# Science Investigations

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# விஞ்ஞான ஆய்வுகள்



NUMBER 3

FEBRUARY 1984

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THE NATURAL RESOURCES, ENERGY & SCIENCE AUTHORITY OF SRI LANKA

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THE WORKING COMMITTEE ON SCIENCE EDUCATION,
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SRI LANKA, 47/5, Maitland Place, Colombo 7.

# INTRODUCTORY NOTE

The main purpose of Science investigations is to provide a medium for school pupils, school teachers, and others, to publish reports of their own scientific investigations in Sri Lanka. The two issues which have appeared so far have been exclusively devoted to this purpose.

The present issue falls within the same framework but it confines itself to summaries of research on science education done by university teachers, school teachers and others in Sri Lanka. Their research was supported with small financial grants from NARESA. NARESA'S Working Committee on Science Education felt it would be appropriate to publish the summaries. The reports themselves have not been published, except in a few cases where the authors did so in foreign journals. The reports are available for perusal at NARESA. The order in which the contents are printed in the present issue is based on the dates of receipt of the reports from the authors.

V. Basnayake
Editor
2 Feb 1984

CONTENTS

# TEACHING OF PERCEPTUAL-MOTOR SKILLS TO DENTAL STUDENTS

D.Y.D. Samarawickrama *

(RP 10/76. English typescript. 3 pp + Appendices A & B)

The author concludes that there was a significant difference in the level of student achievement by a self-instructional method as compared with that by a method which used slides and models. Each method was followed by individualised instruction. The skill taught was the preparation of a cavity on models of teeth carved in soap.

V. Basnayake

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* Dr. D.Y.D. Samarawickrama, Dental School, University of Peradeniya, Peradeniya.

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(Investigation into science education problems arising out of school administrative procedures)

D.P.P. Devapriya *

(Typewritten, bound, in Sinhala, with a separate hand-written abstract which is not bound. pp. 91 plus an appendix of 19 pp. Abstract 16 pp. Illustrated. Many tables. Date of report, 30.8.1979. RP 15/76)

The author did a survey of 25 schools in the Bandarawela region. The following conclusions may be drawn, subject to sampling errors:

1. Laboratory space for practical work was inadequate in the opinion of the majority of teachers and students. There was no laboratory in 80% of the schools.

2. Laboratory work was not specified in the timetable in about 50% of the sample.

3. Laboratory demonstrations formed about half of all the laboratory classes, and student practical work formed the other half. Students worked mostly in groups of four for practical work.

4. Laboratory supplies were deficient in over half of the sample.
5. A laboratory assistant was found in 63% of cases.
6. Laboratory assistance was not enough in about 50% of cases.
7. Facilities fees could be used for helping laboratory work in 18% of cases.
8. Students took down notes by dictation (3%), by deciding on their own (25%), or with help from the teacher after he had explained the topic (72%).
9. Non-qualified science teachers formed about 25% of the science teachers.
10. A-Level education was felt to be improving by 50% of the teachers and principals, while the other 50% felt the opposite.
11. School science activities out of the classroom:
    Science clubs, 67%
    Visits to places outside school, 35%
    Visiting lecturers, 35%
    School environment noticed, 17%
    Science exhibitions, 9%
    Pond, 8%
    Radio Club, 4%
12. A library was found in most schools.
13. Student numbers were more than 30 in a class in about 50%.

14. There weren't enough desks in about 75% of cases. Classes were separated by mere partitions in 31%.

The author makes a long series of recommendations based on his study.

V. Basnayake

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* Mr. D.P.P. Devapriya, Dept. of Education, Ministry of Education.

## USAGE OF-TEXT BOOKS (A/L SCIENCE)

M.P.N.G.M. Cooray *

(Handwritten, in English, 7 pp including 4 tables. Dated 9.12.79. No summary or statement of conclusions)

The author had devised a questionnaire to get information about the use of library books for G.C.E. A/L classes. He received replies from 33 out of 100 schools. He used 25 of them for his tables.

The general conclusions which one might draw from his tables and discussion are:

1. There is a wide disparity between schools for the number of books in the school library.
2. There is no relation between the number of students and the number of books.
3. There is no information about book usage.
4. Professional librarians are practically non-existent in schools.

V. Basnayake

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*Mr. M.P.N.G.M. Cooray - 28A, New Kolonnawa Road, Moragasmulla, Rajagiriya.

