the material that is needed; specially for individual work. Moreover, the school budget is so limited that the school, by itself, cannot solve this problem."

k) "Yes. I have taught General Science for three successive years according to a planned program. The results were satisfactory; the student himself feels that. That which was difficult to understand at I Secondary, gradually was made understandable at III Secondary and so on..."

l) "Rather yes."

m) "Never."

About half of the teachers are satisfied with the way they teach physics. This group consists of teachers that like teaching and do their best under the existing conditions. The criterion for appraising their method of teaching is the satisfaction of their students. On the other hand, it is remarkable to note that the majority of those not satisfied with their teaching base their grievances on not having sufficient laboratory experiments.

4. Miscellaneous comments and remarks from teachers

a) "Laboratory work must be given much time and careful attention; as well as real life problems must be stressed in order to understand the real link between theoretical and experimental facts."

b) "I believe that the most important thing in science teaching is classification of the material taught."

c) "There is the need for more up-to-date textbooks. Modern physics must be introduced into the program."

d) "I suggest to keep [the same] teacher of science for successive years. He would be more helpful; he would have the occasion to plan his work for several years and get results."

e) "If a teacher is to do what I mentioned in (3) above [for the improvement of physics teaching], it means one should provide more laboratory and library facilities."

f) "In order to do something well and lead students through easiest paths of learning you have to spend more time outside the class. This means more labor with less income."

g) "Baccalaureate Program means to cram knowledge as much as possible in a very short time and pass an examination; either fail or pass. I believe academically this is wrong. Teaching of science must be taught in such a way so as to be understood by the students and examined with a comprehensive examination."

h) "Based on my past experience of teaching physics, I suggest that:
   (1) Textbooks be modernized.
   (2) Physics be taught always experimentally.
   (3) Importance be given to projects.
   (4) Theory and applications supplement each other."

i) "I do not particularly like the Baccalaureate Program:
   (1) Program is outmoded.
   (2) The fact that one can de away with the laboratory has led the school and the teacher to discard the laboratory altogether.
   (3) The pupil is out of touch mentally with the current progress in the world of science.
   (4) The teacher is so much preoccupied with covering the program that there is practically no time for digression. Hence no wit, no fun, no lab., no scientific communion."

j) (1) "The Armenian schools need a special budget for Laboratory equipment. Moreover, the present laboratories need larger facilities and space. The teacher should not be the only one responsible for the laboratory. It will be ideal to have an assistant who will set up the experiment, purchase necessary items, and be a good help to the teacher."

(2) "A good textbook with lots of examples, exercises, questions and problems is a must. Most of the ones available contain a lot of mistakes (mainly due to errors in translation and printing). Moreover, the school should have a fixed program: G.C.E. or the Lebanese Baccalaureate Program. Both programs cannot be taught simultaneously, contrary to popular belief..."

(3) "Physics should be a subject for the science students only. I believe that the students should be classified into Science and Arts sections at the end of Secondary III. Time and effort is wasted on students with no interest and no scientific curiosity."

In their comments, teachers were repeating some of their reactions to the previous items. The following series of remarks is representative of the general opinion of the group.

1. Program is obsolete; modern physics must be incorporated into it.
2. Need for better laboratory facilities.
3. Textbooks should be modernized.
4. A closer link between theory and practice.

CHAPTER IV

CONCLUSIONS

A. Summary of results

1. The Armenian Secondary Schools of Lebanon that were involved in the project are fourteen in number. Most of them are located in or around Beirut, particularly in Bourj-Hamoud.

2. At present, the Lebanese Baccalaureate Program has replaced the American High School Type Program as the most prevailing program. At all times, a Special Armenian Program has been devised to integrate the diverse external demands.

3. The teaching of physics is carried in English in four-fifths of the schools, the remaining fifths use French. As to the teaching of general science, a third use Armenian, another third uses English, one-fifth uses French, and one-tenth uses Arabic.

4. For all the grades, the number of physics classes available has been increasing throughout the years. The average number of students in each class section has not changed significantly, although several classes have been divided into sections. The number of students per grade is found to decrease with higher grades.

5. More schools - and more students - have achieved success in the American University of Beirut Entrance Examinations. At present, there is a remarkable increase in the number of students

succeeding in the Lebanese Baccalaureate Examinations. Throughout the years, the same schools have been preoccupied with the preparation of students for the French Baccalaureate Examinations. The least concern has been accorded to the Lebanese Brevet Examinations.

