MARA JUNIOR SCIENCE COLLEGE (MJSC)

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THE ESTABLISHMENT OF MARA JUNIOR SCIENCE COLLEGE
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THE ESTABLISHMENT OF MARA JUNIOR SCIENCE COLLEGE

1. INTRODUCTION AND BACKGROUND

The MARA Junior Science College idea was first conceived by the Training Division MARA in 1968. Due to the shortage of Bumiputera students entering pre-University classes in Science, it was thought that MARA should provide the necessary facilities to absorb those students who could not obtain places in Form 6 Science in the various Government schools. Immediately, this idea received approval in principle, from the Chairman of MARA and steps were taken to secure governmental provisions for its establishment. In the course of the negotiations with the Economic Planning Unit of the Prime Minister's Department, it was felt that the implementation of such an idea should ideally be by the Ministry of Education which not only agreed with the concept but even thought it feasible. At this juncture, the Ministry of Education announced its plan to establish ten fully residential Junior Colleges as step to partially solve these problems and as result of this undertaking by the Ministry of Education, MARA withdrew its proposal to establish the Junior College.

However, in the two years that lapsed, the Junior College Programme have not materialized. In the meantime, the Institute Technology of MARA introduced a number of pre-university classes to absorb those Bumiputera students who have been denied placed in form 6 Science and Arts due to their poor academic performance in the school Certificate Examinations. The results produced so far by the Institute is not encouraging, if not dismal. The experience of the Institute Technology of MARA points to the fact that even with the best training given to the students, it is not probable that they will be first class university materials when their earlier foundations were very weak. Further developments in the country necessitate us to reconsider our original proposal and in April 1970, MARA brought up the issue again at the Inter-Agency Planning Group (IAPG) established under the auspices of the Economies Planning Unit. At the IAPG meeting, while the idea of establishing the Junior College was approved, it was felt that to solve the shortage of Bumiputera science students in the secondary schools, another college on the same pattern as ITM is not the solution. The MARA Junior Science College should particularly emphasize on producing selected quality of Bumiputera Science students rather than emphasis in quantity. MARA proposed to establish 3 Junior Science Colleges in the Second Malaysia Plan to cater for students from Form 1 to Form 6.

2. RE-STATEMENT OF OBJECTIVE

The MARA Junior Science College shall be a Science and Technical Institution fully equipped with modern facilities and able staff to cater for the needs of above average students. It shall be established to meet the needs of boys and girls possessing high mental capacities and a particular interest in Science and Mathematics. While the emphasis will be on Science and Mathematics for all students, the college presents a well-rounded curriculum that give thorough combinations of all aspects of a student's development. This idea was inspired by successful experiments carried out in America and the Philippines (See Appendix I).

It is felt that by exposing these students early in life to 'Science-Based Education', each student will be able to experience some of the excitement, beauty and intellectual satisfaction that scientific pursuits afford. It is also aimed at giving students experience and point of views

hitherto largely limited only to professionals in the field. These experiences, it is hoped, will lead many to enter scholarly profession in their work and their vacations. Over and above these goals that we hope to achieve, every student completing a programme of study at the college is expected to have improved in regard to certain attitudes, understandings and skills. Some of what we hope to achieve at the college are as follows :-

i) Acquisition of greater factual knowledge which any prove helpful in future schooling, in career and in life.

ii) Development for Science as one aspect of our culture.

iii) To develop critical faculty.

iv) Improve ability to express and defend a knowledgeable opinion concerning a controversial issue in Science.

v) Increase facility in access to and understanding in reading Science literature.

vi) Increase ability to recognize common things in his environment, such as plants, animals, minerals, acids, salts, electrical phenomena with the view of stimulating basic creativity.

vii) Development of a better understanding of himself and his role as an integral and interacting part of his environment.

viii) Improve skills at handling a scientific instrument.

x) Development of constructive/creative approach to living things and environment.

xi) Increase ability to apply techniques of problem solving and experimental design to a real and hypothetical problem.

xii) To develop an open mind

xiii) Provide greater insight into the problem of human behavior.

xiv) To develop systematic approach and clear thinking

v) To develop a healthy and keen mind.

3. THE PHILOSOPHY OF THE MARA JUNIOR SCIENCE COLLEGE

In consonance with the objective of the college, our philosophy is to develop an absorbing interest towards scientific process and its method of inquiry among the students. We feel that Science is more than an encyclopedia collection of facts and that students derive much benefit from experiences which enable them to acquire learning processes that are essential for the understanding of Science. These experiences include observing, classifying, using space/time relationships, using numbers, communicating, measuring, inferring and predicting. It is felt that such simple processes will allow us to develop within the students more complex and integrated process abilities, i.e. such operations as formulating hypotheses, controlling variables, interpreting, data, defining operationally, formulating models and experimenting. We attempt to apply the above objectives utilizing the laboratory as the main teaching situation. Thus laboratory experience becomes central to the teaching of scientific concepts at the MARA Junior Science College.

4. JUSTIFICATION FOR THE ESTABLISHMENT OF THE MARA JUNIOR SCIENCE COLLEGE

The plan and expectations of the Government as envisaged in the Second Malaysia Plan depend greatly upon a strong and growing Science and Technology. The growing importance of Science and Technology in our country is the result of the Government's deliberate efforts to increase the pace of industrialization and this in turn, creates pressing educational demands. Literacy in science is becoming essential for all of us who wish to comprehend the world we live and work in and to participate in the decisions that require the understanding of Science.

It is therefore imperative that more and more students in this country must be directed to scientific and technical pursuits and they must be prepared to work with increasingly sophisticated ideas and techniques.

Our country exists in an age of explosive growth of knowledge where more scientific and technological discoveries have been made in the last 15 years than in all previous recorded time. Powerful insights are being gained into the fundamental structure of major area of inquiry. The technological gap that our country faces vis-à-vis other developing countries need no elaboration. As such, our nation can therefore no longer afford to wait for a generation or more for new knowledge to make its way gradually into the school syllabuses. It is felt that the task of bringing the best to all students in ways appropriate to their varied interests, abilities and future lives require new strategy. This is where the MARA Junior Science College shall be the pace-setters in educational innovations in this country where fresh approaches to the improvement of school instruction in Mathematics and Science can be experimented.

The aim is to see that instructions given at this college presents contemporary points of view on established syllabuses/course that have been practiced by the schools in this country. Our objective is to go beyond the presentation of what is known: to stimulate students with experience in the processes by which new facts, principles and techniques are developed. One of the means of ensuring this is to ensure that the 'supply line' in our school system has room for the gifted children who can be nurtured towards this end.

It is also to be emphasized that besides the essential educational objectives, (innovational approach to teaching Science and Mathematics) mentioned above, the establishment of MARA Junior College would go a long way in trying to provide Bumiputera Science students of high academic potential to fill in places in upper secondary premier schools in the country. The MARA Junior Science College intends to play this 'fender' role because it feels that in order to have many promising Bumiputera students pursing science in upper schools there must be Science Orientation as early as Form I, This, it is submitted, is not the prevailing situation in the premier residential school today. As a result there are relatively few Bumiputera who really qualify for the science stream in upper schools, colleges and universities. By establishing three or four Colleges to take in the above-average students right from Form I and process them towards Science Orientation, MARA hopes by 1973, to produce at least 150 very high potentials science students ready to enter Form IV and by 1975 the number would increase to 400 (from 4 colleges that will be established in the various regions in West Malaysia). The best part to this will be absorbed into MARA Junior Science College Form IV who will proceed to Form VI. This upper secondary part of the College will be equipped with modern Science facilities and qualified teachers commensurate with contemporary approach to Science education in schools. It is here that most of the innovative teaching will be carried out. Thus, the Lower Junior College will be the cream feeder to this secondary complex (which will be the central school) and they will also help provide good science students to other national premier school. By 1976 annually about 100 students form MARA Junior Science College who cannot be accommodated in MARA Junior Science College central school will be eligible to enter national premier schools or the Junior College that the Ministry of Education intends to establish. Thus the MARA Junior Science College does not duplicate or compete with these schools but it complements.

5. THE PLANNING & ORGANISATION OF MARA JUNIOR SCIENCE COLLEGE

i. SCHOOL BUILDING DEVELOPMENT

The MARA Junior Science College from the bottom upwards i.e. from Form 1 to Form VI. The first stage will be securing suitable sites, planning and implementation of the lower sections of the College system (feeders). This is to accommodate students from Form I – III. At least three of these 'feeder' schools will be established by 1973. One will be in Seremban, and a suitable site has been obtained for that purpose at a nominal rent from the Negeri Sembilan Government. This will be known as Phase I. The establishment of the second and third 'feeders' schools will respectively be Phase II and Phase III. The planning and implementation of Phases II and III will begin when the Seremban College starts operating about mid 1971 so that these schools will be ready to enroll students in Forms I at the latest by 1973.

Phase IV of the project will be the establishment of upper secondary schools (Forms IV – VI). This will consists of two development stages, namely: the School Certificate stage and pre-University stage. An area of about 20 acres is being negotiated with the Government of Selangor and when completed it will make up the central system of the MARA Junior Science College. The School Certificate stage is scheduled to be ready late

1973 so that the first batch of about 100 students from Phase I may be admitted into Form IV in the central system in 1974. Likewise the pre-University stage should be ready to enroll the same number of students by 1976.

The projected enrolments at the lower and upper schools and the total students population at any given time within the first 10 years is illustrated in Tables I, II and III.