## SURVEY OF SCIENCE TEXTBOOKS IN VARIOUS GRADES OF SCHOOLS IN KEGALLE DISTRICT

M.M. Munasinghe *

(RP 16/76. In English. Handwritten. Three parts:

Part I 10 pp. Dated 30.12.78

Part II 4 pp. Dated 22.01.79

Part III 9 pp. Dated 02.01.79 (2.1.80)

No summary)

The author had devised and used a questionnaire on the topic. She concluded that science library facilities in the Kegalle District were poor. She recommends remedial measures.

There is no full description of the method used in selecting the samples, in administering the questionnaire and in analysing the data.

V. Basnayake

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* Mrs. M.M. Munasinghe, Rajasinghe Madya Maha Vidyalaya, Kegalle.

# CAREER PREFERENCES OF DOCTORS QUALIFYING IN 1977. A POSTAL SURVEY.

K.M.H. Perera *

(Published in Indian journal of medical education 1980 19/2 1-8)

Author's summary:

A postal survey on career preferences had good responses among British medical graduates (Parkhouse 1976). A similar survey was carried out among interne medical officers in Sri Lanka. A questionnaire was sent to 111 internees. The questionnaire dealt with career preferences. A self-addressed stamped envelope was sent. A response rate of 58.7% was obtained. It was considered a good response rate for Sri Lanka.

The most popular first choices of career were General Medicine and Surgery for males and General Medicine and Paediatrics for females. A popular second choice, Anaesthesia, emerged among the females. The most frequently mentioned reason for preferring medical specialities against surgical was the relative independence from other sources (e.g. Anaesthetists) and the associated leisure time. Many females choosing medical specialities said 'It was more

suitable for a female'. The interest shown in General Practice in British samples (Parkhouse 1976) is not seen among our doctors. Over 70% said they intend sitting for postgraduate examinations. The need for development of postgraduate examinations is evident. The role of the female medical officers should be considered when matching health manpower need to resources.

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* K.M.H. Perera, Lecturer,Dept. of Physiology, Faculty of Medicine, Univ. of Peradeniya, Peradeniya.
Present address of Dr. Perera: Faculty of Medicine, Ruhuna University, Galle.

# VIEWS AND EXPECTATIONS OF SIXTH FORMERS IN SRI LANKA, CONCERNING DENTISTRY AND DENTAL EDUCATION

A.N.I. Ekanayake *

(typescript 11 pp. plus 4 tables. In English. RP 8/76. Modified version has been published in Medical education, 1983, 17, 331 - 337).

Author's summary;

Questionnaires were sent to 31 schools in various parts of Sri Lanka on the basis of schools from which the majority of dental students tend to enter. Responses were received from 1445 sixth formers in these schools. Various views common to a large proportion of the sample were identified, as well as differences between subgroups distinguished by sex, language, occupational background, and location of school. The results are intended to aid the teaching of subjects like Community & Preventive Dentistry, so as to avoid conflict with preconceived expectations of dentistry based on traditional patterns of curative services which students may bring with them into dental school. In this connection there were some hopeful signs of preventive orientation in the group studied.

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* Dr. A.N.I. Ekanayake, Dept. of Community Dental Health, Dental School, Univ. of Peradeniya, Peradeniya.

# SURVEY OF UDAWATTEKELLE FOREST WITH A VIEW TO RECOMMENDING CONSERVATION MEASURES

A. Weerasinghe * and the Pupil Forest Wardens of Trinity College, Kandy, Sri Lanka.

(RP 5/78. English typescript, 15 pp., 2 tables, 3 maps, 1 figure, 18 photographs, and 2 printed appendices. Summary provided).

Udawattakelle Forest Reserve, Kandy, was studied for evidence of abuses against conservation. Twentyfive types of abuse were noticed. They were classifiable under the following headings in descending order of frequency:- Mismanagement (84% of all cases), Exploitation (44%), Carelessness (36%), Natural causes (20%). Suggested remedial measures to conserve the forest are classified into actions possible at four levels: Local, District National, International.

V. Basnayake

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* Mr. U.A. Weerasinghe, Biology teacher, Trinity College, Kandy.

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(Relation between intelligence and science education).

A.I. Bandara *

(Typescript, in Sinhala, bound, 25 pp and an appendix of unnumbered pages and 1 page of references. Received 1.9.81. No English summary).