6. Three points are remarked regarding the extent of physics teaching as characterized by the number of physics periods:

(a) The number of physics periods has increased since 1965
(b) The number of physics periods has increased with increasing grade level.
(c) The number of physics periods taught in the Arts Sections has remained at the same low level.

In the first two secondary grades, about four times as many schools teach general science as they do physics.

7. Throughout the years, the number of part-time teachers has been more than the number of full-time teachers. However, the percentage increase in the number of full-time teachers is being more than that of the part-time teachers. Another trend discerned is that mostly young teachers are being appointed to teach physics.

8. About two-thirds of the teachers are holders of Bachelor's Degrees, and of these about two-fifths are in physics. The physics of the fifth and sixth secondary classes is taught exclusively by these teachers. One-quarter of the teachers are on the diploma level - particularly the Sophomore Diploma level. The first two grades are taught mostly by such teachers. The percentage of teachers with Master's Degrees is rather low, and the present ones are in fields other than physics.

9. In the past, the prevailing pattern of class combinations taught by the same teacher has been; (I, II, III), (IV, V, VI) and (II, III, IV, V, VI). At present, although there is no preferred class combination, there seems to be several emerging ones, e.g., (I, II), (I, II, III, IV), (V, VI). This might be an outgrowth of the official classification of teachers into categories.

10. Most physics teachers in addition to physics teach mathematics and other sciences as well. The combination of physics and mathematics, especially in the two higher grades, is becoming stronger. In the first three secondary grades, the teaching load of physics teachers containsmiscellaneous subjects.

11. Regular reading of scientific journals and the reading of recent reference books are the two means of self-improvement most commonly used. Next in order come in-service training with consultants and conferences on science education partaken mostly by experienced teachers. Several teachers were found in graduate work, however, none of these were in physics.

12. More than half of the teachers are following the Lebanese Baccalaureate Program in full. The second largest group of teachers are those following the program as prescribed by the school administration. Only about one-fifth of the teachers have their say in the reconstruction of the physics curriculum.

13. All of the teachers have utilized a sort of a lesson plan, with the monthly lesson plan being followed the least. There was no significant relationship between the type of lesson plan used and the number of years of teaching experience. The item considered by almost all teachers as imperative in a lesson plan is the content of study. The items that were usually included in the lesson plans consisted of goals, concepts, and suggested vocabulary to be established, and to a lesser extent of the list of demonstra-

tions and experiments to be performed.

14. The text-book - centered discussions and the solving of mathematical problems constituted the most frequently utilized technique in physics teaching. These were followed by the lecture-discussion technique in the lower grades and, to a lesser extent, by the lecture-demonstration technique in intermediate grades.

A very small faction of the teachers have incorporated individual laboratory experimentation as part of physics teaching. The common practice regarding laboratory experimentation has been to take the whole class to the laboratory, where most probably the teacher demonstrates a physics principle. A significant number of teachers had assigned real-life problems for the students to solve and selected topics for them to report on.

15. The physics periods were usually begun by reviewing the material of the previous lesson and stating the general outline of the day's lesson. At times the lesson was introduced by asking a puzzle or a question so as to motivate and interest the students. The ending of the physics periods was done either by summarizing the materials discussed in class or by solving numerical applications about them.

16. Laboratory experiments were not assigned to regular periods during the course of physics teaching. They were usually performed at the end of a unit of study or at any appropriate time during the discussion period. The procedure most frequently practiced in laboratory experiments consisted of having the students gather around the experimentation set-up and observe the teacher "demonstrate" the experiment, taking occasional notes of the procedure. As to the effect of the laboratory experimentation most teachers reacted favorable. Insight into the scientific reasoning, mastery of technical skills, and initiation to the habits of the physicist were admitted to be the positive effects of the laboratory.

17. The library was not used effectively in the teaching of physics. Its meagre contribution has been in supplying science digests and magazines as well as recent reference books.

18. The lecture method was primarily used for the purpose of introducing a new topic, and, to a lesser extent, to supplement inadequate textbook material. Few teachers had bothered about specialists lecture on certain aspects of modern physics. The lecture-demonstration method has been utilized to raise interest for the subject and to allure the students into advanced treatment of the subject.

19. Mathematical treatment has been considered indispensable to the teaching of physics. Usually the mathematical rules and operations have been studied before beginning the study of physics. There were even some teachers who considered the mathematical treatment of physics to be part of the laboratory work.

20. Home-work was assigned for the assimilation and application of the material taught in class. Home-work is not considered as an exercise for drill.

The assigned home-work consists of the questions and exercises found at the end of chapters. The problems are assigned at the completion of chapters, and they are selected from those found in the textbook at the end of the chapters.