ii. IMPLEMENTATION OF MARA JUNIOR SCIENCE COLLEGE

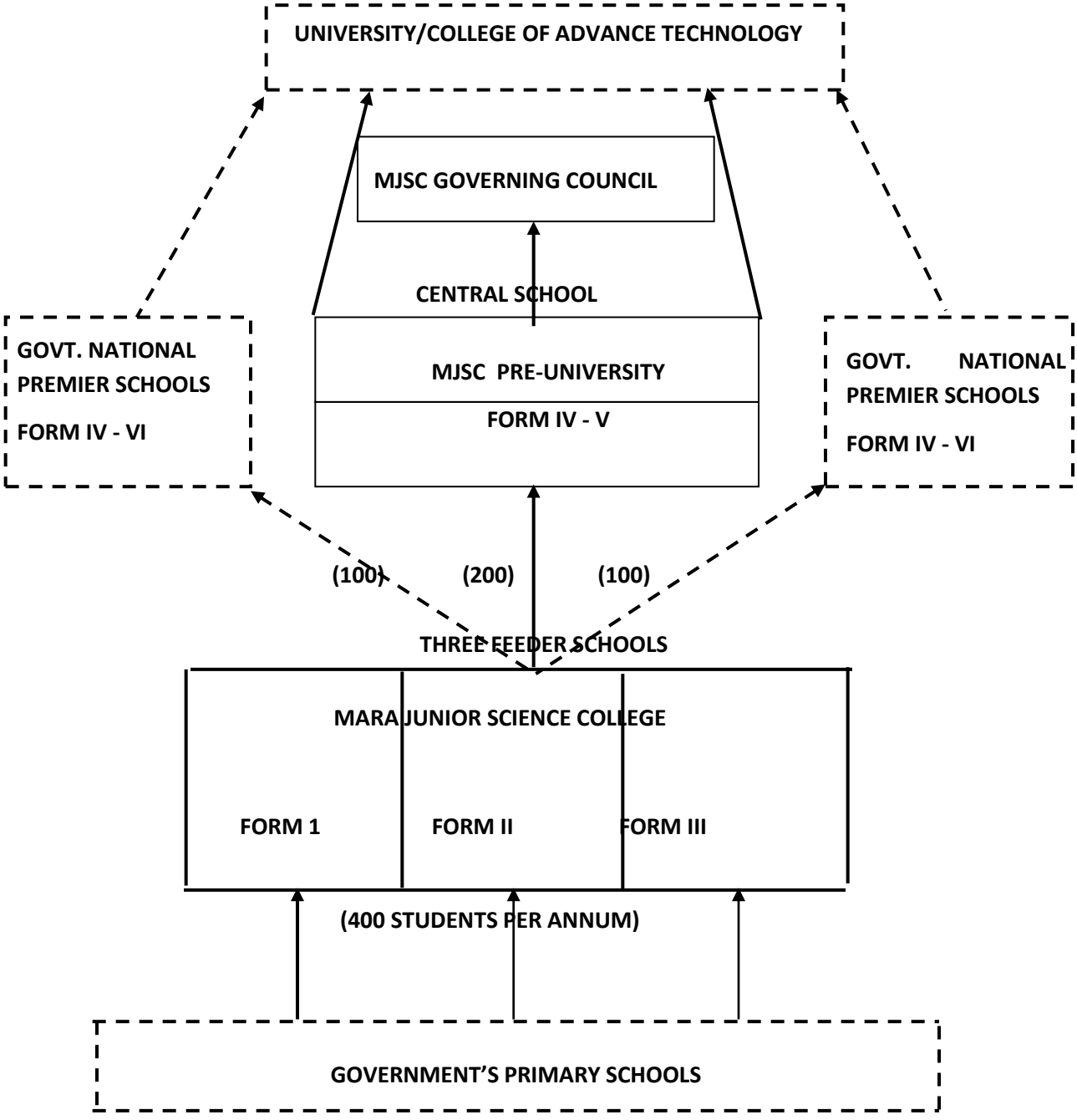
a. Establishment of the Governing Council of MARA Junior Science College.

b. Accomplishment of Phase I (Establishment of MARA Junior Science College Seremban 1971).

c. Accomplishment of Phases II and III : 1972 – 73. (Establishment of second and third MARA. Junior Science College (Lower); One in East Coast and one in Johor.

d. Accomplishment of Phase IV:

The establishment of the Central School in Selangor 1972 – 1974.


UNIVERSITY/COLLEGE OF ADVANCE TECHNOLOGY
MJSC GOVERNING COUNCIL
CENTRAL SCHOOL
MJSC PRE-UNIVERSITY
FORM IV - V
GOVT. NATIONAL PREMIER SCHOOLS
FORM IV - VI
GOVT. NATIONAL PREMIER SCHOOLS
FORM IV - VI
(100)
(200)
(100)
THREE FEEDER SCHOOLS
MARA JUNIOR SCIENCE COLLEGE
FORM 1
FORM II
FORM III
(400 STUDENTS PER ANNUM)
GOVERNMENT'S PRIMARY SCHOOLS

6. TABLE 1

MARA JUNIOR SCIENCE COLLEGE – LOWER SECONDARY MARA
(Enrolment at 'feeder' Schools)

Form	**1971**	**1972**	**1973**	**1974**	**1975**
I	150	150	300	400	400
II		150	150	300	400
TOTAL	150	300	600	850	1100

TABLE II

MARA JUNIOR SCIENCE COLLEGE – UPPER SECONDARY
(Enrolment at Central School)

Forms	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**
IV	100	100	200	200	200	200
V		100	100	200	200	200
VI(L)			100	100	200	200
VI(U)				100	100	200
TOTAL	100	200	400	600	700	800

Subject to accommodation and teaching facility problems and students' academic inclination, only 100 will be taken into the MJSC central School in 1975 (upper secondary – Form IV – VI). The other 50 from MJSC Form 3 will be channeled off to national Premier schools either to do Science or Arts there.

This MJSC output to the national stream will be approximately 200 p.m. as from 1976 (see Table III).

TABLE III

MARA JUNIOR COLLEGE TOTAL STUDENT POPULATION

FORM	**1971**	**1972**	**1973**	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**
I	150	150	300	400	400	400	400	400	400
II		150	150	300	400	400	400	400	400
III			150	150	350	400	400	400	400
IV				100	100	200	200	200	200
V					100	100	200	200	200
VI(L)						100	100	200	200
VI(U)							100	100	200
TOTAL	150	300	600	950	1350	1600	1800	1900	2000

* From one school in Seremban (lower secondary)
** From two schools (Lower secondary)
*** From three schools Lower secondary)
N.B. When the project is fully completed :

1. the annual intake MJSC will be - Form I approximately 400 by 1974 (3 school)
   Form IV " 200 by 1976
   Form VI " 200 by 1978
2. the annual output to national stream premier schools (upper secondary) approximately by 1976
3. the annual output to Universities and Colleges approximately 200 by 1979

BASIC EXPENSES

	Per Annum		Per 3 Years	
	Per Student	**Per 150 Student**	**Per Student**	**Per 150 Student**
Water & Electricity	40	6000	120	18000
Postage	4	600	12	1800
Stationery	7	1050	21	3150
Printing & Advertising	30	4500	90	13500
Transport & Traveling	30	4500	90	13500
Telephone & Telegram	3	450	9	1350
Medical & Dental	30	4500	90	13500
Sports & Recreation	5	750	15	2250
Board & Lodging	275	41250	825	123750
Books	20	3000	60	9000
Financial Allowance	120	5400	360	16200
	564	72000	1692	216900

* It is thought proper that the very poor students should be given pocket money of $20/- per month The number of such students is estimated to be 30% of the total annual intake.

PREPARATION FOR THE MARA JUNIOR SCIENCE COLLEGE

PREPARATION FOR THE MARA JUNIOR SCIENCE COLLEGE
O U T L I N E

1. KEY PEOPLE
- A. Board
- B. Principal
- C. Register – Bursar
- D. Faculty
- E. Other staff

2. PLANNING

A. Philosophy
1. Syllabus
2. Practical vs theoretical
3. Role of administration and role of faculty
4. Admission standard
5. Evaluation procedures :-
   a. Evaluation of students
   b. Evaluation of school
6. Approaches/method of trenching;_
   a. Individualized instruction
   b. Learn by discovery
7. Time-table

B. Defining Students
1. Incoming
2. Outgoing

C. Study curricular Now Available

D. Curricular Planning
1. From university
2. From rural areas
3. From administration
4. From fresh outsiders

E. Building flexibility

F. Materials
1. Texts
2. Lab
3. Teaching aids
4. Special material
5. Furniture

G. Library

3. TEACHER TRAINING
- A. Group Dynamics Workshop
- B. Curriculum Planning Workshop
- C. Teaching Apparatus/Equipment Workshop
- D. Classroom Observing/Teaching

PREPARATIONS FOR MARA JUNIOR SCIENCE COLLEGE

1. KEY PEOPLE

A. Board - the board members of MARA Junior Science College should be people who are, at least, very much interested in education in this country. If at all possible they should have children of school age, somewhere from kindergarten through university. The people should also be quite representative of the regions of the country and some of them at least should have a rural background. It is hoped that these people will not be such professions and position that they never have time to attend a meeting much less go into depth about the needs of the school. At least some of members should be professional educators in their own right , preferably a teacher at the MARA Junior Science College as well as the Principal should be on the board. At least one member should be from the MARA Training Division and one from the University Faculty of Education as well as one each from the mathematics and science faculties if possible. The Ministry of Education should also be represented.

The board members should be carefully picked in each case though to make sure only very concerned and flexible people are put in these positions. The board members should be concerned enough to spend some time finding out what the problems of the school are, but should be flexible enough to listen to members of the faculty of the school and to the students for possible solutions to the problems, rather than thinking they always know what is right for someone else.

B. Principal - the principal of MARA Junior Science College should be a man or woman who has taught before and who is willing and eager to keep on teaching. The principal should teach at least one class everyday and should rotate his class each term so that he will get to know as many students as possible. The principal must be a person who is willing to listen to reason but also one who can make a decision and stick by the results.

The principal must be a very good public relations person who can defend his teachers and his students in whatever they do. He must be thoroughly familiar with all of the latest development taking place in the field of education and should be genuinely interested in learning more all the time. He should have the ability to transfer this interest to his teachers and to encourage them to try their own initiative at doing things. He must above all have the ability to make his teachers feel comfortable in his presence rather than be frightened of him

The principal must also have a genuine love and concern for people of the particular ages, 12 – 14. He cannot be so far removed from the scene as to not know what people of these ages are thinking and what concerns them. He must be interested in every pupil and every teacher and be with them rather than against them in relation to any outside adversary. He must be able to coerce his faculty without forcing them to do things. In other words he must know a great deal about human nature as well as about education. He must also not be totally ignorant of science and mathematics

although he need not know very much just show an interest in learning what he does not know.

C. **The Register – Bursar** - of the MARA Junior Science College has already been hired. Encik Rahim is very qualified for the position not only technically but ideologically also, He not only was the former register – bursar of the Language Institute but has taught for a number of years as well. Even though he left teaching almost a dozen years ago, he still reads and keeps up with the latest developments in the education field. He seems very interested in the job, in the students and in the school , therefore MARA has full confidence in his appointment.

D. **The Faculty** - The Faculty of the MARA Junior Science College will be the crucial part of the whole school. If they succeed in carrying out the philosophy of the school then the school will be a success and if they fail, the school will be a failure. For this reason the choice of teachers must be very careful and very selective. There are several qualities the teacher must possess before his/her academic qualities need to be considered. The teacher must :-

1) Want to teach
2) Be interested in children
3) Agree to live in Seremban
4) Have an open mind about methods of teaching
5) Be willing to try new things
6) Want to continue learning
7) Have a regard for students as individuals.

All the teachers in this school should have an academic degree in the subject they are going to teach, but this itself is not enough. They must realize the importance of each and every student. They must realize that were it not for the students they would not have a job. They exist for the benefit of the students, not the students for the teachers benefit. As the Principal should never intimidate his teachers so the teacher should never intimidate the students. If a student comes to the teacher for help, it should always be given ungrudgingly. The teacher should never indicate that the students is a nuisance even though this might be the case. The teacher should spend much time trying to understand the students and their needs.

The teachers should also remain current with the work going on in their respective fields. They should be interested in new methods and concerned to at least try some of them. They should continually reevaluate their teaching methods and content in the light of their pupils success and interest. If a student cannot understand their explanation they must look for another one which can be understood rather than just dismissing the students as stupid. After each lesson the teacher should try to think of ways to make the lesson butter. For each of the students the teacher should keep careful records for their progress and try to determine ways to enable them to do better.

Above all the teachers should never complain about students to themselves of to others. They should instead always be on the lookout for things to improve their teaching that would in turn help the students to do butter. They should in the same manner not complain about the principal or the board members but rather should discuss with these people their ideas of how to make the school a better place for the students. That is a better place for them to learn as well as a better place for them to develop emotionally and psychologically.

E. **Other Staff Members** - All staff members of the MARA Junior Science College be they the principal, a clerk, typist or the cook should all have a genuine interest in students of these ages and in the value of education as well as being qualified for the particular position.

