CONTINUOUS ASSESSMENT IN A JUNIOR SECONDARY SCHOOL: A CASE STUDY

BY

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A thesis submitted to the Postgraduate School, Ahmadu Bello University, in partial fulfillment of the requirements for the degree of Master of Education in Curriculum and Instruction (Science)

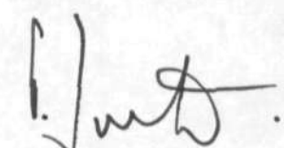
Faculty of Education

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DECLARATION

I hereby declare that this thesis has been written by me and that it is a record of my own research work. It has not been presented in any previous application for a higher degree.

All quotations are indicated by quotation marks or indentation and the sources of information are specifically acknowledged by means of references.



Paul Turton

CERTIFICATION

This thesis entitled CONTINUOUS ASSESSMENT IN A JUNIOR SECONDARY SCHOOL: A CASE STUDY by Paul Turton, meets the regulations governing the award of Master of Education in Curriculum and Instruction (Science) of the Ahmadu Bello University and is approved for its contribution to knowledge and literary presentation.

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ABSTRACT

The experiment was a case study of the operation of continuous assessment in a Junior Secondary School, and determined experimentally the correlation between continuous assessment scores in Integrated Science and an externally applied achievement test. For Year Three pupils, the achievement test applied was the Kaduna State Junior Secondary Examination. In the cases of Years one and two, specially prepared achievement tests were used.

The three achievement tests all showed highreliabilities; Year One 0.90, Year Two 0.81 and Year Three 0.85. The correlations discovered between these tests and the accumulated continuous assessment scores were; Year One 0.66, Year Two 0.77 and Year Three 0.77. These results were of a high level of significance (> 0.001).

As a validating measure, all the pupils were tested with Raven's Standard Progressive Matrices, a non-verbal test of general intelligence. The correlations between the scores on this test and those on continuous assessment and the achievement tests were; Year One 0.37, 0.44, Year Two 0.49, 0.50 and Year Three 0.44, 0.48. These results were well within the range of previously reported results and all were of high significance (> 0.001).

The results were also analysed to establish if there were differences in the performances of boys and girls on the tests. No major differences were discovered although a slight tendency in favour of boys was noted.

The conclusion drawn was that continuous assessment in Integrated Science, using the record keeping system devised for Kaduna State (the

NNPC system) would give reliable results which correlated well with external measures. These results would also form a reliable basis for the prediction of pupil performance. No statistical treatment of continuous assessment test scores at the school level was involved, and the study showed that consistent results could be obtained without such practices.

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This is to acknowledge with gratitude the cooperation and active participation in this experiment of the Principal, Mrs A.N.Jaja,Vice Principal, Mrs F.F.Alaiyemola, Senior Mistress, Mrs C.E.Balogun, Guidance Tutors, Mrs Oni and Mrs Ikoiwak, Head of Scence, Mr M.A.Akhtar, Year Group Tutors, Staff and, of course, the pupils of the Demonstration Secondary School, Ahmadu Bello University, Zaria.

In addition my thanks go to the Director, Kaduna State Educational Resource Centre, Kaduna State Ministry of Education, Zaria, and the Staff of the Evaluation Unit of the Resource Centre, for making available to me the integrated science answer scripts of the 1986 Kaduna State Junior Secondary Examination, needed for this study.

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Finally, without the calm, detailed and objective criticism of my supervisor, Dr M.J.Shuaibu, there is no doubt that this thesis would never have been written. I am indeed grateful.

DEDICATION

This work is dedicated to my wife

Hajiya Lami Mowunti Turton

DEFINITIONS OF TECHNICAL TERMS AND ABBREVIATIONS

The following terms and abbreviations have been used in the text of this presentation with the meanings ascribed below :-

Achievement test - a test designed to measure the attainment or level of understanding of a pupil of a particular course or programme of instruction usually a summative test set at the conclusion of the course or programme.

Amstrad PCW8512 - a personal computer capable of word processing and data analysis functions when using suitable software.

Commissioner for Education - the executive head of a state Ministry of Education charged with an overview of all educational matters in the area of jurisdiction of the state.

Assessment - the measurement of educational outcomes.

Continuous assessment - assessment which is systematic, comprehensive, cumulative and guidance orientated, occuring throughout a particular course or programme of instruction.

Certificate of Secondary Education (CSE) - an examination based award established in England and Wales recording pupil achievement at the end of the five year compulsory secondary education period normally taken by the lower 60 per cent of pupils, in terms of cognitive ability. (see GCE below)

Certificate of Secondary Education, Mode III - as described above but with the modification that the final award may be based in whole or in part on continuous assessment.

Demonstration School - a school normally established in conjunction with a teacher training institution in order to provide facilities for teaching practice and curriculum development.

Educational Resource Centre (ERC) - a centre established by a state Ministry of Education for in-service training and curriculum development, usually including an evaluation unit responsible for statewide examinations.

Federal Government - The Government of the Federal Republic of Nigeria.

General Certificate of Education (GCE) - an examination based award recording pupil achievement at the end of the compulsory five year secondary education period in England and Wales normally taken by the top 40 per ent of pupils in terms of cognitive ability. (see CSE above)

General Certificate of Secondary Education (GCSE) - an award based on both examination and continuous assessment, recording

pupil achievement at the end of the compulsory five year secondary education period in England and Wales designed to replace the GCE and CSE (see above) awards with effect from 1988.

Integrated Science - a programme of instruction incorporating the three major areas of science, biology, chemistry and physics, as described in the Core Curriculum for Integrated Science: Junior Secondary Schools, November 1984, issued by the Federal Ministry of Education, Science and Technology, Lagos.

Joint Matriculation Board - an examination board established in Britain by the universities of Manchester, Liverpool, Leeds, Sheffield and Birmingham for the conduct of the General Certificate of Education examinations, one of six such boards in Britain.

Junior Secondary School (JSS) - schools established under the direction of the National Policy on Education (1981) to conduct the first of the two three year periods of secondary education, i.e that period immediately following primary education.

Junior Secondary School Examination - a final summative examination conducted by state Ministries of Education at the end of the Junior Secondary School course. The results of this examination are combined with school-based continuous assessment records.

Moderation - the process of adjusting individual assessments to a common standard, for example school-based continuous assessment scores to a state or national standard.

Nigeria Integrated Science Project (NISP) - a curriculum development project conducted under the aegis of the Science Teachers Association of Nigeria to develop an integrated science course for the early years of secondary education. This led to the production of text books in integrated science for each of the three years of the junior secondary course.

Nuffield Secondary Science Project - a curriculum development project in Britain funded by a charitable trust, the Nuffield Foundation.

Quasar - a software programme designed for use with the Amstrad PCW for statistical analysis of experimental data, produced by Goode Software, Cardiff, Wales.

Raven's Standard Progressive Matrices (Raven's SPM) - a published, non-verbal test of general intelligence, regarded as being free from cultural bias.

Science Process Skills - skills related to the conduct of scientific activities such as measurement, observation, making hypotheses, design of experiments, data recording and analysis, prediction etc. i.e. the processes as opposed to the content of science.

Subject Head - the teacher in charge of the teaching and evaluation of a particular subject in a school, usually leading a group of teachers of that subject.

Test 100 - a test of general academic ability devised for use in the British educational environment at secondary level.

West African Examinations Council (WAEC) - an examination body responsible for the conduct of national examinations at the conclusion of the secondary stage of education in Nigeria i.e. at the end of the second period of three years of the secondary programme, the conclusion of the senior secondary programme. It is an international body with similar responsibilites in other West African States.

Year Group - the group of students admitted to a school at the same level and year of entry, usually divided into classes for the purposes of instruction, sometimes referred to as a Form.

Year group Tutor - a teacher assigned to a particular Year Group with professional/administrative responsibilities such as welfare, checking attendance and ensuring that continuous assessment records are properly kept.

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CHAPTER 1

THE PROBLEM

1.1 Introduction

Although continuous assessment had been widely used as a component of student evaluation in higher education in Nigeria for some years, the introduction of a formalised system of continuous assessment into the earlier levels of the educational system was a direct consequence of the adoption of the National Policy on Education (Revised 1981).

The National Policy on Education was initiated in a seminar held in 1973 under the chairmanship of Chief S.O. Adebo, which deliberated on the need for such a policy given the uncoordinated growth of the Nigerian educational system which had simply evolved from that introduced by the colonial government, whose aims and purposes differed greatly from those of an independant and sovereign Nigeria. This seminar considered the report of an earlier National Curriculum Conference held in September 1969 (Adaralegbe 1972), at which the concept of a national policy was first raised. In 1977, an implementation task force was established under the chairmanship of Professor S.D.Onabamiro to prepare an implementation blue print. In 1979 a government white paper on the report of the implementation task force was published (Federal Ministry of Education, 1979), and the more widely known and used National Policy on Education (Revised) was published in 1981. After some twelve years of development of ideas, the National Policy on Education was launched in 1981, and for the first time in the history of Nigeria, a clear and cogent statement of the relationship between national aims and the philosophy and structure of the educational system was made.

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The National Policy on Education eventually became categorised as the 6-3-3-4 system since, to the lay man at least, the change in time scale from a five year secondary programme and a three year degree programme to one which prescribed a secondary stage divided into two parts of three years followed by a four year degree programme, was the most easily recognisable new feature.

To educationalists, however, the most revolutionary aspect of the National Policy was the insistence that pupil evaluation at the terminal stages of each level of the system was to incorporate continuous assessment.Section 1 of the policy document, which dealt with the Philosophy of Nigerian Education, para 7(6), stated:-

> Educational assessment and evaluation will be liberalised by basing them in whole or in part on continuous assessment of the progress of the individual.

This statement was subsequently reiterated in sections of the document dealing with Primary Education (paras 15(8) and (9)), Secondary Education (paras 23(1),(2)and(3)),Higher Education (para 43(2)), Teacher Education (para 70) and finally in Section 11 which dealt with the Administration and Planning of Education (para 99(1),(2) and (3)).

Some guidelines as to how a system of continuous assessment was to be introduced at the primary and secondary levels were given, through the publication of a booklet, " A Handbook of Continuous Assessment " by the Federal Ministry of Education, Lagos (undated). In addition, workshops were organised throughout the country in 1982 to ensure that the officials involved in policy implementation such as State Ministry of Education

officials, inspectors of education, school principals and teachers were alerted to the implications of continuous assessment.

The clearest statement in the National Policy on Education (Revised) 1981, as to how the desired 'liberalisation' was to be achieved was in para 70, which stated:-

> The existing practice in most of our institutions of learning of basing the assessement of students' work on one final examination and on one type only is no longer tenable. Continuous assessment based on a variety of evaluation techniques should be henceforth adopted, and there should be some means for ensuring some common national standards both in areas of public examinations as well as internal ones.