21. The function of problems is believed to provide operational situations for the understanding of concepts. Also it is held that the solving of problems disciplines the mind by providing drill in quantitative thinking.

22. French books translated into English are prevalent. The use of Anglo-American books is diminishing, itsuse being continued whenever external official examinations are not a pressing

factors. (The prevailing attitudes towards textbooks point to the rigidity and bookishness of the teaching of physics) In general books are treated as providing the general outline of the course, although a substantial number of teachers consider text-books a satisfactory source of knowledge.

23. The same sort of apparatus is employed for experimentation and for demonstration purposes. The apparatus commonly utilized by physics teachers is almost wholly related to classical physics. Practically no use is made of modern equipment.

24. Very few teachers have employed audio-visual aids. The drawing of diagrams on the blackboard-mainly by white chalk- has been the most common practice.

The extracurricular activities commonly practiced were the organization of science clubs and the arranging of bulletin boards.

25. The subjective tests were the most frequently administered ones. The objective tests were used to a certain extent mainly in the lower grades, while the use of quantitative tests was considerable in the upper grade.

26. There were five factors that have been considered most in evaluating the student in all the classes of the secondary cycle. The factors referred to are as follows;

(a) Clear definition of concepts and generalizations
(b) Cogent and systematic presentation of a topic
(c) Correct solution of mathematical problems.
(d) Ready memorization of factual and theoretical data.
(e) Neat and regular preparation of homework.

27. The difficulty of the physics courses was felt most acutely in the second and third grades. Moreover, there are four factors that proved to be the main sources of difficulty in all classes. These factors are:

(a) Difficulty in grasping abstract definitions and generalizations.
(b) Inadequate background in mathematical principles and operations.
(c) Inability to apply the mathematical principles to physical problems.
(d) Too little time allowed for laboratory experimentation.

B. Implications and suggestions

1. Since most of the Armenian Secondary Schools of Lebanon having adopted the Lebanese Baccalaureate Program more emphasis is to be put on the subjects covered by the program. To compensate for the diminishing concern for non-Baccalaureate subjects, such subjects must be relegated to extra-curricular activities. New ways of teaching and evaluating these subjects must be devised - other than the traditional patterns.

2. The characteristic overcrowding of the Baccalaureate Program, i.e., to cram as much material as possible in the shortest time, has diminished certain aspects of the physics teaching to the barest minimum. The aspects of physics teaching referred to include the investigation and "discovery" of physics principles by laboratory experimentation and the application of these principles to the everyday experience of

the students.

3. Several remedial approaches can be suggested:

   (a) Increase in the number of physics periods, in particular making allowances for laboratory experimentation.
   (b) In certain classes - II, III, and V - that are not terminating in a diploma, teachers can afford to be more informal; intuitive rather than analytical, inquiring rather than authenticating.
   (c) Real-life problems, projects of scientific devices, and laboratory experiments can be relegated to science clubs to be carried out as extra-curricular activities - provided the latter are more effectively incorporated into the curriculum in the traditional sense.

4. Increase in the number of physics periods taught per week per class, together with the advocated increased involvement of teachers in extra-curricular activities related to the teaching of physics, implies more teachers with less load being employed in the teaching of physics. This in turn would imply two things. On the one hand, more full-time teachers have to be employed, and on the other hand more budget must be allocated to physics teachers. Although the former is not necessarily a cause of the latter, most of the poor secondary schools are employing inexperienced part-time teachers. It must be realized, however, that for successful teaching of physics, there should be teachers with ample time to plan and carry out some of the time-consuming activities that are inseparably related to physics.

5. The existence of a laboratory in almost all of the schools signifies the recognition of the importance of experimentation. But the bare minimum of the laboratory apparatus - signals to budget deficiencies on the one hand and to the ineffective use

of the apparatus already available. As to the first factor, a welcome remedy would be a special fund provided by either of the following institutions: the Agency for International Developement, the Lebanese Government, or the Calouste Gulbenkian Foundation. As to the second factor, three reasons can be cited:

(a) The Baccalaureate Program in general, and the external examinations in particular, have reduced the experimental aspects of physics teaching to a negligible minimum.

(b) Teachers are unfamiliar with the apparatus and inexperienced in the performance of experiments.

(c) Teachers are not willing to devote extra time for the preparation of experiments.

It would be a good information with practical implications for the improvement of the laboratory experiments to find out which of these factors mainly responsible for the present state of the laboratory.