Intelligence tests were given by the author to 91 school children and to 91 adults in a number of places in the Nuwara Eliya District. The test was an adaptation by the author of an Eysenck test. It had three parts: verbal, number, and general ability, with 25, 20 and 20 questions respectively. The results are analysed in relation to a number of variables, such as age, grade, educational background, etc., for which information was obtained by questionnaire.

The main conclusions drawn by the author are:

1. Science students show a higher Intelligence Quotient (IQ) than others.
2. Students in higher grades (classrooms) show higher IQs.
3. IQ is positively related to age.
4. IQ is related to environmental factors.

The author recommends that tests of intelligence and numerical ability should be useful in selecting students for the science stream in schools.

Comment : Only mean values are shown throughout. Variability is not shown. The significance of differences in mean values remains unknown. Copies of the test papers and questionnaires are not shown.

V. Basnayake

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* Mr. A.I. Bandara, Education Department, Ministry of Education.

INTEGRATED SCIENCE FOR PRIMARY

S. Allegakoen *

(Handwritten manuscript. In English. Illustrated profusely). Pages not numbered. Received 1.9.81).(Grant No. RP 2/76)

No Preface.

There are ten chapters:

| | | |
|---|---|---|
| Ch. 1. | Living and non-living things | 26 pp |
| Ch. 2. | Food | 30 " |
| Ch. 3. | Domestic animals | 10 " |
| Ch. 4. | Pets | 14 " |
| Ch. 5. | Classification of animals | 36 " |
| Ch. 6. | Soil, plants | 10 " |
| Ch. 7. | Plant Kingdom | 26 " |
| Ch. 8. | Insects | 12 " |
| Ch. 9. | Water | 8 " |
| Ch.10. | Earth and light | 10 " |

Common objects are illustrated with coloured pictures and named in English. The pictures are hand-drawn or cut out from magazines. The child is presumably expected to learn concepts by studying the pictures under a teacher's guidance.

The work requires revision and the addition of a teacher's guide.

V. Basnayake

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* Mrs. Sybil Allegakoen, 53, Vihara Lane, Colombo 6.

# ACQUISITION OF SCIENCE CONCEPTS IN RELATION TO THE HOME AND SCHOOL ENVIRONMENT

S.M. Jayasuriya *

(RP 25/76. Dissertation for M. Phil. (Ed., University of Colombo, December 1981. Summary not provided).

Knowledge of a chosen set of science concepts was estimated in a sample of 460 rural and 460 urban school children in Grade 10. The samples were drawn at random on an island-wide basis (six out of the island's 27 Educational Districts entered into the sample). 'Rural' meant Village Council area, while 'Urban' meant Municipal, Urban or Town Council area. The testing was done with a multiple choice test paper which had been specially devised and validated. It was a 20 item test. Questionnaires were used to get data about the home and school environment of the subjects.

It was found that:

1. The rural students' score was significantly lower than the urban. (The coefficient of variation of scores was as high as about 30 percent).
2. The rural students parents and siblings had a lower educational level than the urban, they read newspapers to a lesser extent, had lower incomes and lower

occupational levels, and did less trips with family.

3. There was no rural/urban difference in going to temple or church habits.
4. Rural family size was larger, and there was more crowding in the home, less lighting at night, and there were less visits to doctors.
5. Rural students received less study help from their parents, and they did less regular study.
6. Rural schools had less easily traversible roads, less school total room space, less desks and chairs, less blackboards, less electricity, less water, qualified teachers, less visual aids, and less library facilities.

It is of course not possible to assess from the present data the contribution of these various factors to the inferior performance of the rural student in a test on science concepts. There are other factors too which may contribute, such as the lack of teachers' guides and student texts. The author is inclined to conclude that the factors which she has studied and which have shown a significant rural-urban difference are important determinants of the difference. She therefore recommends that the rural environment should be enriched (in terms of school buildings, libraries, textbooks, teachers, etc.).

V. Basnayake

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* Mrs. Senani Maheswari Jayasuriya.

## "KURULU-KELLE"

D.D.P. Jayakody *

(RP 12/76. Typescript in English, 15 pp. including photographs, all in photocopy. No date. No summary).

The title of the research project itself is stated as 'Utilization of the bird sanctuary for field work in science education'.

The author has held field classes for school pupils in the forest reserve called Kurulu-kelle Kegalle. She gives a list of plants and animals seen in the reserve. The Curriculum Development Centre of the Ministry of Education had given her support in the later part of her work.