The "Handbook on Continuous Assessment" developed the concept of continuous assessment by ascribing to it four major characteristics, these were that it should be :-

(i) **Systematic**, that is it should be planned and periodic

(ii) **Comprehensive**, this was manifested in two aspects

(a) through the use of different types of assessment instruments

and (b) by being concerned with all aspects of the individual pupil, not simply his or her cognitive ability, but also those qualities categorised under the terms affective and psychomotor by Bloom et al (1956), a terminology widely used in the National Policy on Education.

(iii) **Cumulative**, that is it should take into account previous assessments and records

(iv) **Guidance Orientated,** that is it should aim at producing information to optimise the further development of the pupil.

From the description of the characteristics of continuous assessment it was clear that a major change in curriculum style was to be introduced. Major changes in content were also predicated in the National Policy on Education by the adoption of a number of integrated 'subjects' such as Integrated Science, Social Studies and Introductory Technology. This together with the already mentioned new time scale left no doubt that an unprecedented curriculum innovation was being launched on a largely unprepared educational system.

In Nigeria, education at the primary and secondary levels was a responsibility of both the Federal and State Governments, being by virtue of the constitution on the concurrent list of responsibilities. At the time of its introduction, not all of the 21 States of Nigeria adopted the National Policy on Education. However, Kaduna State in the northern part of the country was one of five States which did adopt the policy with effect from the 1982 intake of pupils into the secondary stage of the educational system. Even here, it was not until the following year, with the 1983 intake, that a common system for continuous assessment scores to be derived and accumulated was introduced, and plans laid for a common Junior Secondary School leaving examination.

Up to this point, in spite of the long lead-time which the new National Policy had, little had been done by way of evaluatory studies of the new techniques involved, in particular those required in continuous

assessment. In many respects this aspect of the policy represented an act of faith on the part of the policy makers.

1.2 The Statement of the Problem

The problem addressed was whether or not the inclusion of continuous assessment as an element of the evaluation of pupil progress was justified. The reason advanced in the National Policy on Education was for the "liberalisation of assessment", but this was not a precise term and liberalisation achieved at the expense of reliability of assessment could not be the intention of the policy. The problem was restated therefore as did scores achieved through continuous assessment correlate to a reasonable degree with scores achieved by students in achievement tests ? Even here, the question of degree of correlation remained problematic but a positive correlation of about 0.6 could be taken as an indicator that continuous assessment and the achievement tests were measuring similar attributes, subject also to the content validity of both measures. Smith (1978) in discussing the use of external measures as a means of statistical moderation of teacher based assessments stated:-

> The extent to which the components are measuring the same thing is indicated by the degree of correlation. What then is an acceptable level of correlation? There is not complete agreement among statisticians as to an acceptable value for the coefficient; a coefficient of +0.3 is sometimes accepted as the lower bound although there is no statistical basis for doing so. A coefficient of +0.6 is a much more acceptable figure, and it is not until the coefficient rises to +0.8 that doubts about the advisability of including both components arise although, again, there is no precise statistical basis for selecting this particular higher value (p.20).

The research problem in this particular case study then became:-

1. To what extent did the continuous assessment scores in integrated science correlate with externally set achievement scores?

Two sub-problems were also addressed, one of which related to the design of the study, and the other to the nature of the case. These were:-

2. To what extent did continuous assessment and achievement scores in integrated science correlate with scores on Raven's Standard Progressive Matrices (a non-verbal test of general intelligence, and
3. Whether there were any significant differences in the performances of boys and girls who made up the student population of the school chosen for the case study in any of the test instruments used?

1.3. **The Need for the Study**

In the context of the problem as stated above, a correlation study of pupils' scores achieved under continuous assessment and under the external examination offered an opportunity, indeed the first opportunity, to actually test whether the confidence shown by the originators of the National Policy in introducing so radical a concept as school-based continuous assessment was justified. A reasonable, positive correlation between school based continuous assessment scores and those obtained in the external examination, subject to the normal statistical confidence levels,would indicate satisfaction not only with the National Policy in its determination to 'liberalise assessment' through continuous assessment but also with the arrangements made for the implementation of the policy, in

particular with the system of data collection and administration of continuous assessment at the school level.

A further need for the study is to allay the fears expressed by some educationalists as to the viability of teacher based assessments as a measure of pupil performance. Manuwuike (1981) saw a danger of the new idea of continuous assessment being defeated by cynicism even before it had been introduced. Fagbamiye (1982) was pessimistic about implementation of the new National Policy on Education, noting the need to develop the necessary administrative and managerial skills for programme implementation. Olomolaiye (1982) noted the need to establish performance criteria in all subject areas and warned of the dangers he saw in administering a scheme of continuous assessment without due regard for the possibility of fraudulent practices. He highlighted the problems of record keeping and the security of such records. He was also one of few writers to mention the possible counter-productive effects of over testing students. Ogunseye (1979), as secretary to the Science Teachers Association of Nigeria, Teacher Education Panel Workshop on Guidlines for Continuous Assessment, noted in his report a number of factors militating against the successful implementation of continuous assessment in schools, among those he listed were (i) the laziness and lack of devotion of the majority of teachers, (ii) their ignorance, and that of their supervisors of continuous assessment and the techniques of continuous assessment, (iii) the increased cost of record keeping, (iv) the lack of a comprehensive record system and (v) the question of comparability of standards

The fears and reservations expressed by these authors could not be dismissed lightly since they were based on a thorough knowledge of the educational system by persons who were genuinely concerned for its future. Only by experiment could it be shown whether or not their fears had been justified, and whether or not it was possible to devise a continuous assessment system which embodied the necessary checks and procedures to minimise security defects, and yet remain simple enough to be operated by classroom teachers.

If the confidence of the originators of the National Policy on Education was shown to be justified, then this would confirm the shift in focus of evaluation away from the external examination boards and towards the schools, as profesionally based institutions capable of making valid and reliable assessments of the performance of their own pupils.

1.4. **Delimitation of the Study**

For this particular study, one school, the Demonstration Secondary School, Ahmadu Bello University, Zaria, and one subject, namely integrated science, was chosen for detailed analysis. Although the school was typical in its structure and organisation to other Junior Secondary Schools, it was in fact, the school in which the data collection scheme adopted by Kaduna State, Katsina State and later Borno State Ministries of Education, was developed. As such the staff had a greater familiarity with the data collection procedures than the staff of the average school. The science staff were all graduates with professional training, which again, may not be typical of the average Junior Secondary School and their experience in pupil assessment in science was considerable.

A further measure was incorporated to compare with the continuous assessments scores and the external examination scores. This was a non-verbal test of intelligence, Raven's Standard Progressive Matrices which has a long history of use, world wide, of almost 50 years. Since the continuous assessment scores were based on teacher made tests and evaluations of assignments, and the State examination was prepared without there being time for trials or standardisation procedures, the use of a firmly established standardised test as a reference measure was seen as method of relating a relatively small scale investigation to a much larger and more firmly established data base.

Although the study was concerned mainly with the Year Group admitted in September 1983, a similar series of correlations between continuous assesment scores, attainment test scores and standard progressive matrices scores was extracted from the two Year Groups behind the 1983 cohort, referred to as Years Two and One, thus laying the basis for a longitudinal study at a future date.

Given that the Demonstration Secondary School was a mixed school, the opportunity to compare the performance of boys and girls on the various test instruments used, was taken.

1.5. The Hypotheses

For the purposes of the experiment, a number of hypothese were formulated as follows. These hypotheses were tested for **each year group** taking the level of significance for rejection of the hypotheses as 0.05 :-

Continuous Assessment - Achievement Test

1.5.1 That there was no significant correlation between continuous assessment scores and achievement test scores for the entire Year Group.

1.5.2 That there was no significant correlation between continuous assessment scores and achievement test scores for boys in the Year Group.

1.5.3 That there was no significant correlation between continuous assessment scores and achievement test scores for girls in the Year Group

Continuous Assessment - Raven's Standard Progressive Matrices

1.5.4 That there was no significant correlation between continuous assessment scores and Raven's Standard Progressive Matrices scores for the entire Year Group.

1.5.5 That there was no significant correlation between continuous assessment scores and Raven's Standard Progressive Matrices scores for boys in the Year Group.

1.5.6 That there was no significant correlation between continuous assessment scores and Raven's Standard Progressive Matrices scores for girls in the Year Group.

CHAPTER 2

REVIEW OF RELATED LITERATURE

2.1 Introduction.

A researcher on continuous assessment writing in 1983 stated that "The research literature on this topic in Nigeria is scanty, if any." and he went on to give samples of opinions on the topic (Obe,1983:10). A similar picture was reported in Britain by Hoste and Bloomfield (1975), who mentioned that published writings on the subject "reveals a wide diversity of opinion and relatively little factual information."(p11) and "necessarily, much of this is opinion because facts are few and far between in this field"(p17) and later, "Much of what has been written about continuous assessment during the past few years has been part of an armchair debate about its advantages and disadvantages"(p27).

2.2 Some British Experiences.

Given that there is still little actual research into the area of continuous assessment, a review of literature becomes, for the most part, a survey of opinions. In Britain, however, from time to time experimental attempts at diversifying assessment procedures have been made, involving teacher based estimates of pupil performance, and some of these throw light on some aspects at least, of what has now come to be known as continuous assessment.

Chalmers and Stark (1968) described a successful scheme for the Scottish Higher National Certificate course in practical chemistry. Teachers were given wide scope to devise practical courses, based on the subject areas detailed by the examining body. Curriculum objectives were also specified e.g. the ability to work accurately, to calculate results correctly,

to use equipment effectively, to write clear, concise and accurate reports and to demonstrate an understanding of the principles involved. The assessment was based on these objectives, and marks were awarded according to a stated weighting for accuracy, calculation, methodology and comprehension. Each candidate had to complete a minimum of ten experiments covering the major areas of the syllabus.

Eggleston and Newbould (1969) and Eggleston and Lobel (1969) described experimental schemes for using continuous assessment in physics and history, respectively. In both of these experiments, abilities appropriate to each subject were listed and used as the basis for a number of assessments over a period of time. In comparing the teachers' asessments of their pupils and the results obtained in tests devised by the experimenters, in both cases, the teachers' results were 'substantially higher' than the test results and in both cases this was explained as teacher failure:-

> First....to isolate a particular demand .... when constructing 'test' situations.....; secondly insensitivity of the scale used or in its implementation; and thirdly, 'halo' effects in which, potentially, judgements in all three categories may be dominated by some irrelevant consideration (Eggleston and Lobel,1969:110).

Eggleston and Kelly (1970) later reported on the more successful continuous assessment of candidates' project work for the Nuffield A-level biology course. Projects were divided into eight specified stages, each of which was assessed by the candidate's teacher as it was completed. Five of the stages were assessed on a five point scale, ranging from "well above average" to "well below average" while three, regarded as less important were assessed on a three point scale. A complex system of moderation of the

school-based assessments was included in the system, involving both inspection by external moderators and common standardisation of scores from all the participating schools. Initially 358 students took part in 48 schools and the final conclusion of the investigators was that project work in biology could be assessed with adequate objectivity. The major problem of the system, however, was the increased work load, not only of the teachers who had to assess their pupils individually over the eight stages of their projects, but also the work generated by the moderation process.