6. Within the frame of reference of the present conditions of the Armenian Secondary Schools of Lebanon the following immediate approaches for the improvement of laboratory experiments can be suggested:

(a) A laboratory technician for the maintenance and smooth functioning of the laboratory. In collaboration with the teacher, and in cooperation with the students, he must help in the designing and the performing of experiments.

(b) An alumnus who is attending physics courses in a college and who is willing to help his alma mater can be trusted with maintaining the laboratory in working condition. Such students can be of particular help in organizing science clubs in which laboratory experiments can hold a primary place.

(c) Scholarship students from the upper classes can be employed as assistants in the laboratory. These

students will be of particular help in demonstrating physics principles to students of the lower grades.

7. The teaching of physics in the English language implies at least two inconveniences. In the first place there is the difficulty of understanding texts written in English by the students in the lower classes of the Armenian Secondary Schools. Realizing that there are no available books in Armenian or in Arabic that can replace them, and having in mind the technical difficulties in preparing books with colored diagrams and illustrations, this is not an easy obstacle to be surmounted. Secondly, the books of the terminating classes have been translated into English from the original in French so as to conform to the requirements of the Baccalaureate Program. Two unsatisfactory points can be noticed. The language is not in correct idiomatic English and the illustrations and applications are not directly related to the everyday life of the students. Some local books have attempted to meet the suggested requirements but with little success. What is needed is the preparation of a series of books according to conditions and aspirations of the country by the collaboration of local physicists, curriculum experts and educational psychologists.

8. The absence of definite class combinations, coupled with the prevalence of some sort of subject combinations, implies that the selection of the teachers has not probably been on the basis of filling a vacancy. Rather, the division of subjects is determined on the basis of the availability of teachers. Also, the prevailing subject combinations have been dictated by the academic preparation of teachers. To carry out the teaching procedures outlined above there will be more need of Bachelors in Physics holding Normal Diplomas and Teaching Groups majors in Physics, Mathematics and Education.

9. The absence of any one strongly preferred type of lesson plan points to arbitrariness and indecision regarding their use. This is all the more apparent due to the absence of any significant relation between the type of lesson plans utilized and the number of years of teaching experience. This raises interesting questions requiring further research: e.g., what kind of teachers use lesson plans, what is the benefit of using lesson plan, how to induce teachers to make lesson plans? It can be surmised that the utilization of lesson plans will be a natural necessity of the method of teaching physics advocated. Such lesson plans would not only include the objectives and contents of the study, but also include the means of attaining them, i.e., audio-visual aids, related activities, demonstrations and experiments.

10. Although the ideal number of students in each class should be less than what they are now, however, considering the existing conditions of the Armenian Secondary Schools of Lebanon it would be impractical to recommend any cut in the number. It is more important that schools have spacious classrooms and varied teaching facilities in which to engage the students: e.g., laboratories, workshops, science exhibition rooms, sections of libraries for science books and magazines. Effective use must be made of such facilities by assigning groups as well as individualized work to students.

Appendix I

MISCELLANEOUS DATA
about the

Armenian Secondary Schools of Lebanon
- with particular concern on the teaching of physics -
(Items to be checked and blanks to be filled by the cooperation of the office of the principal or the registrar)

Name of School: -

Location of School: -

Planning of the Present Program: (Check the relevent one)

Armenian National Educational Council - - -
Armenian Evangelical Educational Council - - -
A. G. B. U. Educational Council - - -
Program Committee of the Board of Managers - - -
Other: -

Program Adopted in the Years Indicated:
1960-61 - - -, 1961-62 - - -, 1962-63 - - -, 1963-64- -,
1964-65 - - -, 1965-66 - - -, 1966-67 - - -.

Lebanese Baccalaureate	(A)
French Baccalaureate	(B)
General Certificate of Education	(C)
American High-School	(D)
Special Armenian program	(E)

Language in which physics was taught in each class of the secondary school in the following years.

Language code: Armenian (A), Arabic (B), English (C), French (D).

Classes / Years	60-61	61-62	62-63	63-64	64-65	65-66	66-67
I							
II							
III							
IV							
V							
VI							

Indicate the number of students in a class, or class section, if it is divided.

Classes / Years	60-61	61-62	62-63	63-64	64-65	65-66	66-67
I							
II							
III							
IV							
V (Arts)							
V (Sc.)							
VI(Arts)							
VI (Sc.)							

Indicate the percentage of students who have successfully passed in the following external examinations.

Type of examination/Years	60-61	61-62	62-63	63-64	64-65	65-66	66-67
Lebanese Brevet							
Lebanese Baccalaureate							
French Baccalaureate							
General Cert. of Educt.							
A.U.B. Entrance Exam.							