V. Basnayake

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* Mrs. D.D.P. Jayakody, Ministry of Education, Colombo 2.

# SOCIAL MOBILITY THROUGH SCIENCE EDUCATION: THE FATE OF A COHORT OF SCIENCE STUDENTS.

G.I.C. Gunawardena *

(RP 13/78. Report received on 4.1.1982. Photocopy of a typescript, 24 pp. including 16 tables, and 3 pp notes and references in English).

A survey was done to seek an answer to the question whether those who had been in the science stream in secondary school showed a subsequent rise in their socio-economic status. The sample consisted of 400 individuals who had sat for the GCE O-Level Examination in 1968. The strata in the sample were:

a. those from two urban and prestigious schools.
b. those from two Madya Maha Vidyalayas.
c. those from two deprived schools.

The technique used for data collection was a mail questionnaire. The reply rate had been 41.8 percent.

The results showed that the upper and upper-middle social classes retained their dominance over the lower-middle and lower social classes all along the way, viz. in-

i. performance at G.C.E. O-Level.

ii. facilities and freedom for study.

iii. entry into tertiary education.

iv. socio-economic status in adulthood.

It was concluded that the social mobility of those who had been in the science stream was small.

V. Basnayake

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* Dr.(Mrs.) G.I.C. Gunawardena, Faculty of Education, University of Colombo, Colombo.

# AN ATTEMPT TO SURVEY THE ATTITUDE TO SCIENCE OF PUPILS WHO HAVE FOLLOWED THE PROGRAMME OF INTEGRATED SCIENCE COURSE FOR FOUR YEARS

S.Sivanesan *

(RP 11/78. M.ED. thesis, University of Colombo, July 1981).

The author wished to evaluate the attitudes of pupils towards a subject which they were learning in school. This was integrated science, which had been introduced into Sri Lanka schools for grades 6-8 ( and also to grade 9 at one stage) from 1972.

The author devised a 34-statement Likert-type attitude scale for the purpose. It was administered to pupils in 12 Colombo schools. Four of these were boys' schools, two were girls' schools, and six were mixed schools.

The data were subjected to factor analysis. Four factors emerged.

Factor I was a set of attitudes which could be categorised as High Motivation to Learn Science.

Factor II was an unfavourable attitude which the author calls Reaction to Learning Science.

Factor III is called Scientific Knowledge by the author.

Factor IV is called Utility value of Science, although it involves interests which are not all purely utilitarian.

On the basis of these clusters, the author made the following recommendations regarding curriculum development and teaching of integrated science in Sri Lanka:-

1. Laboratory classes should involve student activity (and not only demonstrational work).
2. The mathematics curriculum needs revision in order to adapt it for science needs.
3. The syllabus/time ratio is excessive.

V. Basnayake

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* Mrs. Sasidevi Sivanesan, 36/1, Pereira Lane, Wellawatte.

# SOME STUDIES ON THE GUIDED DISCOVERY APPROACH FOR LEARNING CHEMISTRY

M. Selvaratnam *

(RP 17/78. Communication to an educational conference in Dublin. 10 pp. English).

Author's summary :

The current A-Level chemistry curriculum emphasizes in many places 'discovery learning'. Here the student is expected to do experiments and from his data draw conclusions. These conclusions are the principles of chemistry which he thereby learns.

The author has studied the limitations in this approach at 5 schools in Kandy. A chemistry teacher in each of these schools was also jointly involved in this study. The method of study adopted was the analysis of the students' answers to questionnaires and tests, consideration of the experimental results of students and discussion with the teachers.

The author concludes that the discovery learning method is unsuitable for A-Level chemistry in Sri Lanka

for the following reasons :

i) Lack of facilities. He states that the guided discovery approach demands good laboratory facilities, small classes, ample time and intellectually motivated students and teachers, and points out that even in the best schools all the requirements are not met with.

ii) Students' lack of experimental skills. The author's study of the experimental results of students in one school showed that the results were unreliable and random.

iii) Lack of 'discovery' motivation. Students' motivation for discovery learning is poor; their aim, almost exclusively, being best performance at a highly competitive examination. The author emphasizes that it is the students' aims that really influence learning and that any realistic curriculum must ensure that the students' aims are unattainable without the curriculum objectives being attained simultaneously. Discovery learning does not ensure this, at least in Sri Lanka.

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* Prof. Mailoo Selvaratnam, Dept. of Chemistry, Univ. of Peradeniya, Peradeniya.