A continuously assessed mathematics scheme for use in Secondary Modern Schools was described by Banks (1970). Children were assigned a set of twelve tasks presented on individual cards, to be completed over the period of a term. Banks' aim was to devise a system of assessment which eliminated the need for formal examinations completely. A review of the children's performance on the tasks was carried out at the end of the term and the results used for revision and evaluation purposes. The tasks were matched to the individual child's ability level and went up to the Certificate of Secondary Education (CSE) level. This was a major project involving sixteen schools and over 1,400 pupils and although in a survey, 95 per cent of the teachers involved agreed that it was as good as, or better than class teaching, the scheme did not become widely adopted. Again, additional work was entailed by individualising tuition and record keeping, though teachers noted increased motivation on the part of the pupils.

In reporting an experiment which had been carried out over six years, the British Joint Matriculation Board (1970) described a scheme which involved assessing the day-to-day work assignments in English Language for the General Certificate in Education (GCE) O-level, and presenting the

results in terms of a nine point grading system. The scheme included an elaborate system of moderation involving the collaboration of teachers from different schools. In this experiment, a rise in pass rate was observed in the schools which had used continuous assessment, compared with their previous results. Although not a controlled experiment, and although the increase in pass rate was described by Hewitt and Gordon (1965) as not statistically significant, Petch (1967) commented:-

> ....the principal results of the experiment have been the encouragement of wider reading and more opportunity to discuss what has been read, and freer and wider experiment in writing (p6).

Later, the Joint Matriculation Board (1970) stated:

> It is clear that the scheme enables the enthusiastic teacher to communicate his enthusiasm to his pupils and that the pupils respond better to this approach than to the requirements of a written paper. Teachers..... have commented on the high standard, especially at the pass level. The scheme seems to encourage the average or weak candidate to persevere throughout the year, to work at assignments in which he knows himself to be weak and thus to provide convincing evidence for an outside assessor that he deserves a pass. On the other hand, a good candidate may be adversely affected by the effort required to maintain a consistently high standard over the year (p13).

During the trial period of the Nuffield Secondary Science Project, a scheme described by Duffey (1972) was introduced, aimed at the continuous assessment of science objectives which went beyond the cognitive domain, into areas such as interest, imagination and attitudes. Duffey demonstrated that through the use of rating scales, continuous assessment based on such objectives was possible. A degree of objectivity was introduced into these assessments by defining the type of behaviour which pupils should exhibit to gain a particular grade in the non-cognitive fields. For example, to gain an A grade for the interest scale, a pupil needs to be:-

> Eager and curious - lively in discussion - quick to see connections - needs only a hint to get started - makes

> suggestions which show links with other fields of knowledge - shows occasionally originality or ingenuity (p23).At the other

end of the scale, a pupil could be awarded an E grade for having been:-

> not in the least interested - quite incurious and insensitive - utterly passive in his responses - takes little or no voluntary part in class discussions (p23).

The difficulty of maintaining objectivity, even with these guidelines was apparent, but the principle of describing behaviours as a basis for assessment was innovative.

Mathews and Reece (1975) as part of an experiment in the development of the Nuffield A-level chemistry course, incorporated continuous assessment as one of the assessment strategies for the practical aspects of the course. The results of teachers' assessments in practical work were then correlated with the scores students obtained in written papers covering the same course content. As in some of the examples mentioned above, the authors pointed out :-

> Of course, no curriculum and its attendant assessment can be completely free if it is subject to the normal requirements of public examinations. The fact that the work is internally assessed does not, in itself, bestow freedom on either students or teachers.....If comparability of work and effective curriculum evaluation is to be achieved a common structure is necessary, even if this structure has to be prescribed at a very general level.... the common element in the work has four dimensions: common areas of subject matter, common types of work, common objectives in terms of skills and abilities, and a common form of assessment (p15).

The authors continued, with what is seen as a seminal remark which gave emphasis to that element of professional judgement which is always at the heart of any educational venture:-

> The essential condition to permit both freedom to teachers and students and continuous evaluation is to pitch the description of those four dimensions at a level of generality as will allow sufficient common ground to make reporting meaningful and comparable, together with sufficient freedom to prevent teachers and students from feeling constrained (p15).

In fact, the instructions were seen as fairly prescriptive by teachers who adopted a uniform approach to assessment by following the suggested guidlines. The results showed, inter alia, correlations between continuously assessed practical work and written examinations of 0.52, 0.67 and 0.64 for the three years of the investigation (N= 733 for the third year, the numbers of candidates for the other two years were not quoted).

More recently, Sands (1981), described a scheme for continuous assessment of A-level practical Biology, which was introduced by the same Joint Matriculation Board, as a matter of necessity when the numbers of candidates (over 9,000) became too many to be accommodated by the earlier practice of a traditional, end-of-course practical examination. Once again, the introduction of this scheme was accompanied by a comprehensive system of moderation both by inspection and statistical methods. It is of significance, however, that at this time sufficient confidence was felt to exist in a continuous assessment approach to the problem that little in the way of experimentation was felt necessary although induction of teachers into the system was thoroughly done.

Science educators in particular have come to recognise the value of continuous assessment in so far as the assessment of practical work in science is concerned. Research here seemed to indicate that a continuously assessed practical course gave results which correlated more highly with the theory examination of the same course than did the 'traditional', 'one shot', final practical examination. Kempa (1986) in discussing these findings stated:-

> The major point of criticism is implied in the question of whether any significant relationship can be assumed to exist between students' practical abilities and their theoretical knowledge, even if this relates to practical situations. From a

> strictly theoretical point of view, there does not seem to be any *a priori* justification for this assumption. However, it must be remembered that 'practical abilities', as defined in the context of teacher assessment [of pupils], go beyond purely manipulative and observational skills and also encompass facets having a strong theoretical bias, viz. interpretation and planning abilities (p88).

He continued by quoting the results of Futcher (1973) which gave correlations of 0.59 between teacher-based assessments of practical work in A-level Chemistry and the theory examination, while the correlation between the 'traditional', end-of-course, practical examination and that of the theory examination was 0.33.

Most of the experiments mentioned above were precursors of what eventually emerged as the greatest example of the use of continuous assessment in the British educational system, involving hundreds of teachers and thousands of pupils every year, that was the Certificate of Secondary Education examination system, Mode III. The CSE examination, as it was known when it was introduced in 1963, was devised as a school leaving examination for those pupils, the large majority (in fact about 60 percent of the total secondary school population), who were not entered for the General Certificate of Education O-level examinations on completion of the compulsory five year secondary school programme.

Kempa (1986) described the CSE examination as follows :-

> Like GCE O-level examinations, CSE examinations are aimed primarily at the 16+ age group, although they cater for a lower ability group (30th to 60th percentile and beyond). They to are subject based but, unlike the former, are conducted and administered by regional examination boards, which are controlled by teachers and not the university sector.....It provided teachers with far more autonomy in the sphere of syllabus and examination design than had ever been the case before, albeit in relation to pupils of lower ability than those proceeding to O-level examinations.
>
> The fact that the top grade of the CSE became officially recognised as being equivalent to a GCE O-level pass grade

> contributed significantly to the status of the new examination (p3).

The CSE allowed for a measure of flexibility in the assessment of pupils and the Mode III form permitted schools to devise their own syllabuses and assessment systems, subject to approval by the appropriate examining board. Within the Mode III arrangements, continuous assessment could be included as part of the assessment package adopted by a school and , according to Hoste and Bloomfield (1975) , by 1972 an increasing number of continuous assessment schemes were in operation. An example of how an examining board allowed for continuous assessment may be gauged from the following extract from the regulations of the West Yorkshire and Lindsey Regional Examining Board, Sheffield (1971):-

> In reaching their initial assessment schools may base their judgement:
> 1 purely on the results of examinations set and marked internally;
> 2 partly on the results of internal examinations and partly on other evidence (course-work,project-work,etc.);
> 3 solely on the standard of work and achievement shown by candidates over a reasonable period of time.
> Assessment: *there are two kinds of assessment*- assessment pure and simple and continuous assessment (p.1).

Although the above extract may appear to imply a tremendous latitude in the area of assessment, the examining boards maintained control by, in addition, describing :-

1. Moderation procedures
2. Course objectives
3. Criteria for assessment
4. Assessment techniques, and guidance as to their use.

With the emergence and growth of a dual system of evaluation in the CSE Mode III option, the Schools Council, a body established at that time to

overview the educational system in England and Wales, commisioned the National Foundation for Educational Research in England and Wales to undertake an investigation into the question of comparability of standards under the two systems. This investigation reviewed the position as at 1972 and undertook an experiment involving over 4,000 boys and girls who were candidates of the West Yorkshire and Lindsey Regional Examining Board.

The basic thrust of the investigation, reported by Hoste and Bloomfield (1975), involved testing all the pupils in the sample with a test of general scholastic ability, called Test 100, and then comparing the correlations between the Test 100 scores and those awarded in different subjects by the two methods of evaluation i.e. written examinations and continuous assessment. The subjects covered by the investigation were English, History, Geography, Technical Drawing, Biology, Chemistry, Physics and Mathematics. The conclusion reached after a detailed analysis of the results was that:-

> There was no evidence that standards were different for candidates awarded grades by continuous assessment and by examination in any of the subjects studied (p113).

The study also indicated that the girls in the sample performed significantly better than the boys, in continuous assessment.

In the summary to the report of this experiment, the authors stated:-

> Continuous assessment gives scope to the teacher to make use of a wide variety of assessment procedures appropriate to the subject. General course-work, practical, oral, project-and field-work can all have their place in a continuous assessment scheme. Marks (or grades) may be awarded to work which arises directly out of the process of learning and is the product of experience (learning experience assessment) or to the result of a special separate exercise, set to test what learning has taken place (special assessment). The special exercise may take the form of written, practical or oral tests. In the opinion of the teachers involved in continuous assessment, the choice is open to the teacher to suit his assessment procedure to a particular course and to the pupil, and this is seen as an advantage which leads to

> increased motivation on the part of the pupil and a more valid assessment which reflects the pupil's true ability (p11).

This statement appears to parallel, expand upon and illustrate the concept of "liberalisation of assessment" as mentioned in the Nigerian National Policy on Education (1981). While noting the difficulties which may be experienced by pupils who were transferred from one school to another, and the special needs of private candidates to whom continuous assessment could clearly not apply, the authors also mentioned other comments against continuous assessment, which could only be answered by investigation, namely that it was "....seen as cumbersome and open to abuse by staff and pupils" (p38). In the event, in so far as the scheme investigated by them was concerned, these fears were not substantiated.

Some common characteristics of the continuous assessment experiments and schemes reviewed above may be described as follows:-

1. There was always specification of the assessment objectives in the light of the subject course objectives,
2. Guidance was given to teachers on assessment procedures, though this was not intended to be prescriptive,
3. Assistance was given to teachers in the form of both descriptions of what was intended to take place and in the provision of data collection forms to provide a degree of consistency,
4. Moderation, in any scheme involving inter-school comparability, was always emphasised as an essential part of a continuous assessment exercise, and
5. It was generally felt that the educational gains to be derived from a continuous assessment system outweighed the administrative burden which it very obviously entailed.