Indicate the number of physics periods per week in each class of the secondary school for the following years.

Classes / Years	60-61	61-62	62-63	63-64	64-65	65-66	66-67
I							
II							
III							
IV							
V (Arts)							
V (Sc.)							
VI(Arts)							
VI (Sc.)							

Indicate the number of General Science periods per week in the first two classes of the secondary school for the following years.

Classes / Years	60-61	61-62	62-63	63-64	64-65	65-66	66-67
I							
II							

State the number of <u>physics teachers</u> with the indicated qualifications for the following years.

	60-61	61-62	62-63	63-64	64-65	65-66	66-67
Full time							
Part time							
M.S. in Physics							
B.S. in Physics							
B.S. in Mathematics							
B.S.(in fields other than Physics & Mathematics							
B.A. (Teaching Group							
Baccalaureate II							
Sophomore Diploma							
Normal Diploma							

Appendix II

QUESTIONNAIRE

Answered by Physics Teachers of the
Armenian Secondary Schools of Lebanon

Note.- Every teacher answering this questionnaire must have in mind the following points:

(a) This questionnaire is to reveal the status of the physics teachers of the Armenian Secondary Schools as a whole. No comparison is intended of different schools, or of the individual teachers in these schools. Under no circumstance is your name going to appear on the thesis paper.

(b) The main concern of this questionnaire is to acquire factual data, rather than evaluative information. So, please, in answering the questions, do not give your opinions on what you think you should do, or what you would do under other conditions. What is required is simply what are you actually doing under the prevailing conditions.

Part I
Teacher's Academic Background

Name of teacher -

Degree or Diploma held	Name of Institution	Year of Graduation
- - - - - - - - - - - -	- - - - - - - - - - -	- - - - - - - - -
- - - - - - - - - - - -	- - - - - - - - - - -	- - - - - - - - -
- - - - - - - - - - - -	- - - - - - - - - - -	- - - - - - - - -

Number of years teaching physics. ( )

Number of years teaching physics of the Baccalaureate Program in the V and VI Secondary Classes. ( )

Number of periods teaching physics per week during the following years.

1960-61 ( ) 1961-62 ( ) 1962-63 ( ) 1963-64 ( )
1964-65 ( ) 1965-66 ( ) 1966-67 ( )

What classes do you teach physics at present?

Sec. I Sec. II Sec. III Sec. IV Sec. V Sec. VI

Which classes did you teach physics in the past; and for how many years?

Sec. I ( ) Sec. II ( ) Sec. III ( ) Sec. IV ( )
Sec. V ( ) Sec. VI ( )

What other subjects besides physics do you teach now?

Chemistry --- Biology --- Algebra --- Geometry ---
Arithmetic --- General Science --- Trigonometry --- Other ---

What other subjects besides physics have you taught in the past?

Chemistry --- Biology --- Algebra --- Geometry ---
Arithmetic --- General Science --- Trigonometry --- Other ---

Which of the following means of self improvement are you engaged in?

(a) Teacher training courses.
(b) Graduate study in physics.
(c) Graduate study in education.
(d) Conference of science teachers.
(e) In-service training with consultants.
(f) Summer Institutes for science teachers.
(g) Refreshing physics courses from a college.
(h) Regular reading of scientific journals.
(i) Reading of recent reference books.

Part II

Methods and Practices

1.- What program do you follow in your teaching?
   (a) I follow the Lebanese Baccalaureate Program in full.
   (b) I follow the program as prescribed by the school administration.
   (c) I devise my own program according to my possibilities.
   (d) I devise a program to suit the needs and abilities of the students.

2.- Do you prepare a lesson plan? If so, is it:
   Yearly --- Term --- Monthly --- Weekly --- Daily ---

3.- How often do you follow a lesson plan?
   Never --- Rarely --- Sometimes --- Usually ---
   Always ---

4.- From the following list of possible entries, check the items that you include in your lesson plan. (Frequency code: Never (1), rarely (2), sometimes (3), usually (4), always (5).
   (a) Goals and concepts to be established ---
   (b) Content of study ---
   (c) Suggested vocabulary to be established ---
   (d) Required classroom materials and equipment ---
   (e) List of demonstrations and experiments ---
   (f) Audio-visual aids ---
   (g) Extra activities related to the lesson ---
   (h) Additional reference materials ---

5.- Which of the following techniques of teaching do you practice - and to what extent - in each of the classes that you teach? (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).