2. PLANNING

A. Philosophy of MARA Junior Science Collage – if the school is to produce the kinds of students the objectives say, allowance must be made for the school to be flexible. The objectives say, the students should "experience some of the excitement, beauty and intellectual satisfaction that scientific pursuits afford". Further the programme should lead to the "development of constructive/creative approach to living things and environment". In other words, the goal is to develop people with open minds who can think and act on their own without necessarily following a pre-learned method or without being told exactly what to do.

Scientists and/or leaders of the country must be people who can think creatively on their own. A leader is not told what to do. He functions on his own initiative and indeed even tells others what to do. A scientist as well must be creative. Naturally he wants to learn what previous scientists have done, so as not to unnecessarily repeat things. But unless he has an inquiring mind and the ability to foresee something else to be done then he cannot be a true scientist. The person who discovered the zero knew mathematics current at that time but could visualize a need for something new and was clever enough to introduce the zero into mathematical knowledge.

The fact that knowledge has increased at such a fantastic rate, especially scientific knowledge, shows that some people are thinking new thoughts and proving them to the extent that they become facts. For example the recent studies in heart transplants got their start in the head of someone who probably thought "why, if one man dies with a beautifully functioning heart and another man is about to die because of a malfunctioning heart, could I not take the heart and give it to the otherwise healthy man". Of course from this stage to an actual successful transplant there is much work, but anyone who was ever felt the thrill of doing something new, even if it is only new for him, knows the same kind of success feeling as a person who can transplant a heart.

As a product of this school, students should be able to think **new** thoughts and to endeavor to accomplish their goals by using all of their past acquired facts. "New" does no even have to mean "new" universally like splitting the atom or testable babies, but just new to them. The students should not only be able to think these thoughts but should not be afraid to act on them as well. People should say "it has never been done in Malaysia before, but lets try it and see what happens". Too many people are already saying "it cannot be done in Malaysia because it has never been done in Malaysia". The school should turn out people who can think and act on their thoughts but who can also if necessary admit they were wrong and try again without fear of being wrong a second time.

What The School Can Do To Encourage Creative Thinking – the school must first of all encourage whatever natural curiosity the person already has. The school must give a student plenty of opportunity to be himself and express himself: a school that is stimulating in many ways to all of the student interest and senses. If a student expresses an idea, no matter how far fetched or even wrong, he must be congratulated on the fact that he spoke out and encouraged to speak out on all of his ideas. Later an effort can be made to provide him with information – through books, experiences, etc. – that might correct his false nation, but one should never do that at a time when the students is making an effort to express himself. A similar relationship should exist between the faculty and administrative staff as well. For example, a teacher might go to the principal with an idea which was to him new and great, and the principal might tell him to go and soak his head and not to take up valuable time with such trivia. This teacher would probably never go back to see that principal even to tell him the building was on fire. Instead if the principal listened to his idea and said thanks for bringing it to his attention and gave the teacher some material to read on the topic, then the teacher surely would have felt like going back and even perhaps discussing again the same topic in light of the new information he had just received. The same kind of process takes place in the students but seemingly even more subtly. Even just a short polite "no" to a student's idea, discourage him as much as calling him 'bodoh" which teachers have done.

An atmosphere must prevail at the school that suggests "The students and their ideas are important". After all schools are built for students and without them all adults at a school would be without a job, but so many times the students are treated like so many pieces of wood or even as if they were in the way and interfering with other work. If a student comes to a teacher with a problem of even just speaks to one, the teacher must listen. The teacher must be interested and can never say – see me later, I am too busy now. This does no mean teachers must dedicate twenty-four hours of the day to the student. Anyone who has taught before knows that the teacher – to maintain sanity must have some time off from the students completely.

By the time students get to Form I they should be able to make their own decisions and this self direction should be encouraged at the school. The fewer rules made – maybe only to protect life and limb – the better the school will be. To produce students who can think on their own, they must be let to think in their own and make

decisions on their own. They must see that some decisions they make only affect themselves so they can be pretty free in making these, other decisions effect everyone and therefore need to be made collectively. Collective decision always mean that some people do not get things as they want them. Ideally, one should have a say in everything about the school.

How to Encourage Creativity and Freedom of Thought In The Students – Perhaps the easiest and least expensive way to encourage freedom of thought is by giving positive reinforcement to work done and ideas produced. More expensive perhaps and certainly more time consuming is the need to provide each students with a variety of good learning experiences. For example if every student must get up at exactly the same minute, do exactly the same lesson in unison with other students, read exactly the same books at the same time, wear all the exact clothes, come and go at the exact time, etc. then creative individuals are not going to be produced, but rather boys that all think and act alike. They will all act as they were trained and everyone can identify immediately the school from which they come. If the desire is to produce a society of robots who can all do the same job, be it in an office or at a factory, then this process should work. Is this is the kind of people Malaysia needs? Malaysia seems rather to need creative individuals. To produce people who can think, the school and the teacher must recognize every students on an individual. If possible, to encourage each individual personality, even uniforms should be discarded but perhaps, "we can't do that in Malaysia". "Discipline would go", but is this sort of discipline desired anyway. This is not to say the students should be naughty, rather free. Remember, some decisions involve others and must be made collectively and some people therefore cannot do as they please. The discipline that needs to be eliminated is the sort of discipline to the extent that everyone jumps to attention on just meeting the teacher in the toilet.

To rid the school of this sort of discipline means also to do away with the idea that teachers are infallible, always right and inherently above the students. Teachers are just ordinary people – they make mistakes, they also not know all of the massive knowledge there is to know and perhaps the only thing that separates their status from the student status is age. Students are human as teachers are, so we must not think of ourselves, as teachers, as somehow better, as persons than our students. To overcome this attitude will probably to be a giant step on both the part of the student and teacher but perhaps it is one of the great blockages to good teaching in Malaysia. Also in this case I cannot be convinced that this change cannot be made as I have seen it done in Malaysia.

The education philosophy of the MARA Junior Science College should contain a concern for each student as person and a desire to help each one to develop to the limits of his capabilities and desires. We want to remain as flexible as possible in what ever we do. Rigidity stifles creativity. In summary: "There is no one programme for today – and that is as it should be. Each school (and indeed each student) has its own needs".

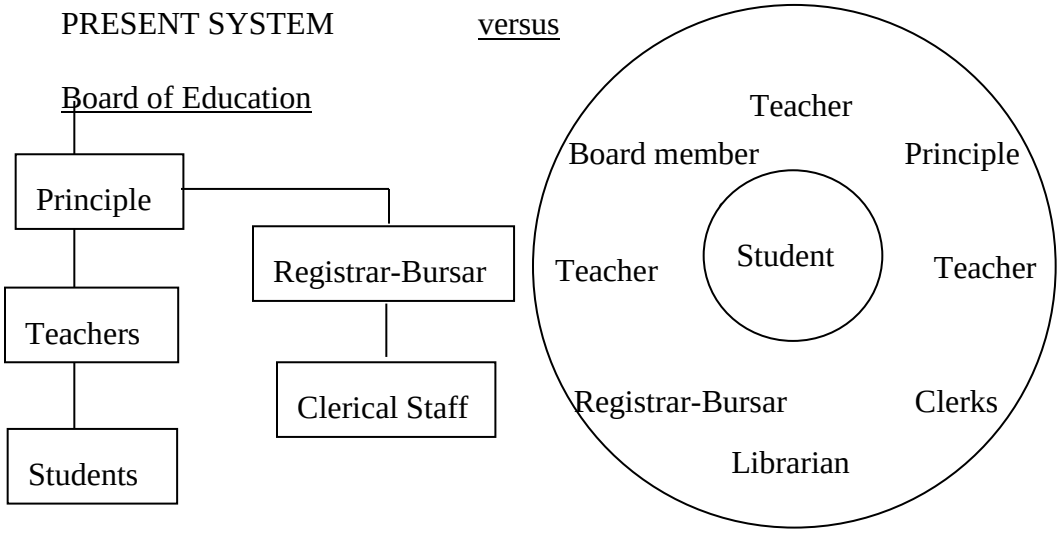
1. **Syllabus** – the syllabus to be followed will be the regular syllabus for secondary schools that the Ministry of Education requires. The MARA Junior Science College will have a science bias in that one half of the instruction time will be dealing with mathematics and science topics. But all of the Ministry of Education requirements will be met thus requiring the MARA Junior Science College day to be longer. The MARA Junior Science College feels it is necessary to cover all of the topics in the syllabus in order to enable the students to pass the L.C.E., M.C.E, & H.S.C. exams.

The only changes to be made will be in the methods by which the syllabus is taught. By using individualized instruction, however, some students should be able to cover topics beyond and outside the scope of the syllabus as well.

2. **Practical vs Theoretical** - by practical vs theoretical in this sense the concern is not with the method of instruction but rather with the approach to the subject itself. In other words does the students learn business arithmetic and accounting or higher algebra and calculus. The MARA junior Science College should have a varied approach to each topic according to each student's needs. In the long run the students must be prepared for university work, therefore, they must get as much theoretical knowledge as possible. They should be made aware, in all areas of the curriculum, however of the value and importance of practical work. As this will be a residential school, impressing on the students the value of denial work and encouraging them in doing things with their hands as well us their heads should not be difficult.

3. **Role of Administration and Role of Faculty** – the administration and faculty of the MARA Junior Science College will hopefully work together as team to the benefit of the students. The more traditional system to be one of a hierchy with the Board of the School on top progression down step by step until the students is the bottom rung on the ladder. In diagram form the traditional model and the proposed model for the

MARA Junior Science College could be represented us follows :



In the present system, it seems that each person on the ladder is just a bit lower than one above him, responsible to and afraid of the person at the level up. A person is only allowed to communicate with the next person up and must depend on that person to pass on his message to the top

Hopefully with the MARA Junior Science Collage system no one will be afraid of anyone. That does not mean each person will not have respect for each other person, but just that each person will be allowed to communicate comfortably with each other person. In other words the principal should have respect for the students, as person as well as the student for the principal as a person, not as a principal only.

The specific jobs of each of these person will be pretty much the same as in the traditional system, the only change being that hopefully each person will perform his or her job in the light of the needs of the students rather than for personal advancement or satisfaction. Hopefully the success of the student will be satisfying to all concerned. In other words the principal will still be responsible for guiding his teachers in the philosophy of the school, encouraging the students to do their best and representing his students and staff to the public. The teachers will be responsible for encouraging the students as well as keeping themselves informed of all new activities going on in their field. The registrar-bursar will still be in charge of administrative affairs in the school and the cook will still cook, but hopefully they will all perform their jobs in light of the needs of the students. This is not to say the students will have the final word on issues. The staff will continue to make the decisions, but will hopefully consider the students point of view in their decisions.

4. **Admission Standards** – for admission to the MARA Junior Science College, a search will be made to find students who are 'capable of learning'. That is, students who can learn whether or not they have learned up until this point. Students who are creative, initiative and think they might be interested in science desired.

To find students for the school, several steps will be taken :-

a) Headmasters will be asked to nominate Form I students to take an examination.

b) The examination will consist of four parts : Science, Mathematics, Language and Creativity.

c) The students who do the best on the test will be offered place at the school.

d) No students will be taken if he wishes not to come no matter how well he did on the test.