Renewed interest in continuous assessment has been shown in Britain following the scrapping of the dual examination system of GCE and CSE, and its replacement by a unified examination system, referred to as the General Certificate of Secondary Education (GCSE). The new examination featured continuous assessment in all subjects and much of the debate on this topic has centred round the issue of moderation (vide Bennetts et al 1986, and Fairbrother, 1987,). In a survey of the policies of different Examining Groups, Bennetts, Fairbrother and Willmott (1987) showed that in the case of science subjects, including Agriculture, Technology and Electronics in addition to the 'traditional' sciences, five of the six Examining Groups were proposing direct inspection of pupils work and teachers grades in addition to the statistical treatment of results, as the basis for their moderation efforts. The feasibility of direct inspection by an external assessor has, however, already been questioned by Fairbrother (1987):-

> ...a number of us asked questions about these Assessors - who were they to be - from where were they to be recruited etc.? We received no answers ! (p12)

Both the tone and content of the above extract indicated the emotions and the technical difficulties involved in the introduction of continuous assessment on a nation-wide basis, as opposed to relatively small scale investigations and practice by enthusiasts of educational innovation.

2.3 Some Nigerian Experiences.

One of the first complainants of the ineffectiveness and stifling nature of the Nigerian examination system was an American educator, Wendel (1970). In a short article, composed of opinion and anecdote without a single reference or attribution, he complained of the "impossible communication gap" between himself and his "British trained" Nigerian colleagues whenever he suggested that a review of the examinations system

could assist students to learn material more easily and with greater understanding. In fact, he stated that "many seemed threatened" by the proposal. In comparing what he called the single examination system with his proposal for a multiple examination system, he, in effect, described the educational gains which could accrue from a system of continuous assessment as compared with the negative effects, as he perceived them of the system then in use, which was the West African School Certificate Examination. He stated:-

> It may be that the single examination system actually discourages learning.....As the single examination system now exists it effectively discourages creativity in students, teachers and examiners (p120).

Arguing in favour of the multiple examination system he described testing during the year, for each year of the course, proposing a minimum of two assessments per term which could take any form in consonance with the subject matter and student capabilities. He saw these tests as acting as a stimulus to learning on the part of the student and providing both student and teacher with information as to the effectivenes of the teaching/learning situation so that both could take corrective action if necessary. He proposed that the marks should be averaged into the final grades awarded by the end of course examination, proposing a 40:60 weighting (as later prescribed for the Senior Secondary School Certificate). He also proposed a system of moderation of the multiple examinations, as he called them. This was an amazingly predictive paper in many respects, although at the time it was written, continuous assessment was already flourishing in Nigeria, albeit at the tertiary level in the Nigeria Certificate in Education programmes established in 1962, and in several university courses.

Obe (1983), in the introduction to his survey of teacher opinions on continuous assessment quotes from a number of newspaper articles of the early 1980s, when the National Policy of Education had ceased to be the concern of professional educators and had become a matter for public, political debate. Not surprisingly, continuous assessment, as the most revolutionary aspect of the policy attracted a great deal of attention. The Daily Sketch of 26 October 1981, quoted unnamed Ondo State Education Officers under the headline "New Policy: means to curb examination leakage" as saying that they saw continuous assessment as a means for a solution to the examination leakage problem and they proposed the formation of a special unit within the Ministry of Education aimed at training teachers in continuous assessment. Ekefre (1981), writing in the Daily Times of 29 October, quoted the Conference of Secondary School Principals in Bauchi as being strongly in favour of continuous assessment. He expressed the view that continuous assessment could be most objective, valid and reliable and play an important role in certification of students. Ogwe (1981), writing in The Daily Times of 9 July, under the heading "Exam Malpractices: Nigeria's festering sore", saw continuous assessment as the answer to "over emphasis on dubious paper qualifications". Also on certification, Olaniyan and Majasan (1981) quoted in the Daily Times of 25 December, as part of a communique of the Nigerian National Committee of the West African Examinations Council, saw continuous assessment as a means of coping with the "astronomical increase in students being examined". They predicted a shift away from the predominantly essay type questions to multiple choice questions, supplemented by the proposed continuous assessment system.

Not all the commentators were favourably disposed to continuous assessment. Ogan (1981) under the headline "Bailing WAEC out of the deeps",

published in the Daily Times of 24 November, noted that with staff pupil ratios of 1:70 in our primary schools, under these conditions continuous assessment was "totally unrealistic". Cookey (1981) took a similar gloomy view with the remark credited to him in the Daily Times of 7 December, that with 80 percent of teachers in Primary schools in Nigeria unqualified for the job, ...there may be hitches in the National Policy on Education. Akinjobi (1982) quoted in the Sunday Times of 17 January, referred to "some new fangled thing called continuous assessment, and wondered if anyone would really say that an 'A' grade in one school would be the same 'A' grade in another under the continuous assessment system."

The above quotations place Obe's (1983) scholarly survey of teacher opinion in Lagos State in the perspective of what had become a national debate on the National Policy on Education and the role of continuous assessment. Taking a random sample of 95 teachers he administered a rigourously prepared 26 item attitude questionaire which yielded the results that teachers welcomed the opportunity of involvement in pupil assessment, and saw continuous assessment as a means of reducing examination malpractices and reducing the failure rate in schools. On the negative side the survey showed teachers to be worried by the extra work load involved, varying school to school standard, careless approach to record keeping, and lack of skill in test development. They discounted the potential for student victimisation which, it had been suggested, could mar continuous assessment, neither did they feel that the work load would result in teachers becoming ill through over-work. At the time of both the public debate in the press and the above quoted survey, continuous assessment had not actually been introduced into schools.

An evidence of the seriousness with which the Federal Government viewed continuous assessment and its introduction into schools, was the publication in 1980 of a book, "A Handbook of Continuous Assessment" by the Educational Evaluation Unit of the Federal Ministry of Education. In addition, a series of workshops on continuous assessment were organised throughout Nigeria in 1982 to ensure that officials of state governments, including inspectors of education and school principals were aware of the implications of the proposed continuous assessment scheme at all levels of the educational system.

Other publications on the subject of continuous assessment followed, notably Ezewu and Okoye (1981), Ipaye (1982), Turton (1983) and Carew, Banu and Tukur (1985). Each made its contribution to the propogation of the concept of continuous assessment and each had its differing emphasis according to the authors' predelictions, with regard to theory and practice.

By 1983, the tide had started to turn in favour of continuous assessment. Ohuche and Ike (1983) noted that:-

> [at that time] Assessment is divorced from instruction. Continuous assessment is designed to remedy this fault. It is meant to assist the student, the teacher and the parent in diagnosing, planning for and promoting student progress.....continuous assessment by its systematic, comprehensive, cumulative and diagnostic nature has several benefits but it is only through proper understanding, planning, development and correct usage of measuring instruments that these fruits can be reaped (p266).

The authors also noted a need for "pooled standardised achievement tests" and nominated the Federal Ministry of Education as the base for such pooling. The problem of record keeping was mentioned but the authors were still thinking in terms of weekly tests and the cumbersome reporting system recommended in the "Handbook for Continuous Assessment"(1980).

Noting also the problem of inter-school comparability, they appeared to suggest that the use of standardised scores would solve this problem. More cogently, however, they proposed that:-

> At the pre-service level, teacher education should ensure that continuous assessment is not only taught as an aspect of educational measurement but that certain important sections of the course should be emphasised through compulsory assignments (p274).

Turton (1983) also commented:-

> At present the initial training of teachers at Grade II, NCE and even Graduate level suffers from a lack of emphasis on assessment in general and continuous assessment in particular. State Ministries of Education, through their representatives on the various Boards of Governors of Institutes of Education, Training Colleges and Universities need to take up this point to ensure that new teachers coming into the service are properly prepared for the task ahead of them.(p58)

A brief description of Turton's (1983) scheme of continuous assessment is appropriate at this point since it is the one most relevant to this study. Starting from the characteristics of continuous assessment stated in the "Handbook of Continuous Assessment i.e. that it should be Systematic, Comprehensive, Cumulative and Guidance Oreientated, the author developed five other characteristics which a scheme intended for implementation in a school setting should have. These were Simplicity, Comprehensibility, Security, Validity and Integrity. By developing these sub-characteristics, a workable scheme was devised and tested in the Demonstration Secondary School, Ahmadu Bello University, Zaria. Suitable forms were designed for data collection, and , more importantly from the author's point of view, organisational structures within the school were created to make the scheme 'self-supporting'. Alone among the authors of books on continuous assessment mentioned above, Turton rejected the idea of statistical treatment of raw scores at the school level (except in one particular circumstance), seeing

it as a major obstacle to rapid and easy implementation of the practice of continuous assessment, and yet this aspect had been the one most emphasised both by the workshops organised by the Federal Ministry of Education and by some authors to the extent that, to quote Turton (1985):-

> The impression created by some of these courses is that transformation of scores (to a mean of 50 and standard deviation of 10), is a *sine qua non* of continuous assessment, which is patently not the case.....the example of the Nigeria Certificate in Education programme, which has been running since 1962 with a continuous assessment element and a final result which is the simple accumulation of three years' raw scores, is there.... Most university courses incorporate continuous assessment but how many take the trouble to transform scores to ensure accurate weighting of the component parts? There are, in fact, strong reasons why transformation is not used. Basically a system which allows for the statistical manipulation of scores is incompatible with a system which relies on absolute scores as measures of pass or fail, distinction or credit and so on. Both the NCE programme and the Junior Secondary School final result have a pass mark of 40 and a distinction mark set at 70. In each case transformation of scores to a mean of 50 and a standard deviation of 10 would result in a 15% failure rate and only a little over 2% of candidates with distinction grades,regardless of their actual performance, assuming a normal distribution of scores (p10).

In the same paper, Turton (1985) showed from an analyis of pupils scores in four subjects, Integrated Science, Social Studies, Mathematics and English, in Forms I and II (N = 200 in each), for three terms, that little or no difference resulted from the addition of raw scores or scores after standardisation, having obtained correlations greater than 0.99 in every case. In explaining this result, the author concluded that text book examples showing the need for such practices assumed wild variations in performance on the part of the pupils which, in practice, did not occur, in a given subject area. The practice of adding scores from different subject areas was rejected outright by the author as having no educational or any other value.

More recent writings on continuous assessment have shown that although there were still implementational problems, the basic concept was accepted and seen as desirable. Etim (1986), in a survey conducted among a self selected sample of teachers (N = 69), principals (N = 33) and inspectors of schools (N = 20), all of whom were Long Vacation Course students at the University of Jos, showed that over 80 percent of them wanted continuous assessment to continue into the Senior Secondary School, an even higher percentage saw the need, however, for the continued training of teachers in continuous assessment. Only a negligible percentage thought that continuous assessment would lead to a lowering of standards and it was only on the question of whether or not favouritism was a factor militating against continuous assessment that anything resembling non-unannimity was evidenced, here about 45 percent thought that this could be possible. Given that these respondents must have had some experience of continuous assessment in practice, their views can be taken more seriously than, perhaps, Obe's (1983) sample, although as volunteer post-graduate students they are not so representative a group as Obe's sample.