# STUDENTS' MISTAKES IN PROBLEM SOLVING

M. Selvaratnam *

(RP 17/78. Published in Education in chemistry 1983 July, pp 125-132).

Author's summary :

The author has identified precisely some of the students' difficulties during problem solving, associated both with knowledge of chemistry and the processess of applying knowledge. The study method adopted was the analysis of students' answers to carefully selected problems. Eight examples of problems are given and analysed in the paper. The author also strongly emphasizes that for effective problem solving, equations should consistently be used, and not statements.

* Prof. Mailoo Selvaratnam, Professor of Physical Chemistry, Univ. of Peradeniya, Peradeniya.

# THE HABITS OF GRADE NINE AND TEN STUDENTS IN LISTENING TO SCHOOL SCIENCE RADIO PROGRAMMES

M.P.W. Fernando *

(RP/6/80. Report received on 13.12.82. Text and 12 tables. No summary. The'discussion' gives the author's conclusions).

The author, who is a script writer for SLBC school science programmes for Grade 9 and 10, wished to find out how the programmes were received by the target audience.

For this purpose he conducted a survey by questionnaire. The survey was limited to a stratified random sample of 26 schools in the Kalutara region. The questionnaire was answered by about 1700 students in Grades 9 and 10.

The findings may be summarized as follows:

1. Number of schools that listened in to the programmes: 12 (48%).
2. The non-listening schools could in most cases be easily persuaded to listen in. Ten out of 14 did so (71%).

3. Home listening, in addition to school listening, was done by about half of the listeners (about 36% as compared with a listener percentage of about 64).
4. The programmes were judged by the pupils to be satisfactory on the whole (to 87% of listeners).
5. More radio time would be welcome to the listeners, including repetition of the programmes in the evening preferably at about 5 p.m.
6. Work books on the programmes should be more freely available.

The author makes a series of seven recommendations.

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* Mr. M.P.W. Fernando, UNDP-Unesco Project for Quality Improvement in General Education. 220/5, Havelock Road, Colombo 5.

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(Search for a way of rendering the activity of agricultural science students more productive for village development).

B.M. Karunanayake *

(RP 10/80. Report received 5.1.83. About 45 pp typed foolscap. Entirely in Sinhalese. Numerous photocopied photographs. Pages not numbered sequentially).

The purpose of the project was to foster village development and to establish closer links between community and school by means of the school agriculture curriculum.

The project had been initiated in 1979 by the Curriculum Development Centre of the Ministry of Education. Mr. Karunanayake had been chosen and trained to lead it. It was located at Wilpata agricultural settlement in the Chilaw district. The number of families in the scheme was about 850. An agricultural demonstration centre had been

set up. Agriculture classes and agricultural exhibitions had been held for the public. The author is optimistic about his aim and his results. There are no hard data. The present report is called Part I. Presumably the author hopes to write more later. He also has ancillary material, such as addenda and cassettes, with him.

V. Basnayake

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* Mr. B.M. Karunanayake, Adviser to Teachers of Agriculture, Puttalam District.

# THE ASSESSMENT OF NUMBER OF G.C.E. O/L SCIENCE STUDENTS TAKING PRIVATE TUITION.

A. Jeganathan *

(Typescript in English, 2 pp. with 1 table and a large expanded table. RP 9/80).

Author's summary :

In a sample of 504 O-Level students in 27 schools in the Kopay Circuit, consisting of 283 males and 221 female students, 294 (58.3%) stated that they were taking private tuition.

Approximately 5% of them had started doing so from Grade 6, 5% from Grade 7 and another 5% from grade 8 and the remaining 85% at O-Level only.

The reason stated by the majority for resorting to private tuition was the feeling that they were weak in science.

294 students (60.5%) reported that taking tuition was a worth while experience as the quality of teaching was very satisfactory while 94 (20%) felt it was unsatisfactory and tiring.

The monthly cost of the tuition was in most cases between Rs. 100/= and Rs. 1000/=. It was said to be over Rs. 1000/= a month in 134 cases. Transport between home and tutory was in most cases by foot. The author formed the opinion that private tuition is valuable because students learn more at the tutories than they do in school. They also value it because they pay for it. Further investigations have to be carried out to find out the benefits and ill effects of Private Tuition.

V. Basnayake

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* Mr. A. Jeganathan, Teacher Advisor (Science), 'Chandrothayam', Puttur.