The test itself is being prepared by two trained testers and a group of teachers from the various fields.
The admission standards as well other matters related to the school must be flexible and certain charge are envisaged for the future :-

a) Each time the test given it will be revised to enable better selection of students.

b) Eventually students with the most interest and insight, but the least change to study science at their present school will be taken in preference to students who perform well academically.

c) In time and at other schools plans are not only to have Malay male students, but also Malays female students and finally if the situation allows, a racially and sexually balanced student body at each school.

In all choice of students, however, preference will be given to students who want to come and who have a local school ill-equipped for science teaching.

5. **Evaluation procedures** – evaluation procedures must to be divided into two types of evaluation :-

a) Evaluation of the students and (b) evaluation of the school programme itself. Evaluation of the students of grading is the easier method to describe and usually the only evaluation that is done, but both are important and must be done.

   a) Evaluation of the Students – the method of evaluating the students will naturally include the L.C.E., M.C.E., and H.S.C. exams, but hopefully more as well. Students need continual evaluation and feedback to enable them to know where they stand and what things they need help on. Each subject matter teacher should keep careful daily records of each student's progress and at least once a week discuss with each students his strengths and weaknesses. At least once a week also the teacher should give some sort of test to see how each student has understood the material presented. The best however should cover more than just the week's work. It should have a few question on every thing the child expected to know so that the child will not just learn for the test and then promptly forget. Studies have shown that over learning of a topic is a very good method to retain something. Therefore if the child is continually tested on something that he already knows he will tend to over learn and then retain it.

      Testing should be frequent enough and non-threatening enough to enable the student to become unafraid of taking tests. The teacher should always

stress that the tests are intended to allow the student to find out what he does and does not know. Testing should be trended as a learning process not a competitive or eliminating process. For the reason it is hoped that teachers will structure their grading system to be one to measure self progress rather progress in relation to other class members. In other words a student's grade could be based on his percent of improvement from a previous grade. For example if a child is given a pre-test then taken through a series of lessons to explain a topic, than given a post-test his grade can be based on the number he got correct on the post-test above the number be got correct on the pre-test. Above all the student must be made aware of his successes and failures. Results of all testing must be shown to the students and what he did wrong, corrected with the teachers help.

b) **Evaluation of the School** – the other half of evaluation, that is evaluation of the school itself should also be done continuously but may be done with outside help. At present it is hoped that some arrangement can be made with the university of Malaya Education Faculty to do some continuing studies of the school programme. Before the study starts however, same baseline data keeping must be done. Careful records should be kept on everything that goes into the school as well as everybody. How much money was spent for each item, how many books have been acquired, what are the qualifications of each teachers, what are the qualities of each student – his previous school and record, his socio-economic background, even his height, weight and health should be recorded. As much baseline material as possible should be kept. Records should also be kept on a comparable group of students, teachers and the schools from which our students come so that after year comparative studies can be done, between the school and what the students would have done had they stayed where they were. There comparative studies should be done in order to determine if the methods employed are at all effective or are worth the expense in results. If these records are not kept initially though, the studies will not be able to be done later.

   In addition to these comparative statistical evaluations, attitudinal studies should also be made. Base-line data must again be taken by giving the students an attitudinal test when they first center the school. A comparison could then be made with this base–line data by giving the same or a similar test at later times. What the students feel and think their environment will reflect in how they perform. Thus it is important to know what the students are thinking. Perhaps their main worry is something that was overlooked but that be easily corrected if only the problem is made know. The entire staff should have the same sort of attitudinal and opinion testing as their suggestions and/or complaints can be used in planning future schools as well charging the policies of this school.

In future school comparative studies can be done by controlling various factors of the school such as the characteristics of the students who enter, the methods used in instruction, class size, and almost anything else relating to the school. All of the schools and factors involved in them should have careful studies done so that eventually an optimum school can be achieved in terms of students, staff, coast, curriculum and methods of teaching. Continuing records on everything the school does or produces should be kept in order to change the school in the direction that the research indicates. The more factors that can be controlled and tested the better. The essential point is to do as much research as thoroughly and scientifically as time and staffing will allow. To ask the education faculty of the university to do these evaluation studies would enable more studies to be done and hopefully more thorough studies.

6. **Approaches/Method of Teaching** - to encourage creativity and decision making ability in the students a creative type of teaching is essential. Children as well as adults learn by imitation. If the example is creative so is the result. Thus learn by discovery and individual instruction are two teaching techniques which the MARA Junior Science College wishes to encourage. Rote learning which has been pretty much the traditional practice in Malaysian schools means according to the dictionary, "mechanical repetition of words, etc. Without much understanding of the meaning,". Rote learning, can thus be associated with mechanical robots that repeat back what they are told, not with creative individuals who think new thoughts. Thus the MARA Junior Science College does not want to teach the traditional rote method or lecture method with notes, but rather 'individualized instruction' and 'learn by discovery'.

a) **Individualized Instruction** – means first of all to find out how much each student already knows. Certainly each student's performance will in some aspects be different from every other students. If pretest is given to determine where each student is, the varied results of this test should show just how important individualizing the instruction really is.

As an example of how to individualize the instruction some lessons from a sample mathematics programme are given at the back of the booklet. Other example will be provided and hopefully worked on throughout the teachers training sessions. For these who are not exactly sure is meant by individualized instruction though an attempt will be made to briefly describe how a programme might work.

First of all the persons writing material must make a list of all the objectives they hope the material to accomplish. These objectives must be specific to the learning task not general to the entire topic. In other words similar to the lessons presented on "Solving Conditions" each specific item must be listed : "find the sum of two real numbers', etc. rather than "learn about real numbers". After writing the objectives, the rest should be easier. Develop a test to test each item in the

objectives, for example the first objective should have four questions as these are four different kinds of problems here :-

i. Where both numbers are positive ;
ii. Where both numbers are negative;
iii. Where the positive numbers has the larger absolute value and
iv. Where the negative numbers has the larger absolute value.

Give the pre-test and keep a specific item analysis on every question for every student as is shown in the evaluation sheet. Then develop lessons to correspond to each test question. In other words a lesson on adding real numbers accompanied by a quiz, plus another easier lesson accompanied by another quiz for those who did not quite learn the first lesson. Ideally third, fourth, etc. lessons should be developed for slower students, but there is a limit to how much time the teachers have who are developing the material. The reference texts found in the room can be used for further practice of students who need it however.

After the pre-test is graded, the student only does the lessons of the questions he missed. He corrects the lesson himself from posted answers and then takes the quiz which the teacher corrects. If he gets all questions correct on the quiz he goes on to the lesson for the next question he missed on the pre-test. If he does not get the quiz correct then he does the second lesson or supplementary material in the present topic.

After he has progressed through all lessons applicable to him, then he takes the post test which is exactly the same questions but with different numbers as was the pre-test. His grade is based on his percent of increase from the pre-test to the post test.

As can be seen the number of possible combinations done will depend on the number of students in the class. No one should get bored because as soon as he can perform one task, he goes on to the next. Likewise no one should feel pushed ahead of his ability as he need not move on until ready.

At first the teacher might feel the students is only copying the lesson answered from the notice board and going fasted than he really should, and this might be the case. The students soon learn, however, that it is to their advantage to do as well they can on each lesson for it they cannot do the lesson, they cannot do the quiz, and thus they must do extra lessons. Also some students come to point where they do additional work as they do not feel they are ready for the post test. Already it is obvious how student can be encouraged to and even forced to make a whole raft of decisions for themselves, which only affect themselves and the consequences of which they must live with.

b) **Learn by Discovery** – to learn by discovery, the student must not be told everything and in fact should be told as little as possible. The teacher should instead set up the situation in which the students can discover things for themselves. For example if teaching Galileo's principle that falling objects fall at the same rate regardless of weight, do not say this, but lead the students to discover it. Take one sheet of scratch paper and fold it into a small square and staple it together, then take four sheets and to the same thing. Mark on the paper, 1,2 & 4 to indicate how many sheets of paper in each, but do not tell the students what this indicates. Make a set of these 3 squares for each students in the class i.e. 30 sets or 90 squares. (Now this sounds like a lot of work and it is, but these can be kept from year to year and besides any ten year old kid would probably love to help). Pass out these squares and ask each student to rake the one marked 1 in one hand and the one marked 2 in the other. Ask each one to record on a piece of paper his observations. 'Does either one feel heavier?" "Which one would fall faster if the two wore dropped together?" Would they fall together?" 'Try dropping them from the same height what happens?"

Have the students repeat the experiment with the same two squares several times and then by using all possible combinations of the squares, they should make as many observations as they can each time they drop the squares. (Remember sometimes human error dropping earlier or from a different distance – may not make it work just right each time).

Then ask the students, "From all the trials and observations can you draw any conclusion?" Now some students may to be able to, but surely someone will came up with something. Then do not just say right or wrong – lesson over, but ask another student if he agrees or disagrees and continue the discussion until the students too have get the idea. Then, perhaps, tell them about Galilee who leaned out of the tower of Pizza to try this and made the tower lean.

This procedure may sound as if it is going to take an extremely long time and a lot of work for the students to just get one idea that can be told in five minutes. This is true, they could have been told this fact and the time involved would have been shorter. It is doubtful, however, if the fact itself would have stuck with them. Certainly they would have learned nothing about thinking and discovering on their own, had they just been told the fact and told to learn it.

Part of the goal of the MARA Junior Science College is to develop a programme to teach the regular school syllabus, or a variation of it, in this discovery sort of manner. But not only discovery – also as individual as possible. You notice each child had to have his own equipment. This is because, I, Thomas Dewey, and several others, feel a child learns best doing not by seeing or hearing only. In fact the more of a child's senses used the better. Of course some experiments do involve more costly materials than rough paper and staples, so they must be done for the class as a whole, but each time each student should write down his own observations and draw his own conclusions before the class discussion. To begin

with, a teacher will probably have to ask very specific questions to get the students to observe what is important, but eventually, if the teachers are doing their job correctly, the students should become more adapt at asking his own questions, making his own observations and drawing his own conclusions. This is not to say however, that the process is easy, some students may never be able to do it. The teacher should not become discouraged soon if at all. Remember the students have had six years of training in one direction and to try and teach them in different manner will not be easy. If it is any encouragement to you, other teacher before you in other lands felt uneasy about teaching students along the discovery line. In a publication of the Newton Public School in the United States it is reported that the teachers felt threatened by that discovery method because they thought the student would ask them something they could not answer. But they reported after trying it for a while that even though difficulties had been encountered, the new programme (discovery and individual) seems more popular (then the traditional one) both with the students and teachers." They said, "Using physical objects challenged the one right answer' complex of teacher and students."

7. **Timetable** - a timetable can be made in many different ways depending on the needs and purposes of the school, staff and students. At lent three different sorts of timetable seem to be feasible.

The Traditional Timetable : in Malaysia would consist of - eight forty minute periods a day for five days.

In this sort of a timetable a student is with the same group of student all day long in the same room and every 40 minutes a different teacher pops in, gives a lesson and leaves for the process to be repented by someone else.

The advantage of this sort of procedure would be administrative, in that the students are completely accounted for as soon as they are put into the room and the only remaining problem is to make the teachers a schedule.