Macauley (1986) rehearsed many of the old arguments on the implementation of continuous assessment mentioning, insufficient understanding on the part of teachers of the processes and instruments of assessment and their objection to the extra work involved. Her novel contribution was, however, the comment that the lack of availability of computers to handle the enormous quantities of data being generated was a handicap. Her statement that :-

> Though the process of continuous assessment is now built into the school programmes and schemes of work, far too much is being taken for granted where the teacher is concerned (p38).

appeared to summarise many of the recent views, and she too emphasised the need for in-service training as well as pre-service,

Anukam (1986) was more forthright in his view of the shortcomings of teachers and stated:-

> More than 80% of Nigerian teachers are scared by the notion of continuous assessment. It is considered as time consuming and tedious. Besides, 75% of them do not know how to appropriately test major domains of measurable behaviour (p96).

Though he did not mention the grounds for his quantification, he went on to emphasise the need for training, workshops and in-service courses "which are currently sparsely and haphazardly organised" (p96).

Ajayi (1986) posed questions relating to the implementation of the National Policy on Education and asked, with regard to continuous assessment:-

> How do we ensure uniformity and comparability in standards especially with the introduction of the continuous assessment system ? As a corollary, what efforts are we making to train teachers in the aspects of the continuous assessment system ? (p106)

From the above brief review it was evident that a shift in attitudes towards the acceptance of continuous assessment had taken place and the questions of implementation and teacher training had replaced the earlier suspicions. Hard data on the reliability of continuous assessment results had not been reported, however, the address of the Commissioner for Education, Cross River State, Obong E. Eno Udofia (1986) to the 50th plenary session of the Joint Consulative Committee on Education (JCC) at Calabar on 8 September 1986, reported in the Guardian newspaper of 11 September, hinted at "discrepancies" in the continuous assessment results from some schools. He too emphasised the need for training teachers in the processes

of continuous assessment, and stated that "only very few teachers are familiar with.....the skills required for the conversion exercise". The conversion referred to was the transformation of raw scores to standardised scores, a practice which Turton (1985:10) had described as needless in the light of his findings.

The review of literature, showed, in fact, that the comment of Obe (1983), quoted in the introduction to this Chapter, to the effect that research literature on the topic of continuous assessment in Nigeria was scanty, was justified. This was, perhaps not surprising given that the Junior Secondary programme was of three years duration and that for a valid and fair test, scores should be allowed to accumulate over the whole of the three year period before a quantified estimate of the efficacy of continuous assessment could be made.

It was to fill this gap in the literature of continuous assessment in Nigeria that the present study was designed and executed.

CHAPTER 3

DESIGN AND PROCEDURE

3.1 The Plan

The experiment was intended as a case study of continuous assessment working in a Junior Secondary school, with reference to a particular subject, Integrated Science and a particular scheme of continuous assessment known as the Northern Nigeria Publishing Company (NNPC) Continuous Assessment System. This system of continuous assessment had been adopted throughout Kaduna State of Nigeria, in which the school chosen, the Demonstration Secondary School, Ahmadu Bello University, Zaria, was located.

The thrust of the experiment was to investigate the significance of continuous assessment at the three stages of the Junior Secondary School course, Years I, II and III, on the basis of a simple Pearson Product-Moment correlation between pupils' continuous assessment scores for each year and their scores on an end of year achievement test.

As a refinement of this procedure, and using an idea suggested by the work of Hoste and Bloomfield (1975), a test of general intelligence was included in the investigation, in this case, Raven's Standard Progressive Matrices. This was a well established, non-verbal intelligence test, usually regarded as being free from cultural and linguistic bias. Nwana (1975) wrote:-

> Culture-free tests are intelligence tests in which the items are non-cultural, that is, devoid of any cultural elements and meanings. They are non-verbal and non-numerical in nature, consisting of tasks in which testees are required to reason in abstract situations. A good example of this type, which has been used successfully by a number of scholars in West Africa is the Raven's Progressive Matrices Test (p180).

The Test 100, used by Hoste and Bloomfield (1975) in their experiment was not considered suitable for use in this case since it was a test specifically designed to measure the general scholastic aptitude of British school children(Nuttall,1971; Forrest,1971; Forrest and Smith, 1972).

Although this case study had similar elements with the Hoste and Bloomfield (1975) experiment i.e. the intelligence test, achievement test scores and continuous assessment scores, and used a correlation process for analysis; there were important methodological differences.

In the Hoste and Bloomfield (1975) experiment, there were basically two different groups of pupils, those who were assessed by continuous assessment only and those who were assessed by the end-of-course examination only. These two groups were linked through the common Test 100 and comparisons were made on the basis of correlations between grades (not scores) awarded to one group under continuous assessment and the grades predicted by Test 100, and for the other group the correlations between grades awarded by the end of course examination and those predicted by Test 100. The arrangement was as represented diagramatically below (Fig 3.1):-

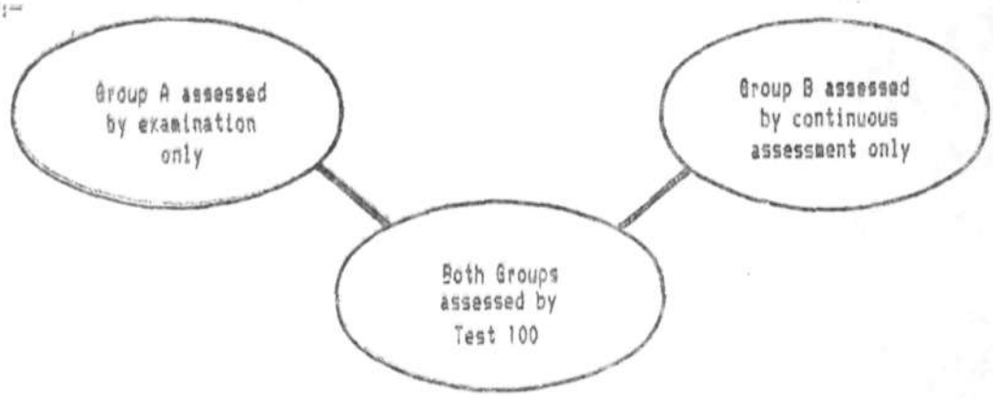


Fig 3.1 Diagramatic Representation of the Hoste and Bloomfield (1975) Experimental Design.

In the case study at the Demonstration Secondary School, Ahmadu Bello University, Zaria, it was the same pupils who were tested by two different means, by continuous assessment and achievement test. The experimental design of this study is represented diagramatically as shown below (Fig 3.2):-

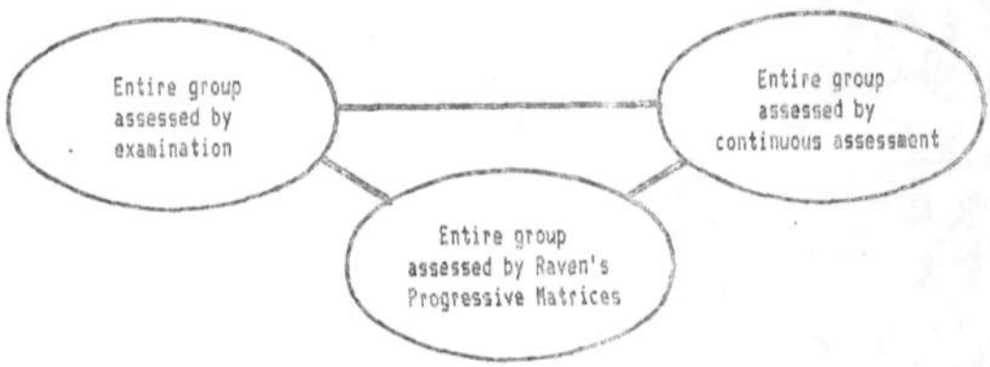


Fig 3.2 Diagramatic Representation of the Case Study at the Demonstration Secondary School, Ahmadu Bello University, Zaria.

A triangular pattern emerged in which the role of the intelligence test was to link the continuous assessment-achievement test relationship to a long established and well researched external measure, so that what was essentially a case study could be related to a wider context.

Each of the three year groups (i.e. Forms or cohorts) in the school under study were assessed under three areas:-

1. Achievement test in Integrated Science,
2. Continuous assessment in Integrated Science, and
3. Raven's Standard Progressive Matrices.

A correlation matrix was derived for each year group in the above areas so that the level of relationship, if any, could be established, for the entire year group and for boys and girls separately.

In addition, the mean scores of boys and girls on each of the three assessment measures were compared, for each of the year groups, in order to establish whether any significant differences existed.

3.2. The School

The Demonstration Secondary School, Ahmadu Bello University, Zaria, had opened in 1982 with six staff members and 72 students for the 1981/82 session. This first batch of students followed the five year O-level course of the West African Examinations Council. However, the second intake into the school started to follow the National Policy on Education (1981) in terms of curriculum, with the accompanying emphasis on continuous assessement and the splitting of the secondary school course into two parts of three years each, junior and senior secondary school. The pupil population of the school was largely drawn from the University community although a percentage of places was allocated annually for children of non-university staff (five per cent). The school was established with the approval of the Kaduna State Ministry of Education and a further percentage of places in the school (10 per cent) was allocated to Kaduna State indigenes. It was a fee paying school, and parents were also responsible for the provision of books and uniforms for their children.

Admission to the school was by entrance examination and interview. As vacancies occurred following pupils leaving the school for one reason or another, these were filled by transfer of pupils from other schools. Class sizes were of the order of 40 pupils per class.

The stated emphasis of the school was in the area of science and mathematics and it was expected to achieve this emphasis through allocation of adequate periods of instruction to these subjects and through the provision of well qualified staff and the appropriate level of equipment and facilities. Three of the original six staff members were graduate science teachers, and they were soon followed by two graduate teachers of mathematics.

In terms of staff, at least, at the time of this investigation there were experienced teachers handling the teaching of integrated science including some holders of the Nigeria Certificate in Education in science subjects. Laboratory facilities were, however, limited and much of the instruction was taking place in classrooms rather than in one of the two laboratories. Science equipment was not plentiful although there was evidence of an inventive approach to the improvisation of equipment and to the use of classrooms as teaching bases for integrated science.

The Year Three pupils whose performance was investigated in this study were the second group of students to follow the junior secondary system as advocated by the National Policy on Education (1981) and the system of continuous assessment and record keeping was firmly established by this time. It was in this school that the testing and development of the continuous assessment system adopted by the Ministries of Education of Kaduna, Katsina and Borno States took place so there was a high degree of familiarity with the system on the part of staff, parents and pupils.

At the time of this investigation, the senior secondary section of the school had already started, so the study became that of the junior secondary section of the school, taking in Years One, Two and Three.