A SURVEY OF SCIENCE CLASSES IN THE KANDY WEST REGION TO DETERMINE THE EXTENT OF OVERCROWDING IN GRADE 9 AND 10

M. Perera *

(RP 25/80. Handwritten. In English. With about 40 data sheets).

The purpose of the study was to find out the extent to which a proper balance was maintained between number of science pupils in Grade 9 and 10 and the number and qualification of the science teachers in schools.

The population consisted of all 225 schools with Grade 9 & 10 classes in the Kandy West region. Information was obtained by postal questionnaire to the principals of the schools during 1981 and 1982. The number of schools that responded was 185.

The findings were consistent with the hypothesis that -

A. rural schools are neglected in regard to staffing them with science teachers;

B most science teachers feel they do not clearly enough know what they are expected to teach;

C. misuse of teachers is common.

In support of hypothesis A are the following findings:

i. No science teachers at all in about 25% of rural schools with Grade 9 and 10 science classes.

ii. Untrained teachers teach science in many schools, especially in rural schools (e.g. in about 75% of rural schools), and they even teach some A-Level classes.

iii. Requests made by principals to fill the vacant cadres often go unheeded.

In support of hypothesis B is the finding that most rural as well town school teachers had not received teacher's guides and did not clearly know what the syllabus was.

In support of hypothesis C is the finding that:

i. while many schools did not have even a single science teacher, some few schools were over-staffed.

ii. in a few schools, teachers qualified in science taught only mathematics or other non-science subject.

V. Basnayake

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* Mrs. M. Perera, Field Centre, Teachers' College, Peradeniya.

# ACHIEVEMENT IN THE LEARNING OF INTEGRATED SCIENCE BY LOWER SECONDARY SCHOOL PUPILS

N.J. Liyanage *

(RP 11/80. Report received on 5.5.1983. In English. Handwritten. pp. 16 + 9 pp of tables. No summary).

'Integrated sciences' is the name of the subject in which science is taught in junior secondary schools. It was introduced to Sri Lanka in 1972 as a general education subject for all pupils in Grades 6 - 9, at the end of which the pupils sat for a science paper in the NCGE examination. With the change of government in 1977 it was retained as a general education subject for all pupils in Grades 6 - 8 but as an optional subject in Grades 9 and 10, ending in a science paper in the GCE O-Level examination. Science is not taught as separate subjects such as biology, chemistry and physics in Grades 6 - 10.

Hypothesis. The author of the present report has had a certain hypothesis implicit in his mind. It may be stated thus:

> Integrated science, taught as a unified subject to all junior secondary pupils, is a failure, because of a number of factors including lack of teachers and

materials and the dilution of able pupils by less able pupils.

Method. The author sought to show that integrated science has failed. His method was to study test performance of Grade 10 students in science and in mathematics in the Kandy West educational region, using two criteria of performance, viz. (i) marks in a "common examination" held in December 1980, (ii) proportion of passes in science and in mathematics in the December 1980 GCE O-Level examination. Nine educational circuits in the Kandy West region were included in the study, involving a responding sample of 96 schools with 4818 pupils for criterion (i) above and 6173 for criterion (ii). Data are presented as mean and S.D. for science and for maths for each school in the sample for the "common examination", and as percent passes in science and in maths at the GCE O-Level.

Results and conclusions.

1. Integrated science test performance shows average scores, for schools, of the order of 20% in science and 15% in mathematics. Not one school got an average score over 50% in science or in mathematics. In 17 schools there were no passes at all in science. In 55 schools there were no passes at all in mathematics.

The author concludes that these results are dismal and that they show that integrated science has failed as an educational subject. (This conclusion is based on the assumption that the average score should be about 50%).

2. There are a number of other conclusions which may be drawn from the data but the author has left them alone. Perhaps they are rather peripheral to his (unstated) hypothesis. We may note the following:

2.1 Science vs mathematics. Science scores were almost always much higher than the mathematics scores. Science passes were about twice as many as in mathematics.

2.2 Town vs rural. No statistical comparisons have been made on the data for town schools vs rural schools, but the general impression from the data is that town schools tend to score more than rural schools. But there are exceptions both ways, and many rural schools scored as high or higher than many town schools in science as well as in mathematics. A number of town schools had not furnished data.