Techniques / Sec. Classes	I	II	III	IV	V	VI
Lecture - Discussion						
Lecture - Demonstration						
Lecture - Projected materials						
Textbook centered discussions						
Mathematical problem solving						
Real-life problem solving						
Individual Laboratory Experiments						
Group Laboratory Exp. (2 students)						
Group Laboratory " (3-5 students)						
Group Laboratory " (whole class)						
Student projects of devices						
Student reports on chosen topics						

6.- Which of the following do you employ to begin the physics period; and how often? (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).

(a) Review the material of the previous lesson ---
(b) Ask a puzzle or a question related to the lesson ---
(c) Relate an event or an anecdote bearing on the lesson ---
(d) State the general outline of the day's lesson ---
(e) Perform a demonstration to raise interest ---
(f) Other method ---

7.- Which of the following do you employ to end the physics period; and how often? (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).

(a) Summarize the materials discussed ---
(b) Consider an illustrative example ---
(c) Solve a numerical application ---
(d) Quiz the students on the material taught ---
(e) Other method ---

8.- Do you perform laboratory experiments; if so when? (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).

(a) At the end of a topic to fix in the minds of students the materials previously studied ---

(b) At the end of a unit to test the theoretical materials studied previously ---

(c) Before starting a new topic to introduce the subject and get the students involved in it ---

(d) At appropriate time during the discussion period ---

(e) At regular periods during the course, irrespective of the theoretical study ---

9.- Which of the following procedures do you follow in laboratory experimentation, and how often? (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).

(a) The teacher performs a trial experiment and the students repeat it by themselves. ---

(b) The students gather around the experimental set-up watching the teacher demonstrate the experiment, taking occasional notes of the procedure. ---

(c) The students set up the apparatus and perform the experiments individually. They depend mostly on their lab. manuals, with little help from the teacher. ---

(d) The students are provided with the necessary apparatus and are allowed individually to cope with the problems of the topic under study. The teacher is around to assist the students. ---

10.- Which of the following effects are the end results of the laboratory experiments; and to what extent? (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).

(a) Prove to be a source of joy to the students ---

(b) Prove to be a failure ---

(c) Cause frustration to those involved ---

(d) Increase the puzzles, rather than answer the questions, of students ---

(e) Help the students gain insight into the scientific reasoning ---

(f) Help the students gain mastery over technical skills ---

(g) Initiate the students to the habits of the physicist ---

11.- When do the students use the library during your physics course? Indicate the extent of its use by the following code: never (1), rarely (2), sometimes (3), usually (4), always (5).

(a) The library is used for book research and reporting ---

(b) The library is used to consult encyclopedias and do-it-yourself books ---

(c) The library is used to supplement the text material with the up-to-date version of recent books ---

(d) The library is used to peruse science digests and magazines for latest inventions and discoveries ---

12.- According to your practice, what is the place of mathematics in the teaching of physics? Indicate the degree of your preference by the following code: never (1), rarely (2), sometimes (3), usually (4), always (5).

(a) The mathematical rules and operations are studied before beginning the study of physics ---

(b) The physical processes and phenomena are studied simultaneously with the pertinent mathematical operations ---

(c) The physical phenomena are studied qualitatively first - prior to mathematical treatment ---

(d) The mathematical treatment of physics must be inseparably related to laboratory work ---

13.- When do you resort to the lecture method in your teaching of physics? (Frequency code: never (1), rarely (2), sometimes (3) usually (4), always (5).

(a) At the beginning of a course; to introduce the new subject since the students are not in a position to work by themselves ---

(b) When the textbook material is not adequate and I have to supplement it ---

(c) When a specialist is to impart information on a certain aspect of modern physics which is not available easily---

(d) Almost always, since my superior knowledge and technique warrants efficiency and perfection ---

14.- When do you resort to demonstrations in your teaching of physics? (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).

(a) To introduce the subject to be studied and interest the students in it ---

(b) To exhibit phenomena that the students are not likely to meet ---

(c) To perform experiments that the students are not able to do ---

(d) To end the study of a certain topic; to review things already studied and project them into advanced treatment of the topic ---

15.- Why do you assign home-work? (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).

(a) To supply the students with exercises for drill ---

(b) To provide opportunity for the students to assimilate the material ---

(c) To provide a chance for the students to do individual study of the material ---

(d) To assign written work in order that the student may apply what he has learned in class ---

16.- What kind of home-work do you assign, and how often? Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).

(a) Questions or exercises at the end of the chapter to be answered ---
(b) Certain parts of the subject to be elaborated with the help of reference books ---
(c) Improvising a situation in which the student is required to define and solve a problem ---
(d) Investigating and reporting on an aspect of everyday life related to the subject under study ---

17.- When do you assign problems? (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).