Those characteristics of the school which could be considered atypical of the average junior secondary school in Kaduna state could perhaps be the relatively good command of English of the pupils and the high level of training and experience of the science staff teaching integrated science.The results obtained by the Year Three pupils in Mathematics, Integrated Science, English and Social Studies in the Kaduna State Junior Secondary Examination showed above average performances in these areas, as tabulated in Table 3.1 below.

Each of the three Year Groups making up the junior secondary section of the school was under the administrative control of a Year Group Tutor who was also responsible for ensuring that the continuous assessment records were properly kept and compiled on an annual basis.

3.3 The Instruments.

Three types of instruments were used to measure pupil characteristics; achievement tests, continuous assessment and Raven's Standard Progressive Matrices.

3.3.1 The Achievement Tests

Three different achievement tests were used for each of the three year groups which comprised the Junior Secondary School as follows:-

1. **The Year One Test.**

For the Year One achievement test, use was made of a test developed

for use with Year One of Junior Secondary Schools by Abua et al(1984). This was a 50 question test which had been carefully developed and tested as part of a project in test design. It was non-homogeneous in so far as the design of the actual test items were concerned. These consisted of

(i) Supply type

(ia) Long response

(ib) Short response

(ii) Selection type

(iia) True/False or Yes/ No

(iib) Direct answer - multiple choice

(iic) Incomplete statement - multiple choice

(iid) Matching

(iii) Activity based.

The most significant feature of the test was its attempt to involve the measurement of science process skills through the final category of questions mentioned above. In the absence of an actual test of process skills through observable practical testing, an attempt to estimate pupils knowledge of such skills through a pencil and paper test was felt to be better than ignoring them completely.

The test items were developed by Abua and 18 other students who formed sub-committees to design items to test the following learning outcomes, based on the Year One work as contained in the Nigerian Integrated Science Project Book 1.

(a) Recall of information

(b) Comprehension of facts

(c) Application of knowledge

(d) Basic science process skills.

Items designed by the sub-committees were scrutinised by the whole group and unsuitable items rejected. This process was conducted under the supervison of an experienced science educator, and by this means the content validity of the test was ensured.

An analyis of the test showed the following distribution of items between the various areas assessed :-

	Number of Items	Weighting	Percentage
Recall	21	35	32
Comprehension	7	28	25
Application	8	31	28
Process skills	14	16	15
Totals	50	110	100

Later applications of the test to actual classroom situations in 10 secondary schools showed the test to have a reasonable reliability. This was deduced from the fact that testing 687 pupils in 10 schools gave results in respect of the four course objectives tested which were very nearly normal in their distribution about the mean score,i.e. the mean, median and modal scores were almost the same (Abua et al, 1984:70).

In using the test at the Demonstration Secondary School, the reliability of the test was established using the test-retest procedure in the light of Guilford's (1965) comment "The only meaningful estimate of reliability for a heterogeneous test is of the retest variety" (p450).
Two months after the test had been originally administered to the whole of Year One, it was re-administered to a sample (N=30) out of the original population of 138 students i.e. 21.7 percent. The test-retest correlation for

this sample was found to be 0.90, indicating a satisfactory level of reliability. Downie and Heath (1974) wrote:-

> In general, reliability coefficients of well-made standardised tests tend to be high, 0.9 or above. There is no hard and fast rule that says that any reliability has to be of a certain size before any test or measuring instrument can be useful. Today we look upon reliability as a relative thing,.. (.p240).

2. **The Year Two Test**

This test was modelled on the Year One test as designed by Abua et al. In particular the test attempted to measure the four areas of recall, comprehension, application and science process skills using Book 2 of the Nigerian Integrated Science Project as the source of topics for item design. The test was submitted to three experienced science educators for comment before administration with a view to confirming its content validity and the few ammendments pointed out were incorporated into the test. Pre-testing was not carried out. An analysis of the test showed the following distribution of test items over the four behavioural areas :-

	Number of items	Weighting	Percentage
Recall	21	28	21
Comprehension	7	28	21
Application	10	57	42
Process skills	6	22	16
Totals	44	135	100

As another heterogeneous test, the reliability was assessed by administering the test a second time to a sample (N=34) of the original population of 160 students i.e. 21.3 percent. The test-retest correlation for this sample was found to be 0.81, indicating a satisfactory level of reliability.

3. **The Year Three Test.**

This was the test specially designed for the Junior Secondary Schools of Kaduna State by the State Ministry of Education. It comprised an 80 item multiple choice paper, each item having five options. The paper had been prepared by the Board of Studies for Integrated Science established under the aegis of the Educational Resource Centre (ERC), of the Ministry of Education, Kaduna State, Zaria. The Board consisted of the science inspectors, science staff of the ERC, and science teachers from participating schools. No pre-testing of the items had been carried out, but they were selected from a pool of questions submitted by teachers with a view to giving adequate coverage of the Year Three course content. The content validity of the test was thus assured. An analysis of the test showed a distribution of test items with regard to Recall, Comprehensionand Application as:-

	Number of items	Percentage
Recall	29	36
Comprehension	28	35
Application	23	29
Totals	80	100

No attempt was made at assessing higher objectives, such as synthesis or evaluation. No practical test was included and no attempt was made at assessing practical skills through written questions aimed at this area, unlike the tests used for Years One and Two. The test was, however, homogeneous in so far as the distribution of items reflected the actual weightings given i.e. each item was counted equal and earned 1 mark.

With the consent of the Director of the ERC, Zaria, access was allowed to the scripts completed by the Demonstration Secondary School Year Three pupils, thus enabling a split-half correlation analysis to be carried out on odd and even items for all the scripts. This yielded a correlation coefficient of 0.75, which, after the application of the Spearman-Brown correction for half test to full test as described by Guilford (1965:457), gave a reliability coefficient of 0.85 for the test as a whole. This was regarded as a satisfactory level of reliabilty.

The split-half correlation analysis was used with the Year Three test mainly because the interval between the test being taken as part of the Kaduna State Junior Secondary School Leaving Examinations and the resumption of the pupils in the senior secondary section of the school and the commencement of testing for this experiment was about seven months. Advantage was taken of the fact that the test was homogeneous, so that the split-half correlation technique was appropriate.

3.3.2 **The Continuous Assessment System**

In this experiment, continuous assessment was the variable under investigation. The National Policy on Education (1981) had insisted upon its introduction into the educational system at all levels, and in the particular school under investigation, a system of continuous assessment had been devised involving professional and administrative supervision of the process of evaluation and data collection.

The major characteristics of the scheme were as follows:-

1. The Subject Head of a particular subject discussed and agreed with his staff members at the beginning of the term, the course

content and the assessment pattern to be followed in each year of the course. This was to be a common pattern where two or more arms of the Year Group existed. For each term there would be three assessments recorded for each pupil, one of which would be the end-of-term test, and the other two could take any form as agreed between the teachers and the Subject Head. They could be pencil and paper tests, oral tests , homework assignments, practical tests a combination of these or any agreed form so long as they were common to all arms of the Year Group.

2. During the term, the progress of the teaching would be reviewed by the Subject Head and teachers, and modified where necessary. A common end-of-term test would be drawn up.

3. At the end of the term, after the end of term tests, the results of each arm of a Year Group taking a particular subject would be submitted to the Subject Head on a specially designed form, designated Form CA1 (A). On this form the three assessments weighted out of 25, 25 and 50 respectively would be summed and the total represented the individual pupils total for that term in that subject. This was the total reported to parents in the termly report card together with a letter grade representing the pupil's group-rank order in the entire Year Group. Ten percent of this termly score was carried forward onto the Annual Summary Sheet, designated Form CA2(A), as that term's contribution to the continuous assessment total.

4. By the end of the year, three such contributions would have accumulated onto the Annual Summary Sheet. These scores were then summed directly yielding a total score out of 30 for the year.

5. A system of weighting for the three years of the junior secondary

continuous assessment programme was agreed upon nationally, through the Joint Consultative Committee on Education (JCC) and the National Council for Education (NCE). This prescribed weighting places the Year One total out of 10, the Year Two total out of 20 and the Year Three total out of 30. The sum for the three years of the programme was therefore a total of 60.

6. In the system under examination at the Demonstration Secondary School, these weightings were achieved by

1. For Year One, dividing the annual total by 3.
2. For Year Two, dividing the annual total by 3 and multiplying 2.
3. For Year Three, the score already had the correct weighting.

7. The weighted scores were carried forward onto the Cumulative Record Sheet (Transcript) designated Form CA3(A) each year so that by the end of the course, the total on this sheet represented the pupils total continuous assessment score for the whole course.

8. Under this system, the termly summaries, Forms CA1(A) were kept by the Subject Head. The Annual Summary Sheets, Forms CA2(A) were kept by the Year Group Tutors and the Cumulative Record Sheets (Transcript), Forms CA3(A) were kept by the Principal or school central administration.

9. Overall control of the continuous assessment system was maintained by the continuous assessment committee under the chairmanship of the Principal of the school.

10. A feature of the continuous assessment scheme used was that teachers did not have to produce standardised scores or use statistical processes other than the simple addition of raw scores.

Provision was made in the system for external moderation of continuous assessment scores but this was not employed during the experiment.

To determine the performance of pupils in the period under investigation, access was allowed by the Principal of the Demonstration Secondary School, Ahmadu Bello University, Zaria, to the Cumulative Record Sheets in respect of Years Two and Three, and to the Annual Summary Sheets for Year One.

For the purposes of data analysis, the Year One scores were represented as scores out of 100. The Year Two scores were represented as scores out of 300 made up of the sum of the Year One and Year Two weighted totals. These larger scores rather than the actual totals were used so as to simplify calculation and data entry by eliminating the decimal point. This practice did not, of course, affect the value of the correlation coefficients calculated. The Year Three scores were represented as scores out of 60, which was the actual total, and was used as such.

Access to a few termly and mid-term tests for the period in question showed that generally careful and well presented tests had been used.(Ref Appendix XI)It was noted that practical tests featured for each Year Group, usually each term. The content validity of the tests seen was satisfactory. There was, however, no way of ascertaining at that point in time the reliability of the tests used. One of the purposes of the experiment was to shed light on this aspect of the continuous assessment system used, through the correlation study.

3.3.3 **Raven's Standard Progressive Matrices**

The same version of this test was administerd to each of the three Year Groups. The test consisted of booklets of test items, 60 items per booklet divided into five "sets" A,B,C,D and E of twelve items each. Each item consisted of an abstract diagram in the form of a pattern with one piece missing. Each item occupied one page of the booklet. The testee had to select the correct missing piece from a set of six or eight samples given below the diagram. Each sample was numbered and the testee recorded his response by writing the number of his selection on a specially designed answer sheet. A standard form of administration was used as described in the handbook which accompanied the test. Candidates were allowed ample time to complete the test, and in no case did this exceed one hour.