The disadvantage would seem to be that no student is looked at as individual to see his needs are, but rather trotted as a part of some whole that should function as a group and be all alike. Obviously, this is not true, everyone in a group does not even have the same abilities in one subject much less in eight or more.

This sort of timetable then would seem to be very inflexible and very meaningful.

Modular Scheduling - a second sort of timetable would be a very individual on such as used at Patrick, Henry High School in California where the day is broken down into 20, 20 minute periods. Each student's schedule is arranged individually giving him at least 20 – 40% of his time to choose his own course. The curriculum is extremely varied including such things as **Hayakawan Semantics**.

The curriculum is designed so that each student will spend each 20 minute period during the week to his maximum advantage, individual needs, and desires. In a large school is would be conceivable that a student could to through a week never meeting the some people in any different class. If the students is good at mathematics he is given accelerated work to do at his own speed. If a student is weak in history he is given work to do only slightly above his level as a challenge.

The advantage or this system would be that each student would get the maximum benefit from his education. No student should be bored because the work is not difficult enough for him not hopelessly given up because the work is too hard or uninteresting. The teachers should also benefit from this sort of system as their job should be made easier just because of the changed outlook of the student, but also because they will not have to be constantly trying to keep 30 people at the same place one should be.

The disadvantage would be administrative in arranging all of these schedules. Of course if one had a very large school, the task could probably not be done sort of using computer but for schools of up to 500 it has been done by the staff.

Compromise Schedule - the third type of timetable and one proposed for MARA Junior Science College is sort of a compromise between the two, in order to alleviate some of the administrative problem of scheduling but at the same time to maintain as much flexibility as possible for the maximum benefit of a student and a teacher. A copy of the timetable is included with this report. The main components of this timetable are three, two hour blocks of time with some resemble break between them. These blocks of time with breaks is all that needs to be kept the same about this schedule. The rest of it could be charged according to the wishes of the staff and students. There is no reason the school day could not start at 7 and end at 3 depending on the desire and wish of the staff and hopefully even the students.

Mathematics and Science - at first glance the timetable looks pretty conventional and indeed can be made so even maintaining the two hour block of time. But flexibility in what is hoped and mined for here. The mathematics and science are scheduled together for each class in one of these two hour shifts. This is hopefully to allow the teacher much flexibility. If the class wants to go for a field trip, it can have science and thus the field trip for the whole two hours or it could have many other variations within the week. You will also notice that for the 60 students there are 4 teachers in the two hour block so even the students and teachers can be arranged in many combinations. If a film or lecture is taking place perhaps all 60 students could view the film or listen to the lecture simultaneously. This would give 3 teachers time to prepare other apparatus. If a small group is called for, each teacher could have 15 or if only a few students needed special attention there teachers could divide 10 students and one teachers could have 30. There is no end to the possibilities. The scheduling should be done each week by the five members of the science and mathematics department as a

whole with a view toward what they are trying to accomplish that week and also toward what the problems of each child are. Is 60 children too many to know personally?

Practical Lab For Mathematics and Science - the other science time, which is indicated in blue on the timetable will hopefully be highly individualized time during which the student can work on things that either interested him greatly from the day's lesson or gave him difficulty. The teachers should be there as a resource person or as a guide to help the student decide what to work on if he has no ideas of his own.

As can be noticed from the time table, the five mathematics and science teachers will have to share among themselves two classes of 30 pupils each having their regular mathematics and science classes and one different class every hour of 30 students having the extra mathematics and science time. Again these five teachers must decide for themselves how to divide out their time here.

This extra hour should involve both mathematics and science according to each child's needs. Suppose one child was just doing lesson 14b on solving conditions when the mathematics time was finished. Suppose further that according to his own timetable, he wants to finish that lesson the same day. He should be allowed to do so during this extra lab.

On the other hand, suppose in the science lessons the students come across the fact that copper burns with a green flame. In addition one student wondered what colour other substances burned. This student should not only be allowed to, but should be actively encouraged to try other substances during this extra hour to find out the answers to his wonders.

In general, these extra lab times should be a time when a gifted student can carry on with work he is interested in, which is normally thought of as beyond his level or outside it. This lab should also be time when the slower student can have extra help on his particular problem, or more experiences of a similar nature the lesson designed to help him discover for himself the knowledge elusive to him.

Language - the rest of the schedule is very traditional with each subject given an hour everyday. Hopefully though, even here flexibility can be insured. For example if the language department had a film on how to learn a language or some such topic, they could show it to these 60 students at once and them perhaps divide up the remaining minutes be they 60, 80 or 100 into equal allotments so that each student would get an equal amount of each language. Numerous other possibilities exist.

Social Studies - the social studies teachers also being two teachers to 60 students each hour should be able to do a great deal of individualized instruction. If one teacher is helping just one student, that only leaves 29 others for the other

teacher. Or perhaps one day one teacher presents a lesson for 20 minutes and following that both teachers take 15 students each for discussion of the topic for 20 minutes and then following that the 30 students all get back together for 20 minutes and present view to each other. Again so many variations are possible.

Extra Help – the tuition period from 3.30 – 4.00 or the last 30 minutes of whatever time the school finishes should again be time for individual help. It is expected that each teacher will be in a specified place easily accessible to the students and available to help anyone who comes. This does not mean that anyone necessarily come. Perhaps the lesson presented earlier in the day is very clear and easy to understand so no one had any question than no one comes so the teacher is free to work on lesson plans for tomorrow and/or grade tests or just sit and discuss with fellow – teachers, but they all must remain available for 30 minutes. If after a few weeks if become apparent to the teacher that a particular student really needs help, but he does not voluntarily come, than the teacher can say during the regular class hour that day, Ahmad come and see me at 3.30 or whatever. Some students will probably be shy to come at first but if the staff set the right tone and atmosphere to the school, the students should eventually pick up in their aggressiveness towards enquiry.

Activities - the only others part of the timetable that might need some explanation is+ the section called activities. In this section also there should be no limitation as to the possibilities. This should be a time when the students are urged to be creative and to use what ever talents, they have or enjoy. Even a few boys who wanted to form a "pep group" should be encouraged. Music is an excellent form for developing originality and one thing to encourage is originality and creativity. A person who is not imaginative nor creative can certainly be only a mediocre scientist. Activities time should certainly be something the boys are interested in, but something at least one teacher is interested in also. The activities could change from term to term and the boys have complete freedom as to what to choose. In fact the choice should be recorded first and then the activities around the most popular. Suppose art is given first term on Mondays, then it might switch to Tuesday second term or if guitar lessons are given first term that might change to Mechanical drawing second term. The student should have the opportunity to switch activities at least once a term. One further scheduling item to consider here is that that a boy should be allowed to make a physical swap with another boy in order to facilitate their activity scheduling. For example Ahmad has games on Monday and Wednesday but he wants to take Art that meets on Wednesday then he should be allowed to switch games time with Isa who has games on Tuesday and Thursday provided Isa wishes to take an activity that meets on Tuesday, Thursday or Friday. Of course all of these changes should be recorded at the beginning of the term so the teacher in charge would know who was going to be where and at what time. The student would have to take the initiative to change their own schedules or also they would left in their normal spot.

Library work – another thing that is not on the timetable but that should be included at all time is library work. Teachers should require and encourage students to use the library. The library should be open at all times say from 7 or 8 a.m to 8.00 or 9.00 p.m depending on bed-time. The students should be taught how to do individual research on their own as science is a creative process not memory one. Students have to be taught how to study. I did not learn how to study until I get to the Varsity, but hopefully one can learn from past mistake and teach these students early. If the library is open and the teacher encourages it properly, the boy should use the library.

Study Hall – a suggestion was made that a supervised study hall in the evening is also needed. This is a good idea only until the boy learn how to study on their own. Again, "a good scientist cannot be made from fitting people into molds, 'so during the supervised study hall as much allowance as possible should be made for individual differences. If a few students want to discuss together they should be able to. If a few want to go to the library they should be able to. If some want to visit an exhibit at a Museum, a film, a speech on moon rock, etc. They should be able to.

Again the thing to stress in this whole timetable is **flexibility**. At the beginning of the school, try it one way for month. If after that the students are grumbling (take a survey first to find out it the majority are grumbling or if just the minority are loud) and the staff feel the timetable is inadequate change it, but only after considering all aspects. Every term the staff should evaluate all aspects of their work including the timetable and change things as the accession warrants.

B. DEFINING STUDENTS

1. **Incoming** – the students to begin with will be Malay boys who have passed the examination as described in (4) above. It is assumed that they will come in with a set mind toward the kind of school training they have had before and that the kind of home training will be reflected also. The home training would in turn reflect the background be it rural or urban, rich or poor. The school should utilize what ever personality differences the boys have.

Probably because most of the students will be from the rural areas, their physical condition may not be excellent. The school hopes to provide health care for the students taking care of all their physical after be they worms or tooth aches. As the students may also have a lack of knowledge about proper health practices, the school will give instruction in this area as well.

In attitudes the students will probably reflect their parents also.

2. **Outgoing** – first of all excellent health care will be available. If a child is not well he will have great difficulty in concentrating on his studies. The students will be treated for worms, malaria and malnutrition as soon as they arrive, but

continuing health care such as dental work will also by provided. Emphasis will he placed on the importance of their own personal hygiene and health care as well. Studying and working in a modern city such as Kuala Lumpur will necessitate a change in some things from the way they did them in their homes. With modern facilities, practices differ therefore, the students will be acquainted with these things before they are forced to learn the hard way.

Academically, the students should be able to perform well in the science and language fields on their LCE, MCE, HSC, and university courses. Hopefully they can do more this, however. Hopefully the students will develop an inquiring mind regarding science, that they will be able think on their own, that they will feel confident to assess facts, make a decision and stick by the decision. To develop either scientists or leaders of the country, one must have people who can read material, draw conclusions from the material and then act. Timidity and unquestioning faith is best for dictatorship, but Malaysia needs actively inquiring people. The people must be well informed however and willing to listen to reason, not dictators themselves.

As for attitudes, the students will hopefully develop enough to see themselves as being privileged in regard to their fellow townspeople and will therefore feel a need and a desire to back to their hometown and work so that others might be similarly privileged. The students should understand that their only mission is not to be head of a government department, but rather to make life easier and better for the 100 or so people who live each of their home areas. They must realize that education does not only prepare one for office jobs, but for jobs as innovators to change difficult things they see around them. For example pounding rice is something that their mother has done for years. As a person interested in simple mechanics and bit of physics, could they as a scientist design a simple, low cost easy to make tool that would help their mother do her work? The school hopes to train so that they can do this, but hopefully will teach them to want to do this sort of thing also.

C. STUDY CURRICULAR NOW AVAILABLE

One way in which a person who is behind can catch up with others to study what the others have done, find out their successes and failures and only follow the successes. This is what can be done by studying curricular developments in other countries. Plus have been made to send the principal and at least one of the science teachers to the Republic of the Philippines to study a science school they have set up. Asia foundation has agreed to pay the passage of one of the staff members and MARA will pay the others. Plans are also to bring over one of their staff members for a six weeks work stint at the school.

In addition to this initial action, plans are, with the help of various foundations and bodies, to send all of the teachers at various times to the United States, United

Kingdom, West Germany, Japan, China and elsewhere not only to observe the kind of teaching, encouraged in this report, but also to get further degrees in the teaching of their subject. This is to be done on a continuing basis so that innovations that came out in 1971 will not be all the school tries, but the programme will be continually updated through continually sending different ones of the staff members out to various countries for further studies.