Recommendations. The author recommends that integrated science be retained as a core subject for all pupils in Grades 6 - 9, but that it should be replaced in

Grade 10 by biology, chemistry and physics as separate subjects, these being reserved for about 20% of the ablest pupils. This recommendation is based on his belief that the able students are being denied a proper science education because of lack of teachers and dilution by less able pupils. The author has not separately studied the scores and examination performance of the top 20% of the pupils. Had he done so, and had he found that the top 20% were scoring well, his conclusion and recommendation might have been different.

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# MATERIALS IN AND OUT OF SCHOOL WHICH ARE AVAILABLE TO TEACHERS OF LOWER SECONDARY SCIENCE CLASSES

D.M.A. Devasinghe *

(Report dated 1.6.1983. Typescript, 12 pp. with 8 tables. Two appendices. RP 3/80).

Author's summary :

For the teaching of science in the junior secondary school, material resources play an important part which greatly affects the quality of teaching. The present study was done in the schools of the Kurunegala region with a sample of 28 schools which is nearly 10 per cent of the whole school population. The data collected through a questionnaire administered have revealed the following:-

The materials are mostly supplied by the Department, specially the chemicals. The teacher's role in getting his materials from external sources is not always active enough. There are only a very few items which could be said to be of vital importance for the teaching of science in the junior secondary grades. The schools with much facilities and student numbers have a good supply of materials but the schools with less facilities and student numbers, though having a slight shortage of supply, do not suffer badly.

There is no difference in the supply of material in the perspective of school locality.

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# A CRITICAL STUDY OF THE N.C.G.E. EXAMINATION IN SCIENCE IN SRI LANKA

J. Wanasinghe *

(RP 19/76. Typescript 11 pp including 4 tables. Appendix containing 1 page of references, 2 tables of specifications and 2 tables of item analyses).

Summary supplied by the author :-

1. The N.C.G.E. Examination replaces the G.C.E. (O.L.) Examination which was held at the completion of the Junior Secondary School. Due to the structural changes introduced in 1972, the N.C.G.E. Examination was held at the end of Grade 9 whereas the G.C.E. (O.L.) Examination was held at the end of Grade 10.
2. The N.C.G.E. Examination was held for the first time in 1975 and for the last time in 1976. The Government that came into power in 1977 decided to re-introduce the former G.C.E. (O.L.) Examination at the end of Grade 10.
3. The aims of the N.C.G.E. Examination were slightly different from those of the former G.C.E. (O.L.) Examination. The N.C.G.E. Examination was not a 'Pass-fail examination', but each student received a certificate indicating his/her performance.

4. The 1975 and 1976 N.C.G.E. question papers were administered to 765 and 804 Grade 10 students. All these students had completely followed the N.C.G.E. curriculum.

5 As it is a 'paper and pencil test', the N.C.G.E. Examination tested only those outcomes in the Cognitive Domain. Those learning outcomes in the Psychomotor and Affective Domains, although very important, were not tested at all by this Examination. Such an assessment therefore does not constitute a composite picture of the students' achievement.

6. This Examination consisted of two papers -
   1. Multiple-choice question paper (Paper I)
   2. Structured-eassay question paper (Paper II)

7. The sampling of content (Content validity) in the multiple-choice papers (Paper I) was around 50%. However the content validity was better in the structured eassay papers (Paper II).

8. Both Paper I and II tested only the first three objectives of the Bloom's Cognitive Domain. Higher mental abilities under Analysis, Synthesis and Evaluation were not tested at all.

9. While the MCQ paper tested mainly factual recall, the Structured essay paper stressed 'Comprehension'; about 50% of items were on 'Comprehension', about 10% on 'Application'.

10. The reliability of the examination is high for both the MCQ and the Structured Essay Paper; the latter can be attributed to the use of a rigid marking scheme.

11. The validity of the examination, as judged by correlating the marks obtained by the test population of students with those they obtained while they were in the N.C.G.E. class ranged from + 0.36 to + 0.59. Only one question paper had a validity coefficient of + 0.59. Other three papers had coefficients less than + 0.5.

12. On the average as much as 71.25% of the multiple-choice items will have to be rejected judging on the basis of items analysis results. This shows that a mere collection of ad-hoc questions does not constitute a soundly conceived question paper.

13. It has to be emphasised that Department of Examinations will have to adhere to the scientific techniques of designing an examination question paper. It is recommended that the setting of question papers of the above types is a highly skilled job which takes time and which needs a systematic office procedure. The Department of Examinations should develop these along the lines followed by, for example, the London University Examination Board.

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