Lazarowitz (1981) describing Raven's Standard Progressive Matrices wrote :-

> This is a non-verbal test.....(it).....is considered to weigh highly with the "g" factor of general intelligence and is known as a measure of analytical thinking. In the literature, it is assumed to be culture-free, being based on visual perception and not on verbal thought, and is included in the test battery in order to overcome language problems. The literature reported retest reliability between .70 and .90, concurrent validity with verbal test of .40 and with performance on tests of intelligence, .70. Predictive validity with academic criteria is lower than with intelligence tests(p18).

Since Raven's Standard Progressive Matrices is a homogeneous test with each item scoring equally, a split-half correlation of the 60 item test was carried out for all of the responses from each of the three Year Groups, in order to assess the reliability of the test. The Spearman-Brown correction for half test to full test was applied to the correlation coefficient computed, to estimate the whole test reliability, as described by Guilford (1975:457).

For Year One with 138 candidates, the split-half correlation was 0.92, which after applying the Spearman-Brown correction, gave 0.96 as the reliability coefficient.

For Year Two with 160 candidates, the split-half correlation was 0.87, which after applying the Spearman-Brown correction, gave 0.93 as the reliability coefficient.

For Year Three with 148 candidates, the spilt-half correlation was 0.83, which after applying the Spearman-Brown correction, gave 0.91 as the reliability coefficient.

For each of the three Year Groups, the Raven's Standard Progressive Matrices test proved highly reliable, as indicated by reliability coefficients of over 0.90 in each case.

3.4 Preliminary Investigations

An earlier study by Turton (1986) to investigate the level of correlation between continuous assessment scores and scores achieved in the Kaduna State Junior Secondary school examination, in 1985, in four subject areas at the Demonstration Secondary School,Ahmadu Bello University, Zaria, had yielded the results shown in Table 3.1 overleaf :-

TABLE 3.1 Means, Standard Deviations and Correlation Coefficients for Four Subjects Assessed by Continuous Assessment and Kaduna State Junior Secondary Examination, at the Demonstration Secondary School, Ahmadu Bello University, Zaria.

SUBJECT	CANDIDATES (n)	CONT. ASSMNT. (mean) (max 60)	(S.D.)	EXAMINATION (mean) (max 40)	(S.D.)	CORRELATION r
Maths	204	26.44	11.77	21.56	7.59	0.8981
Int.Science	202	33.40	9.56	24.22	5.00	0.8209
English	201	35.98	8.69	30.30	5.63	0.8163
Social Stud.	203	34.12	9.25	32.08	3.66	0.6685

The results shown were for the entire class of graduating students from the Junior Secondary section of the school, and appeared to justify the confidence shown in the continuous assessment system used at the school. However, a more detailed study was felt to be necessary.

3.5 The Procedure

The basic procedure of the experiment was to test the three Year Groups in the Junior Secondary section of the Demonstration Secondary School, Ahmadu Bello University, Zaria, on the Integrated Science course content which they had just completed in the academic year 1985/86. In the case of Year Two it was possible to do this at the end of the academic year 1985/86. In the case of Years One and Three, the test had to be conducted at the beginning of the 1986/87 academic year. As a result, the

Year Three group was reduced in number as not all of them had transferred over to the Senior Secondary section of the school on completion of the Junior Secondary course. Only 148 out of a total of 202 who completed the Junior Secondary course transferred to the Senior Secondary section of the school, so it was this smaller sample only who were available for testing on the Raven's Standard Progressive Matrices Test.

Data was analysed only in respect of students for whom all three test measures were available, that is Achievement Test, Continuous Assessment and Raven's Standard Progressive Matrices scores.

The tests were conducted under classroom conditions with supervision by the class tutors. Students had been advised that the tests were for educational experimentation and not part of their continuous assessment programme. The tests were taken seriously, however, as the responses showed considered answers, and it was apparent from inspection during the testing process that proper supervision was maintained.

The test papers were centrally marked according to an agreed marking scheme and the results entered on summary sheets which indicated each candidate by name and code number, and their scores in the three assessment measures.

3.6 The Method of Data Analysis

The data from this experiment was analysed using an Amstrad PCW8512 computer with a computer programme, QUASAR (1986), developed by Goode Software, Cardiff, United Kingdom.

The procedure involved the creation of a series of data 'files' on computer disc each of which represented the data from a particular test for a particular Year Group and sub-group. Once the data was inputted onto the data files, the computer programme carried out the statistical analyses required. These were :-

(i) the production of product-moment correlation coefficients between the various tests, in the form of a three way matrix;

(ii) the production of descriptive statistics of each file i.e. the means, modes, range, standard deviation etc for each data set, also frequency tables and histograms for each whole group, for each test.

(iii) the analysis of data files to produce the student-t statistic for differences of means between boys and girls scores on each test.

The above analyses and descriptive statistics were printed out and included as Appendices.

The data files were also printed out for checking. This was most important since an error in data entry could have had serious effects when the correlation programme was applied. These files were also included as Appendices.

The hypotheses listed in Chaper 1 paragraph 1.5, were tested by comparison of the experimentally derived statistics with those given in the tables of statistics.

CHAPTER 4

RESULTS AND ANALYSES

4.0 The Results of the Experiment.

The results of the experiment were tabulated as shown below for ease of comparison, each Year Group being treated separately in terms of the nine hypotheses to be tested as expressed in Chapter 1 paragraph 1.5.

4.1 Year One Correlation Results

TABLE 4.1. Summary of Tests of Hypotheses for Year One

Relationship tested	df	Critical value of r at ,05 level	Value of r found from experiment	Decisions
1, Hypothesis 1,5,1 Continuous Assmnt-vs-Achievement test for whole year group, (n = 138)	136	0,17	0,66	Significant, Null hypothesis rejected, Strong positive correlation,
2, Hypothesis 1,5,2 Continuous Assmnt-vs-Achievement test for boys only, (n = 69)	67	0,24	0,74	Significant Null hypothesis rejected, Strong positive correlation,
3, Hypothesis 1,5,3 Continuous Assmnt-vs-Achievement test for girls only, (n = 69)	67	0,24	0,55	Significant Null hypothesis rejected, Strong positive correlation,
4, Hypothesis 1,5,4 Continuous Assmnt-vs-Raven's S, Prog, Mat, for whole Year Group (n = 138)	136	0,17	0,37	Significant Null hypothesis rejected, Positive correlation,
5, Hypothesis 1,5,5 Continuous Assmnt-vs-Raven's S, Prog, Mat, for boys only, (n = 69)	67	0,24	0,51	Significant Null hypothesis rejected, Strong positive correlation,
6, Hypothesis 1,5,6 Continuous Assmnt-vs-Raven's S, Prog, Mat, for girls only (n = 69)	67	0,24	0,24	Significant Null hypothesis rejected Positive correlation
7, Hypothesis 1,5,7 Achievement test-vs-Raven's S, Prog, Mat, for whole Year Group (n = 138)	136	0,17	0,44	Significant Null hypothesis rejected, Positive correlation,

Relationship tested	df	Critical value of r at .05 level	Value of r found from experiment	Decisions
8. Hypothesis 1,5,8 Achievement test-vs-Raven's S. Prog.Mat. for boys only. (n = 69)	67	0,24	0,54	Significant Null hypothesis rejected. Strong positive correlation
9. Hypothesis 1,5,9 Achievement test-vs-Raven's S. Prog. Mat. for girls only. (n = 69)	67	0,24	0,37	Significant Null hypothesis rejected. Positive correlation.

The results summary for Year One showed that none of the null hypotheses was sustained by the experimental findings. Of particular interest for the purposes of this study were the high correlations discovered between the achievement test and continuous assessment scores all of which showed significant levels in excess of the .001 level of significance (for 136 df at .001 significant level, critical r = 0.29, for 67 df at .001 significant level, critical r = 0.39).

Lower levels of significance were found for the relationships between continuous assessment scores and scores on Raven's Standard Progressive Matrices, and also between the achievement test and Raven's Standard Progressive Matrices. However, in no case was the null hypothesis, that there was no relationship between these variables, sustained. A more detailed discusion of these results follows in para 4.5.

4.2. Year Two Correlation Results

TABLE 4.2 Summary of tests of Hypotheses for Year Two

Relationship tested	df	Critical value of r at .05 level	Value of r found from experiment	Decisions
1, Hypothesis 1,5,1 Continuous Assmnt-vs-Achievement test for whole Year Group (n = 160)	158	0,15	0,77	Significant Null hypothesis rejected, Strong positive correlation,
2, Hypothesis 1,5,2, Continuous Assmnt-vs-Achievement test for boys only (n = 91)	89	0,21	0,70	Significant Null hypothesis rejected, Strong positive correlation,
3, Hypothesis 1,5,3 Continuous Assmnt-vs-Achievement test for girls only (n = 69)	67	0,24	0,83	Significant Null hypothesis rejected, Strong positive correlation,
4, Hypothesis 1,5,4 Continuous Assmnt-vs-Raven's S, Prog, Mat, for whole Year Group (n = 160)	158	0,15	0,49	Significant Null hypothesis rejected, Positive correlation,
5, Hypothesis 1,5,5 Continuous Assmnt-vs-Raven's S, Prog, Mat, for boys only (n = 91)	89	0,21	0,38	Significant Null hypothesis rejected, Positive correlation
6, Hypothesis 1,5,6 Continuous Assmnt-vs-Raven's S, Prog, Mat, for girls only (n = 69)	67	0,24	0,55	Significant Null hypothesis rejected, Strong positive correlation
7, Hypothesis 1,5,7 Achievement test-vs-Raven's S, Prog, Mat, for whole Year Group (n = 160)	158	0,15	0,50	Significant Null hypothesis rejected, Strong positive correlation
8, Hypothesis 1,5,8 Achievement test-vs-Raven's S, Prog, Mat, for boys only (n = 91)	89	0,21	0,43	Significant Null hypothesis rejected, Positive correlation,
9, Hypothesis 1,5,9 Achievement test-vs-Raven's S, Prog, Mat, for girls only (n = 69)	67	0,24	0,54	Significant Null hypothesis rejected, Strong positive correlation,

From the summary of the Year Two results, it was clear that all the null hypotheses had been rejected without exception. The correlations between continuous assessment and the achievement test scores again exceeded the .001 level of significance (for 158 df at the .001 significant level, critical r = 0.28, for 89 df at the .001 significant level, critical r = 0.34, and for 67 df at the .001 significant level, critical r = 0.39).

Although the values of the correlation coefficients for the other tests and sub groups were lower, the same high level of significance was obtained in every case, i.e. significance at the .001 level or higher. A more detailed discussion of these results appears in para 4.5.