D. CURRICULAR PLANING

As stated before the Ministry of Education syllabus will be followed as far as the topics to be taught goes but plans are to develop other methods and sequence of doing this. This section of the planning will be left almost entirely to the teachers. They will be supplied with sample material which is good which should be useful in their planning. Hopefully they also will be supplied with resource persons from:

1) The university in the subject matter fields as well as the department of education;

2) The rural areas, a subject matter teacher in each field as well as interested farmers that could tell us how the school could benefit them;

3) The administration in that our principal would certainly be able have his opinions listened to as well as hopefully will the staff of the training division of MARA, and

4) From fresh outsiders such as anyone we may be able to get from the science school in the Philippines, local Ministry of Education people, Peace Corps Volunteers in country, visiting Professors and others.

All of these outside resource materials and people however are seem as sources of information and help for the teachers only. The teachers must be the ones who make the final curriculum decisions as they will be the ones who will actually be in the classroom doing the teaching. Hopefully the teachers will be flexible and open to change and suggestions however. Certainly at the end of each of each year they should make changes in the curriculum by considering the things that did and did not seem effective with the student. No curriculum can be developed independently of students and be expected to be best in all aspects. Continuous evaluation and revision will be necessary and hopefully the teachers will want to do this.

E. BUILDING FLEXIBILITY

The building actually consists of a number of buildings which will be utilized to maximize flexibility. Each building will be specialized according to subject and the students rather than the teachers will be moving around. In other three small buildings and one large building will be divided among the subject matter specialties. The large building will have a chemistry, biology and physics lab on the ground floor with an assembly room with projection equipment available. Most of the furniture will be moveable and multi-purpose. The mathematics room will be on the second floor of this building.

The other three buildings are divided among Malay, English and Social studies. Each these building is about 20 feet by 30 feet and will be divided with a mobile partition into two sections. The room can be used as one room only for the first year, but perhaps the second year it will need to be divided into two rooms.

The cafeteria will be alternately utilized as the boys lounge and study hall. The other buildings will consist of the Library, the hostel, and the teachers lounge and offices. All of the buildings, it is envisaged, will be open as much of the time possible to the students and to various members of the public as is appropriate.

All the rooms should be considered as to the possibilities for others use. For example during the second year when the space is limited the cafeteria could also be used for large group presentations be they films or lectures. The important thing is that we continually see new possibilities for al rooms.

F. MATERIALS

1. **Texts** - the school hopes to use a number of texts depending on just how the curriculum is written. Hopefully; however, no class will depend on just one text and thus have a rigid text book approach. Rather than this, it is hoped, that each teacher will develop her own curriculum and have a variety of texts or reference books. The students will not be required to buy texts, but instead maybe a class set of four different texts will be bought and kept in the room. Or eight kinds of books could be bought with fifteen books to a set. There is no end to the possible combinations of books that the individual subject matter rooms could be supplied with, and still come out less expensive than if each child bought the same set of books as every other child. Many of these books will be supplied for us by Asia Foundation, but again the choice of titles will be left to the teachers.

2. **Lab** - the lab facilities as stated before will be of three types, chemistry, physics and biology. They will be staffed with all the latest equipment up to the complexity of a microscope. Most of the equipment will be as flexible as possible and again the teachers will be responsible for choosing the specific items. Again the teachers should have worked on their curriculum first in order to know just

what they want. Hopefully a section of the mathematics room can be a mathematics lab as well in order for the students to play with games, experiment with shapes or just do what intrigues them enough or lead them on to something else. A language lab with language tapes is also envisioned.

3. **Teaching aids -** other than the traditional chalk and blackboards, it is planned to provide each teacher with a flannel board with letters, a bulletin board, and an overhead projector with transparencies and writing pens.

The teachers will be trained to use there aids to maximum advantage. They will also be encourages to make their own teaching aids from as simple material as possible. Hopefully they can be convinced of the usefulness of having an attractive room decorated with items that entertain as well as educate. Studies have shown the usefulness of aids to education and to the creativity process. All the needed materials such as colored paper, paste, crayons etc. will supplied. A workshop to encourage the teachers to prepare apparatus and to plan lessons to encourage the students to prepare them as well, will also be held.

In addition to each room's material, there will be material that can be used by the whole school. A 16 mm film projector will be supplied and film library that will probably eventually be housed in our upper secondary school in Kuala Lumpur begun. The films will be made available on a rotation basis to each of the schools and to other institutions as well. The International school at Jalan Maxwell has a complete library of Encyclopedia Britannica films which they are willing to loan to the MARA Junior Science College on an exchange basic. U.S.I.S. has films that can be borrowed free of change. Their catalogue and instructions for ordering the films are in the file. If the school started a projectionist club as one of the curricular activities then the club could be responsible for ordering films, running them on the projector and them sending them back. The films could also include fun films as this is a residential school and occasionally the students will need entertainment. With a projectionist club the students could select and order their own films.

Other apparatus according to subject matter will also be purchased . For example the social science room will have appropriate maps, a globe, atlas, dictionaries, etc. while the language room will hopefully have books, pictures, other and tape recorders with head sets so that the students will be able to practice their language. The mathematics room will have various mathematical objects such as sets of solids, mathematics games, rulers, protractor and so forth. The science room will be equipped, with all the usual science apparatus plus various charts of the body and other living things.

Decisions on the specific teaching aids we wish to buy or provide materials to make we hope to leave to the teachers.

4. **Special Materials** - Hopefully special materials will be developed throughout the life of the school. The one topic that, at the moment, could go under this category is programmed learning sheets for various subjects. Examples of how these might work for mathematics are in the file and language and science examples will be obtained as well. This material, however, will all have to be developed by the teachers themselves from these examples so it is hoped they see the need for such work and desire to do it.

The teachers will be encouraged to develop what ever special material they see a need for. Sometimes this will include remedial material as will as material for the gifted child. For example the mathematics programmed generally runs three parallel programmed learning series. The main one is the one that contains the present topic of study, but the other two are often just as important. One is the remedial kind of work on basic addition, subtraction, multiplication and division. Of course the level of the remedial work would depend on the level of the students, Form I to Form VI. The other work is called "enrichment" and. consists of topics outside the syllabus, but not necessarily beyond the present level of understanding of the majority of the students. All three sets of lessons run simultaneously and the students switches from one to the other as his ability and desire change. Decisions as to which he works on are made with the help of the teachers also.

The teachers will be primarily responsible for developing or ordering special material, but the administration is expected to encourage the teachers in this and by all means to prove helpful when it comes to actual approval of orders, etc.

5. **Furniture** - all the furniture in the building, like the buildings themselves will be as flexible as possible. For example the tables are shaped like a trapezoid and have no space underneath for books so that put together one way they form a rectangle but another way they form a curricular hexagon or a semi-circle or most any combination. The chairs and tables can be stacked. Most of the cabinets are on rollers and consist of two sections, one small top section with moveable shelves and one larger base cabinet with wooden or glass doors. Hopefully chalk boards with a metallic background can be provided, as well. The furniture will be allowed to move freely from room to room according to the needs of each room and availability of the furniture involved.

The hostel beds are also flexible in that they can be stacked double or they can be set apart and each look the same. This procedure is intended to save money when the switch from the renovated dorms to the new dorms is made. The other hostel furniture is planned to be of rattan thus easily portable as well. All the furniture as much as possible will reflect local materials and styles. Rattan will be used in much of the furniture and hopefully batik will be used extensively in decoration. Useful but also attractive furnishings is the desired effect for the school.

G. LIBRARY

The library, it is hoped, will be the focus of the school. A library has been hired and almost 100 books have already been enquired. The renovation plans call for one building to be remade into the library. Originally the plans call for the library, which is small, to house only the books, but eventually when the new buildings are put up, it can be turned into more of an instructional materials center where all sorts of learning aids are available. There will be listening centers for learning language, other subjects, or just listening to music. The films, slide and other projectors will circulated from the library as well as the films etc. to go with them.

It is hoped that the library will a place to study ones own textbooks quietly as well as a place to do research. Hopefully the teachers and the librarian will all be trained to teach the students how to do research and will encourage them to do it both on their own and for required assignments. The library should be a pleasant place to work and the students should look forward to coming there. The library should be open at all times as far as possible. That is it should be open continuously from thirty minutes before classes start in the morning until thirty minutes before lights out at might. This course does not mean that the librarian is expected to keep such long hours, but rather that hopefully some qualified students or even volunteers from the community would be willing to just check out books to keep the library open. A library club could be formed as well as projectionist one. The club numbers could be taught the routine duties of a library, such as checking books in and out, shelving books and searching for books. Then on a rotating basic so as not to take up too much of anyone's time, they could work certain hours in the library or on keeping it open their own after hours. Of course only capable and dependable persons could do this, but they should be found among the MARA Junior Science Collage students. My mother is a school librarian and has found that even children eight years of age can perform the duties of an assistant librarian if properly trained and encouraged.

The other possibility is to locate local talent from Seremban that would be willing to perhaps donate one evening a week to assist in keeping the library open. If the library can be kept open after hours, we hope to open it for public use as well so if it is open to the public perhaps some of them might be willing donate their time to keep it open. If a volunteer proves very successful perhaps they could even be hired as part time librarian. Again as in other phase of the school, flexibility is the aim.

An offer of free, books from the Asia Foundation has been obtained and a list of the types of books will be included with this report. In addition to being able to choose and take whatever books they have available, they have set aside a special grant of $9,000 especially to buy books for the MARA junior Science Collage in Seremban which we order. The grant can also be renewed from to year and used at the other schools so all the librarians should become familiar with the procedure and techniques of how this grant works and take full advantage of free books

available. Other avenues might be open in this regard as well and it should be the duty of the library to investigate all possibilities.

The librarian should also be able to each the students how to use the library. She should be cheerful and helpful at all times and be aware that the students are more important than to books. She should feel it her duty to encourage the students in the frequent, and correct use of the library. The librarian sets the tone of the library and hopefully the MARA Junior Science Collage library will be a place where students wish to come and work.

3. TEACHER TRAINING

Plans have been made for at least a four part training session for the teachers.

A. **Workshop on Group Dynamics** - during this session, probably for a week, hopes are to break down barriers between the administration of the school and the teachers and hopefully to extend this thought to the students as well. The school staff including principal, teachers, typists and cooks should see themselves as part of a working whole rather than the traditional rungs on a ladder with the student on the bottom step, the teacher on top of him and the principal on top of the teacher. Dr. Oborn of the University and Enche' Sanusi of Staff Training have agreed to help in this regard. To orient the teachers to a new and different way of looking at themselves in regard to the students, each other, and the principal will be the goal of this workshop.

B. **A Curriculum Planning Workshop** - during this phase of our teacher orientation plans are to have the teachers of each subject matter areas develop their own curriculum. All the latest developments in the teaching field at the Form I level as well as the syllabus for that level will be made available to the teacher. They will then be encouraged to develop their own material for teacher. For example, a set of individualized mathematics material is available the outline of which could be followed to develop material to fit the Malaysia syllabus. The teachers will need to decide on methods to present the topics to the class.