(a) At the end of a unit of study ---
(b) At the end of each chapter ---
(c) Right after a new concept is studied ---
(d) Any time during the course of study ---

18.- What kind of problems do your students tackle, and how often? (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).

(a) Problems found in the text-book at the end of chapters ---
(b) Problems devised by the teacher to suit his students ---
(c) Problems arising from the experience of the students in the laboratory ---
(d) Problems perceived and formulated by the students during their course of study ---

19.- What functions does the solving of problems serve? (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).)

(a) Provides concrete situations for the application of abstract ideas ---

(b) Makes the learners become involved in hypothetical working situations ---

(c) Disciplines the mind by providing drill in quantitative thinking ---

(d) Provides operational situations for the understanding of physical concepts ---

Part III

Teaching Aids and Activities

1.- What text-books for physics or general science are used in each of the classes that you teach?

Classes	Title of Book	Author of Book	No. of Years in Use
Sec. I	---	---	---
Sec. II	---	---	---
Sec. III	---	---	---
Sec. IV	---	---	---
Sec. V	---	---	---
Sec. VI	---	---	---

2.- To what extent do the following statements reflect your attitude towards text-books as revealed by your actual practice? (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).)

(a) The assigned text-book is a satisfactory source of knowledge, no subject material is omitted from it and no new material added to it ---

(b) The text-book provides the general outline of the course; the teacher refers to it and the students study certain parts of it ---

(c) There is no one text-book; there are many reference books which the students consult to supplement the lecture notes delivered by the teacher ---

(d) The students prepare their own text-book based on any/all of the activities such as; demonstrations by the teacher, individual laboratory work, group excursion into scientific and technological places, and solving practical problems ---

3.- Check, from the following list of devices, those that you employ for experimentation purposes. (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).)

sonometer --- microscope --- wheatstone bridge --- radiometer --- barometer --- episcope --- spectroscope --- spring balance --- rheostat --- rectifier --- telescope --- oscilloscope --- transformer --- inclined plane --- calorimeter --- thermometer --- optical disk --- tuning fork --- geiger counter ---

4.- Check, from the following list of devices, those that you employ for demonstration purposes. (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).)

sonometer --- microscope --- wheatstone bridge --- radiometer --- barometer --- episcope --- spectroscope --- spring balance --- rheostat --- rectifier --- telescope --- oscilloscope --- transformer --- inclined plane --- calorimeter --- thermometer --- optical disk --- tuning fork --- geiger counter---

5.- What A. - V. aids do you employ, and how often? (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).)

(a) Scientific films and film strips ---
(b) Models and kits of scientific devices ---
(c) Charts and diagrams of scientific devices ---
(d) Diagram drawn on the blackboard with white chalk ---
(e) Diagram drawn on the blackboard with colored chalk ---

6.- Which of the following extracurricular activities do your students engage in, and how often? (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).)

(a) Visit scientific and technological exhibitions ---
(b) Visit industrial and technological institutions ---
(c) Make scientific devices and instruments ---
(d) General knowledge contests on scientific topics ---
(e) Organize a yearly science fair ---
(f) Organize a science club ---
(g) Arrange bulletin boards ---
(h) Complete scientific kits ---

Part IV

Evaluation Schemes

1.- Which of the following kinds of tests do you administer - and how often - in each of the grades that you teach? (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).)

Kind of Tests/Secondary Classes	I	II	III	IV	V	VI
Objective tests						
Subjective tests						
Quantitative tests						
Practical tests						

2.- To what extent do you consider the following factors in evaluating your students in each grade that you teach? (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).)

Factors for Evaluation/Sec.Classes	I	II	III	IV	V	VI
(a) Interest in and identification with the subject.						
(b) Attentive involvement in class activities.						
(c) Neat and regular preparation of homework.						
(d) Skill and orderliness in laboratory work.						
(e) Originality and technique in making science projects.						
(f) Ready memorization of factual and theoretical data.						
(g) Clear definition of concepts and generalizations.						
(h) Cogent and systematic presentation of a topic.						
(i) Correct solution of mathematical problems.						
(j) Application of scientific principles to real life problems.						

3.- To what extent are the following 'sources of difficulty' for learning physics in the various grades (Frequency code: never (1), rarely (2), sometimes (3), usually (4), always (5).

Sources of Difficulty/Sec. Classes	I	II	III	IV	V	VI
(a) Difficulty in comprehending texts written in English (or French)						
(b) Difficulty in grasping abstract definitions and generalizations.						
(c) Difficulty in distinguishing facts from theory.						
(d) Inadequate background in mathematical principles & operations.						
(e) Inability to apply the mathematical principles to physical problems.						
(f) Insufficient time allotted to physics in the schedule.						
(g) Too little time allowed for laboratory experimentation.						
(h) Discontinuity in development of subjects throughout different grades.						
(i) The problems of the text not related to everyday life of students.						
(j) Program dealing with obsolete appliances & uninteresting phenomena.						

Part V

Observations and Suggestions

1.- Looking back through your experience as physics teacher, what changes and trends do you discern in the teaching of physics?

- -
- -
- -
- -
- -

2.- Are you satisfied with the present status of physics teaching? What changes do you foresee for the improvement of physics teaching?

- -
- -
- -
- -
- -

3.- Are you satisfied with the way <u>you</u> teach physics? - - - - -
Give reasons for your answer - - - - - - - - - - - - - - - -

- -
- -

4.- Any comments or remarks that you may have:

- -
- -
- -
- -
- -

Appendix III

FULL NAME AND LOCATION OF THE RESPONDING SCHOOLS

Senior Secondary Schools

Name	Location
Armenian Evangelical College	Mexic Street, Beirut
Hamazkaine Neshan Palanjian College	Beyhum Street, Beirut
A.G.B.U. Hovagimian Manougian Secondary School for Boys	Zokak-el-Blat, Beirut
A.G.B.U. Tarouhy Hagopian Girls School	Hazmieh,
Armenian Evangelical Central High School	Eshrefieh, Beirut
New High School	Nahr Street, Beirut
Armenian Evangelical Shamlian-Tatigian Secondary School	Nor Marash, Bourj Hamoud
Levon and Sophia Hagopian College	Nor Marash, Bourj Hamoud
Secondary School of Life	Dbayeh
Hripsimiantz Secondary School for Girls	Jounieh
Armenian Evangelical Secondary School	Anjar - Bekaa

Junior Secondary Schools

Name	Location
Armenian Catholic Saint Mesrob School	Arax Street, Bourj Hamoud
Armenian Adventist School	Sin-el-Fil, Bourj Hamoud
Armenian Evangelical Junior High School	Mina, Tripoli

SELECTED REFERENCES

Books and Magazine Articles

Abrahamson, Bernard, "A Comparison of Two Methods of Teaching Mechanics in High School", Science Education, XXXVI (March, 1952), 96-106.

Anibal, F.G. "Comparative Effectiveness of the Lecture-Demonstration and Individual Laboratory Method", Journal of Education Research, XIII (May, 1926), 355-365.

Barnett, R.W., Teaching Science in Secondary Schools.

Brandwein, P.F.,F.G. Watson, and P.E. Blackwood, A Book of Methods, New-York, 1958.

British Asscciation for the Advancement of Science, Science in Schools.

Bossing, N.L., Teaching in Secondary Schools, Third Edition, Houghton Nifflin Company, 1952.

Carpenter, Finley, "The Effect of Different Learning Methods on Concept Formation", Science Education, XI (October, 1959), 282-285.

Kemeny J.G., A Philosopher Looks at Science.

Ministry of Education, Pamphet No. 38, Science in Secondary Schools, Great Britain.

Ministry of National Education and Fine Arts of Lebanon, Program of Studies, 1946.

National Society for the Study of Education, "Science Education in American Schools", Forty-sixthYear-book, University of Chicago Press, 1947.

Richardson, J.S., and G.P. Cahoon, Methods and Materials for Teaching General and Physical Science, McGraw-Hill Book co., 1951.

Sund, R.B., and L.W. Trowbridge, Teaching Science by Inquiry in the Secondary Schools.

Washton, Nathan S., Science Teaching in the Secondary School, Harper and Brothers.

Unpublished M.A. Theses

Al-Khatib, Ahmed Shafiq. "Scientific Attitudes in Scientific Teaching in Lebanon." (1958)

Babikian, Yeghia G. "The Teaching of Biology in the Secondary Schools of Lebanon". (1957)

Badri, Malik, "Audio-visual Aids for Improving Science Teaching in Sudanese Secondary Schools." (1958)

Haddad, Wadi' D., "An Inexpensive Universal Kit for Teaching Secondary School Physics". (1964)

Namek, Yakub R., "A Study of the Causes of Failure in Secondary School Physics in Lebanon." (1958)

Za'rur, George, I., "The Teaching of Chemistry in the Secondary Schools of Lebanon with Some Suggestions for its Improvement". (1957)