C. **Teaching Apparatus/Equipment Workshop** - in this workshop plans are to collect a variety of teaching devices such as the film projector, slide projector, overhead projector, etc. and have a talented person not only show the teachers **how** to use them but also **the advantage** of using them in classroom work. Talented people in specific arenas such as mathematics, science, or language teaching will be available to show the teachers how to **construct** and **use** their own hand made teaching apparatus and again the advantages of these things. The teachers will be shown the effectiveness of using other methods to teach besides lecture, chalk and notes.

D. **Classroom Observing/Teaching** - during this section of the training the teachers will be sent, hopefully to see discovery learning and individualized instruction taking place. Arrangements have made with the Alice Smith School and the International School for the teachers to observe there. The principal and at least one teachers will be sent to the Philippines to see their science school. Hopefully the teachers will see other classes in the rural school, at the primary level, at the secondary level, at the university level, and in the premier schools in this country. They would then do some practice teaching hopefully at the school they prefer.

THE SPHERE OF INSTRUCTION

THE SPHERE OF INSTRUCTION
O U T L I N E

A. THE TEACHER

B. THE CURRICULUM
THE INSTRUCTIONAL METHODS AND MATERIALS

C. MODEL OF AN INSTRUCTION SYSTEM

D. COMPARISON OF CONCENTION SCHOOL PROGRAMME AND INDIVIDUALIZED PROGRAMME

E. INDIVIDUALLY PRESCRIBED INSTRUCTIONS
TEACHER FUNCTIONS

THE SPHERE OF INSTRUCTION
Check List For Individual
Instruction

The Teacher

1. Is the teacher selected deliberately for a rich, varied, and creative pattern of experience?

2. Does he use clues which he finds in the cumulative records and in daily contact as a springboard for individualized assignments and projects? Does he, in fact, have an ever-increasing store house of knowledge about each child? Is he tolerant of extreme deviations in interests, values, intellectual specialties, creativeness, and competencies?

3. Does he involve his pupils in cooperative planning to bring into the open individual goals, concerns, and aspirations, as well as common needs and goals?

4. Does he record a description of each pupil's attainment and uniqueness, for his own future reference and to aid other teachers who will have the same child? And does he assess the accuracy of the description at intervals?

5. Does he provide outlets for the drive for recognition and success?

6. Does he find ways to limit over-selfish ambitions?

7. Does he help each pupil insight into his own limits lacks as well as his unique strengths and resources, in such an atmosphere that the pupil can afford to seek a deepening self-perception and realistic self-appraisal?

8. Does he develop such relations that there is a general atmosphere of warmth in the classroom and each child feels himself to be accepted and supported?

9. Are pupil-teacher relations of such mutual confidence and opened that a child can bring his personal objectives as well as his problems and difficulties – in learning or in personal matters – into the open without fear of loss of status, lowering of marks, recrimination or humiliation?

10. Does the teacher genuinely encourage the exchange of questions and new ideas? Is the situation conducive to boldly trying out new experiences?

11. Are creative productions and special aptitudes given recognition?

12. Are dissenters accepted as normal?

The Curriculum

1. Is the educational program flexible to give the teacher considerable latitude in the selection of learning experiences appropriate for each learner?

2. Are the learning experience organized in such a way that pupils of varying abilities and interests can be assured of a reasonable amount of success?

3. Is the curricular pattern determined only after careful, consistent identification of differences in pupil characteristics, and subject to change when a change in emphasis and direction is indicated?

4. Is provision made for special programs for such substantial groups as the rapid learners and the gifted, the orthopedically handicapped, the hard of hearing, the emotionally disturbed, and the mentally retarded?

5. Do courses of study, syllabi, and resources unite contain suggestions for meeting the needs of individual learners, for self-testing devices, for pursuit of special interests and aptitudes, and for wide latitude in explanatory and creative experiences?

6. Are groupings flexible by subjects, interests, and aptitudes?

Instructional Methods and Materials

1. Are the methods of teaching used of such a nature that they stimulate the students to individual exploration and learning and lead him on to new and more widely varied experience?

2. Does the way of teaching help learning become a pleasant and exciting experience, learning to the development of a love of learning?

3. Is the climate such that pupils ask many questions?

4. Does the method of teaching provide an active rather than a passive role for the teacher?

5. Do pupils or teacher monopolize the time?

6. Is the teaching organized to provide varied ways in which a students can be authentically successful? Does it stimulate responses at various levels of ability? Does is stretch the thinking of pupils at all levels?

7. Can the teaching be highly individualized when that is appropriate, done in large groups when content is being transmitted, and yet utilize the resources of small groups when that is more to the point?

8. Does the method of teaching increase individual responsibility and provide opportunities for each student to organize his own learning?

9. Does the teacher's way of working help the student toward sufficient security to try out creative ideas without undue fear? Does it release him from needless insecurities and build increasing self-assurance?

10. Does the way teaching encourage self-analysis and realistic self-appraisal by the student, leading toward growing self-insight and self-acceptance? Does it help him understand and appreciate his unique strengths and build upon them?

11. Are instructional materials selected with an eye to their adaptability for and encouragement of individual study and individual competence?

12. Is care exercised to secure a wide variety of instructional materials, suitable to divergent individual needs as well as to various levels of ability?

13. Are instructional materials selected to give learning an active rather a passive character? Do the materials stimulate individual action and a various or one trying-out of new experiences?

MODEL OF AN INSTRUCTIONAL SYSTEM

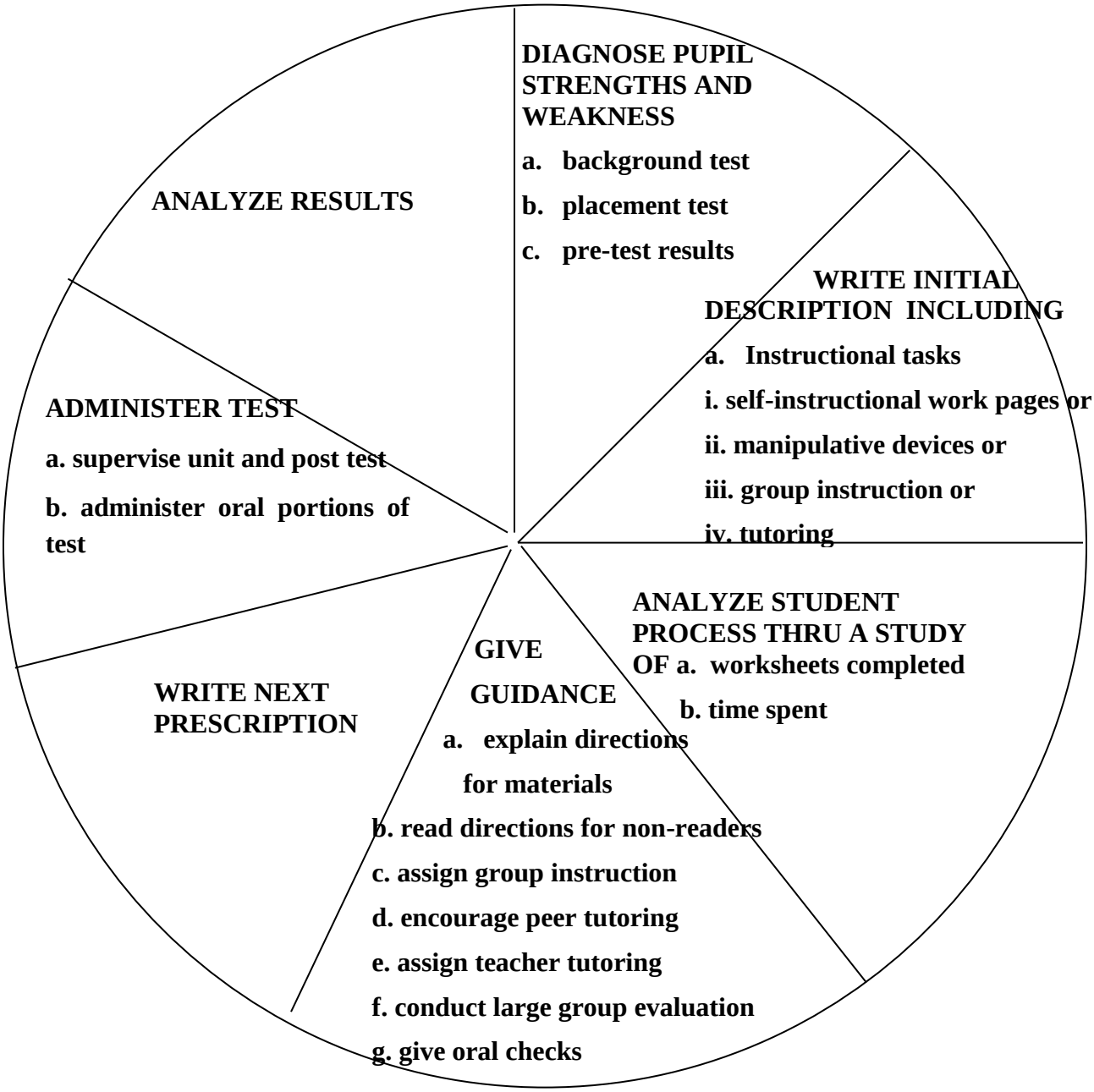
<table>
<tr><td rowspan="2">TYPE I

LEARNING</td><td>THE TEACHER</td><td>THE PROCESS</td><td rowspan="2">THE STUDENT</td></tr>
<tr><td colspan="2">TEACHER-ACTION</td></tr>
<tr><td></td><td>Illustrates
Lectures
Measures
Monitors</td><td>Introducing
Motivating
Explaining
Testing</td><td>Listens
Observes
Organizes
Studies</td></tr>
<tr><td rowspan="2">TYPE II
LEANING</td><td rowspan="2">Questions
Observes
Evaluates
Discusses</td><td colspan="2">TEACHER-STUDENT INTERACTION</td></tr>
<tr><td>-Examining terms and concepts
-Solving problems
-Reaching areas of agreement and disagreement
-Improving interpersonal relations</td><td>-Questions
-Observes
-Tests hypotheses
-Discusses
-Makes decisions
-Develops under-standings
-Develops attitudes</td></tr>
<tr><td rowspan="2">TYPE III
LEARNING</td><td rowspan="2">Counsels
Advises
Plans</td><td colspan="2">STUDENT-ACTION</td></tr>
<tr><td>-Reading
-Listening to records and tapes
-Viewing
-Analyzing
-Experimenting
-Examine
-Investigating
-Considering evidence
-Creating
-Memorizing
-Recording
-Making visiting
-Self-appraising</td><td>-Perfects skills
-Develops independence
-Initiates inquiry</td></tr>
</table>

School that have developed an individualized approach appear to recognize that appropriate tasks of programming are based on the premise that children learn best and teachers help children learn better when the frustrations of artificial and unrealistic barriers are absent. The following descriptive phrases may serve for clarification :

Conventional School Program	**Individualized Program**
Separate subjects	integrated subjects
Member balanced classes	variety of class sizes
Age/grade classes	multi-aged classes
Annual promotion	flexible pupil movement
Horizontal enrichment	rapid progress horizontally and vertically
failure retention	slow progress provided for
remedial classes	rapid progress available
accelerated classes	continuous reporting
quarterly reporting	descriptive comments; contracts
grade cards	teaching teams
teacher compartmentalization	downgraded
age/graded groups	flexible scheduling
hourly periods	multiple text materials
single text each subject	pupils actively involved
pupils relatively passive	self-discipline
external discipline	team evaluation and planning
individual teacher planning	teacher-pupil testing and evaluation
“testing” for retention	teachers-pupil interdependency
Pupil dependency on teacher	and independent study
	humanizing interaction
	variety of acceptable responses
limited interaction	democratic (to a degree)
limited right responses	unity and continuity of
autocratic organization	educational experiences
lockstep subject separation	teaching style pursuing
	behavioral objectives
teaching styles purveying	appropriate tasks
knowledge didactically	90% pupil learning
	continuation from prior years
90% teacher talk	achievement, problem and
Starting over each year	interest grouping.
Grade grouping	

INDIVIDUALLY PRESCRIBED INSTRUCTION
TEACHER FUNCTIONS



RESEARCH

CLUES TO GOOD TEACHING NOTED

By Benjamin Fine

NEW YORK (NANA) - School superintendents and administrators are trying their best to fill the growing number of empty teaching posts in schools and colleges. Even though salaries increased during the past year to minimum starting rates of $6,500 to $7,500 for College graduates, the shortage continues.

There are plenty of applicants, but the question that school systems must ask is : what makes a teachers good? You may have two applicants, with equal apparent qualifications, one thoroughly incompetent, while the other may develop into a master teacher. It is difficult to determine, from the academic record, whether a candidate will do competent classroom work.

A recent report by the National Education Association observes that the most successful teachers accept their pupils as worthwhile individuals and make the students associate of this acceptance.

A carefully controlled study specifically designed to focus on the effect of teaching behavior on pupil achievement was conducted by two professors at Temple University in Philadelphia. Fifteen social studies teachers in a large metropolitan area taught the same four chapters of a book. Instructional time, class size and student ability were controlled but teachers were allowed to teach the material in any way they wished.

Tests administered before and after the four day experiment showed that students in three classes had learned more than would be expected of children of their ability. These in eight others had learned just about what have been expected of them had they been left on their own the book. These in the remaining four had learned even less than would have been expected of them.

The teachers of the highest achieving group were positive in their approach to the children. They found time to encourage a students even when his answer wasn't the one the teacher wanted. They let students explore content along many thinking levels.

The teachers of the classes in which children learned just about what would have been expected of them had they been left on their own with the book were teachers who lectured and who concentrated chiefly on factual information. They tended to have a minimum of personal exchange, either positive of negative, with the students.

The teachers of the lowest achieving group tended to ask the low-level type of question. "How much tin do we get from Bolivia?" They were negative toward the students. If a child would say, "I think this is wrong," the teacher would come back with something like, "How can you say it's wrong when book says it's right?"

RESEARCH
O U T L I N E

A. PRESENT RESEARCH

1. PROCEDURE

2. THINGS TO RECORD ABOUT THE STUDENTS

3. TRAITS TO LOOK FOR

4. FACTORS TO REMEMBER

B. CONTINUING RESEARCH – SOME OF THE THINGS TO TEST

A. PRESENT RESEARCH

In the September 1969 issue of Masa'alah Pendidikan, Dr Ruth Wong wrote a very interesting article entitled "Research and Evaluation". This article expresses many ideas that the MARA Junior Science College will attempt to embody in its research and evaluation. Therefore several quotes have been taken from the article, and all the quotes that appear in this section have been.

"One specific function of evaluation is to provide a proper under-girding for decision-making"

Since this school is a new school and is trying to adapt its own and possibly new for Malaysia approach, it needs much evaluation to guide all of its decision making activities. Hopefully this evaluation will be done on a continuing basis and thus also will be apart of the decision making. Whatever decisions are made at the beginning of this school, it is assumed they will not be binding to the extent that they cannot be changed if it becomes necessary. The school use the results of whatever evaluation studies are done to continually evaluate its own performance and to continually make changes to its structure and content in line with whatever the research shows is the better approach.

The school must not only have research on its own results though, but must know the results of studies done for the population of Malaysia as a whole. For example a study should be done on the factors which enhance or prevent a student's success at the University level. For example the popular current notion is that some students do well at the LCE. & MCE levels but then fail at the HSC or first year university level. If this is in fact the trend, there must be some reasons for it. A study should be done to ascertain whether or not this is in fact the case, and if it is, then just what are the reasons. Often in these sorts of cases, where a person does well in a first year of a language course, for example, and fails the second year, this can be traced to the method the student learns the subject. If he is memorizing all the words and structures then he does fairly well in this first year when the material is not too much to memorize and when what he has memorized is fresh on his mind.

Perhaps this explanation is not applicable for the present situation, but what is needed is research into the factors that cause this situation. Research should be done to find out why students fail the HSC or first year university. If any explanation that is a factor under the control of the MARA Junior Science College appears, then the difficulty should be tackled. In addition an item analysis of the mathematics questions asked and done in correctly should be done comparing the LCE, MCE & HSC tests respectively. Then at the university level a similar item analysis could be done to determine if any of the same kinds of difficulties exist. Once these factors, if any, are discovered and analyzed then the school can make a concentrated effort on eliminating these particular difficulties.

1. **Procedures** :

   Teachers should understand,

   "that they should evaluate not only pupil performance but also be critical of their own behavior in relation to their teaching task".

In order for the teachers to evaluate themselves and their teaching several steps are needed :-

a) Keep records on the students.
b) Frequent testing to find out how the student is doing
c) Daily records of his progress in class – mathematics, evaluation sheets, science worksheets, personal record of teachers, etc.
d) Daily or at lest weekly personal feedback between the teachers and students as to how the student sees himself and how the teachers see him.
e) Daily or at least weekly personal feedback between the students and teachers as to how the students see the teachers.
f) Daily or at least weekly feedback between members of the staff – academic & non-academics about problems and processes of the school in general.
g) Keep records on the entire process of the school.
   How much time one topic, what method of approach, what results.

2. **Things to record about the students** :-

   Keeping records on the students requires various items. Some of the things we should know about each of our students. As well as about our control group are the following:-

   a) Age
   b) Place of residence – city, kampong
   c) Place of birth
   d) Height
   e) Weight
   f) Eyesight
   g) Hearing
   h) Other physical liabilities
   i) Preferences of student
   j) Previous class record as supplied by teachers
   k) Parents names
   l) Parents age.
   m) Parents years of schooling.
   n) Occupation of parents
   o) Total family monthly income
   p) Number of siblings
   q) Age of siblings.

r) Education of siblings if applicable.
s) Score on MARA Junior Science College Examination.

3. **Traits to look for** :

"The best form of evaluation, is that which carries along with it a built-in systematic procedure for examining its own methods, criteria and instruments, and for the identification of new directions. In this sense, evaluation becomes inalienable from research".

The MARA Junior Science College being a new school and trying new methods will necessarily have to undergo some evaluation to make sure what is being tried is better that what already existed. If the school is not better then there is no need for it, but the school cannot just be assumed to be assumed to be better just because it is new. Evaluation tests must be done to see if the school is better and in what ways assuming it is.

Having said this end before going further a definition of what is meant by "better" is necessary. Of course "better" would for one thing mean that all the thing set out in the objectives in the original descriptive plan for school have been done. But in addition it could also very specifically mean :-

a) Do the students get better results on their LCE, SC and HSC than their control group – especially in Mathematics, Science and language – Malay and English?
b) Given a choice of alternatives, are the students able to make a decision, justify it, and carry it out?
c) Are the students inquisitive?
d) Do the students feel that in job in the kampong is not beneath them?
e) Can the students justify their opinions with facts or research?
f) Are the students interested in research science courses?
g) Can the students perform well academically at the University and Post-graduate level?

This is still not a complete list of questions to ask but in each case when asking these questions reference is made to whether the students are better in each of these areas than are their control group, whatever that might be.

When selecting each of the students in accordance with whatever criteria has been set a similar student in all respects will be selected to make up an equal number of control students. For example all the factors recorded on the students will be recorded on the control student as well and accurate up-to-date records kept on all these people for at least ten years from acceptance. Then periodically at least once a year – comparative studies can be done between the MARA Junior Science College students and their respective control students – wherever these students are.

4. **Factors to remember** :

"In the last analysis, however, what weakness there may be found in education may be traced in part to some decision made without the support of proper evaluation".

The immediate research and evaluation however should also have an element of long range planning and evaluation. Some studies which have been done for Malaysia specifically, have been at a disadvantage because of the short time involved. A.T. Balraj's study on "Discovery and Expository Methods of Teaching Numeration System", a dissertation at the University of Malaya in 1970 is just one example. He concluded from his one week, 190 minutes, of teaching that Malaysian children learn better by expository methods than discovery ones. Now this conclusion might be correct, but the evidence does seem sufficient to support this conclusion. From studies done elsewhere, the discovery method is shown to take longer initially to produce results, but that in the long run, time is saved plus learning is better. Now at the MARA Junior Science Collage, several control experiments could be set up and run anywhere from month to years. The control group could be another group of students within the school or a group with similar characteristics outside the school. The important thing to remember is that there should be a control group.

There are at least four factors that all of the research must take into account. Just mentioned have been the control group and the time spent, but in addition to this it must be remembered that no matter what research is done, the learning process of the students must not suffer in the meantime. Also needed for any research to show conclusive is a limiting and delineation of the variables involved. Thus briefly four of the factors to remember about the research are :-

a) Must have a control group.
b) Must have a sufficient length of time.
c) Must have as far as possible only one variable.
d) The learning process of the student must not suffer beyond repair.

B. **Continuing research** :

"Evaluation and research are, both necessary to the health of an educational system".

In addition to the immediate information which must be kept in order to do research in the future, there are a number of long range studies that can be done to effect the way this school can be changed plus effect the initial policies of future MARA Junior Science College's. It is also hoped that if these studies show conclusive evidence for one item over the other, then even other schools in Malaysia would be encouraged to try these methods as well. For example if it be shown between two sets of students that a flexible

time table is better for learning than a rigid one, then perhaps all schools could try a more flexible type of scheduling.

It must be remembered that all of these sorts of studies have been done on other students as the page at the front of this booklet indicates, but the important things to do a similar study to see how these things affect Malaysia students in their own environment. A careful reading of these previous however would give an example of how to set up a research project and to carry it though. Again to do these studies we should elicite the aid of the Education Faculty at the University, the Educational Planning and Research Division of the Ministry of Education and any private individuals who are interested in doing research.

Some of the things to test are :-

a) Class size 1/5/10/15/20/30/50
b) Learn by discovery/rote learning.
c) MARA Junior Science College/Regular school
d) Encouraging/discouraging teachers.
e) Integrated/general science.
f) Individual instruction/lectures.
g) Malays/English instruction in science.
h) Malay/Integrated Boys.
i) Boys/Integrated sexes.
j) Flexible/rigid timetable.
k) Dementia/military discipline.
l) General par pone/pacified classroom.
m) Taking in high behooving/low achieving students.
n) Criteria for text books.
o) Method of promotion of students automatic/earned.
p) Number of teachers of specific categories in the school.
q) Different curriculum.

"Fruitful research has been shown to be that which is attended by discovery and becomes the basis for meaningful theory. Such research is necessary for our country and should therefore be supported with out unrealistic notions as to what it can do or should do".