4.3 Year Three Correlation Results

TABLE 4.3 Summary of Tests of Hypotheses for Year Three

Relationship tested	df	Critical value of r at .05 level	Value of r found from experiment	Decisions
1, Hypothesis 1,5,1 Continuous Assmnt-vs-Achievement test for whole year Group (n = 148)	146	0,16	0,77	Significant Null hypothesis rejected, Strong positive correlation,
2, Hypothesis 1,5,2 Continuous Assmnt-vs-Achievement test for boys only (n = 87)	85	0,21	0,78	Significant Null hypothesis rejected, Strong positive correlation,
3, Hypothesis 1,5,3 Continuous Assmnt-vs-Achievement test for girls only (n = 61)	59	0,25	0,74	Significant Null hypothesis rejected, Strong positive correlation,
4, Hypothesis 1,5,4 Continuous Assmnt-vs-Raven's S, Prog, Mat, for whole Year Group (n = 148)	146	0,16	0,44	Significant Null hypothesis rejected, Positive correlation,
5, Hypothesis 1,5,5 Continuous assmnt-vs-Raven's S, Prog, Mat, for boys only (n = 87)	85	0,21	0,43	Significant Null hypothesis rejected, Positive correlation,

Relationship tested	df	Critical value of r at .05 level	Value of r found from experiment	Decisions
6. Hypothesis 1.5.6 Continuous Assmnt-vs-Raven's S, Prog. Mat, for girls only (n = 61)	59	0.25	0.44	Significant Null hypothesis rejected, Positive correlation.
7. Hypothesis 1.5.7 Achievement test-vs-Raven's S, Prog. Mat, for whole Year Group (n = 148)	146	0.16	0.48	Significant Null hypothesis rejected, Positive correlation.
8. Hypothesis 1.5.8 Achievement test-vs-Raven's S, Prog. Mat, for boys only (n = 87)	85	0.21	0.52	Significant Null hypothesis rejected, Strong positive correlation.
9. Hypothesis 1.5.9 Achievement test-vs-Raven's S, Prog. Mat, for girls only (n = 61)	59	0.25	0.38	Significant Null hypothesis rejected, Positive correlation.

In the case of the Year Three results, all the null hypotheses were rejected. As in the cases of Years One and Two results, the correlations obtained between continuous assessment and the achievement test scores were by far the highest, being well beyond the .001 level of significance (for 146 df at the .001 significant level, critical r = 0.28, for 85 df at the .001 significant level, critical r = 0.35, while for 59 df at the .001 significant level, critical r = 0.41).

Paralleling the results obtained for Years One and Two, the Year Three results showed lower correlations between continuous assessment and Raven's Standard Progressive Matrices, and the achievement test and the Progressive Matrices. All the results were, however, beyond the .05 level of significance, and apart from hypothesis 1.5.9 for the sub-sample girls, all the other scores were, like the continuous assessment versus achievement test scores, significant at the .001 level. A fuller discussion of the

significance of the findings for Years One, Two and Three is given in para 4.5

4.4 Differences in Mean Scores of Boys and Girls.

As additional hypotheses, the opportunity was taken to compare the mean scores of boys and girls in the three performance measures of continuous assessment, the achievement tests and Raven's Standard Progressive Matrices using the Student-t statistic. Analysis of the three Year Groups gave the following results:-

1.Year One Mean Scores

Continuous Assessment Scores

Boys	Number of observations	= 69
	Mean score	= 59.65
Girls	Number of observations	= 69
	Mean score	= 62.01
	t-statistic (pooled)	= -0.86
	Degrees of freedom	= 136

From the tables, the Student-t statistic for 136 degrees of freedom at the .05 level = 1.978. Therefore the difference in means was not significant at this level.

The above result showed that although the mean scores in continuous assessment of the sub sample girls, in Year One, was higher than that of the boys, the difference was insufficient to meet the conditions of significance at the .05 level. This result is contrary to that reported by Hoste and Bloomfield (1975) and Hills (1976) who confirmed that generally the performance of girls in continuous assessment is significantly higher than that of boys.

Achievement Test Scores

Boys	Number of observations	= 69
	Mean score	= 54.36
Girls	Number of observations	= 69
	Mean score	= 55.46
	t-statistic (pooled)	= -0.41
	Degrees of freedom	= 136

From the tables, the Student-t statistic for 136 degrees of freedom at the .05 level = 1.978. Therefore the difference in means is not significant at this level.

The above result showed no significant difference in the performance of the two sub samples, boys and girls, in the Year One achievement test.

Raven's Standard Progressive Matrices Scores

Boys	Number of observations	= 69
	Mean score	= 39.27
Girls	Number of observations	= 69
	Mean score	= 36.54
	t-statistic (pooled)	= 1.37
	Degrees of freedom	= 136

From the tables, the Student-t statistic for 136 degrees of freedom at the .05 level = 1.978. Therefore the difference in means is not significant at this level.

Although the slightly higher mean score achieved by the sub sample boys compared with that of the girls was not statistically significant at the .05 level, Raven's Standard Progressive Matrices scores are age sensitive and the higher mean age of the sub sample boys may have

accounted for the difference (Orme, 1966; Raven et al, 1983).

Mean Ages of Year One candidates:-

Whole group = 13.33 yrs, Boys = 13.43 yrs, Girls = 13.24 yrs

2. Year Two Mean Scores

Continuous Assessment Scores

Boys	Number of observations	= 91
	Mean score	= 173.81
Girls	Number of observations	= 69
	Mean score	= 148.96
	t-statistic (pooled)	= 3.02
	Degrees of freedom	= 158

From the tables, the Student-t statistic for 158 degrees of freedom at the .05 level = 1.976. Therefore the difference in means is significant at this level.

This result showed that the performance of the sub sample boys was significantly better, at the .05 level of significance than that of the girls in so far as continuous assessment was concerned. This result again was in contradiction to the results reported by Hoste and Bloomfield (1975)and Hills (1976), and could have been due to the composition and sizes of the samples found in this case study.

Achievement Test Scores

Boys	Number of observations	= 91
	Mean score	= 74.31
Girls	Number of observations	= 69
	Mean score	= 68.36

t-statistic (pooled) = 1.85

Degrees of freedom = 158

From the tables, the Student-t statistic for 158 degrees of freedom at the .05 level = 1.976. Therefore the difference in means is not significant at this level.

Although the sub sample boys scored on average higher than the girls, the difference in mean scores was not statistically significant at the .05 level.

Raven's Standard Progressive Matrices Scores

Boys Number of observations = 91

Mean score = 40.12

Girls Number of observations = 69

Mean score = 36.91

t-statistic (pooled) = 2.02

Degrees of freedom = 158

From the tables, the Student-t statistic for 158 degrees of freedom at the .05 level = 1.976. Therefore the difference in means is significant at this level.

In this case the higher scores achieved by the sub sample boys was significantly higher at the .05 level, than that achieved by the girls. The ages of the two sub samples of the Year Two experimental group again showed that the mean age of the sub sample boys was higher than that of the girls, which may have accounted for this result.

Mean Ages of the Year Two candidates:-

Whole group = 14.38 yrs, Boys = 14.52 yrs, Girls = 14.20 yrs.

1. Year Three Mean Scores

Continuous Assessment Scores

Boys	Number of observations	= 87
	Mean score	= 35.10
Girls	Number of observations	= 61
	Mean score	= 33.26
	t-statistic (pooled)	= 1.36
	Degrees of freedom	= 146

From the tables, the Student-t statistic for 146 degrees of freedom at the .05 level = 1.976. Therefore the difference in means is not significant at this level.

Although the sub sample boys again scored more highly than the girls, the difference in mean scores was not significant at the .05 level. However, this result again failed to conform to the expectations raised by Hoste and Bloomfield (1975) and Hills (1976) that girls performed better than boys on continuous assessment.

Achievement Test Scores

Boys	Number of observations	= 87
	Mean score	= 25.94
Girls	Number of observations	= 61
	Mean score	= 23.84
	t-statistic (pooled)	= 2.94
	Degrees of freedom	= 146

From the tables, the Student-t statistic for 146 degrees of freedom at the .05 level = 1.976. Therefore the difference in means is significant at this level.

This result showed that the sub sample boys performed significantly better than the girls on the Year Three achievement test, at the .05 level.

Raven's Standard Progressive Matrices Scores

Boys	Number of observations	= 87
	Mean score	= 44.41
Girls	Number of observations	= 61
	Mean score	= 41.41
	t-statistic (pooled)	= 2.40
	Degrees of freedom	= 146

From the tables, the Student-t statistic for 146 degrees of freedom at the .05 level = 1.976. Therefore the difference in means is significant at this level.

On the Raven's Standard Progressive Matrices, the sub sample boys performed significantly better than the girls at the .05 level. The difference between the ages of the two samples may have been responsible for the recorded result.

Mean Ages of Year Three candidates:-

Whole group = 15.11 yrs, Boys = 15.26 yrs, Girls = 14.94 yrs

Summary of Results of Differences in Mean Scores.

The above results of the survey of differences of mean scores of boys and girls in the various test instruments were summarised as follows.

Table 4.4:Summary of Tests of Differences in Mean Scores of Boys and Girls

Year Group	Cont. Assmnt	Achievement Test	Raven's S. Prog. Mat.
Year One	not sig.	not sig.	not sig.
Year Two	significant	not sig.	significant
Year Three	not sig.	significant	significant

In so far as the three null hypotheses stated in paras 1.5.10, 1.5.11 and 1.5.12 were concerned, in respect of the three test instruments, for Year One, all three hypotheses were sustained by the experimental results in that no significant differences between the mean scores of the sub groups boys and girls were discovered.

For Year Two, only in the case of scores on the achievement test was the null hypothesis sustained. In the cases of continuous assessment and Raven's Standard Progressive Matrices, significant differences in scores were observed.

For Year Three, only one of the null hypotheses was sustained, that of continuous assessment scores. In the cases of the achievement test scores and the scores on Raven's Standard Progressive Matrices, significant differences in mean scores between the sub samples boys and girls were discovered.

Where differences in mean scores were statistically significant, the scores were all in favour of the sub sample boys. Even in cases where the differences were not statistically significant, only in one case, that of the continuous assessment scores in Year One, did the sub sample girls have a mean score greater than that of the boys. In general, however, the differences in mean scores were not great between the sub samples girls and boys, indicating, perhaps a uniformity of teaching methods and both pupil and teacher expectations in the school investigated.

4.5 Discussion of Results

The various correlation coefficients discovered in the experiment are discussed in the light of other experimental findings and the significance of the results to the problem and hypotheses stated at the outset is considered here.

Guilford (1936) gave the following advice for an interpretation ofcoefficients of correlation:-

Less than 0.2	- slight correlation; almost negligible relationship
0.2 - 0.4	- low correlation; definite but small relationship
0.4 - 0.7	- moderate correlation; substantial relationship
0.7 - 0.9	- high correlation; marked relationship
0.9 - 1.0	- very high correlation; very dependable relationship (p165).

This statement attempted to put correlation coefficients into perspective. However, the meaning to be attached to words such as "substantial", "marked" and "dependable" still left room for ambiguity.

The same author, was later much more cautious in his approach to the interpretation of correlation coefficients when he stated:-

> Any coefficient of correlation that is not zero and that is also statistically significant denotes some degree of relationship between two variables (p103).....
> and:-
> The practical conclusion ....is that *a correlation is always relative to the situation under which it is obtained, and its size does not represent any absolute natural fact.* To speak of *the correlation between intelligence and achievement is absurd. One* needs to say *which* intelligence, measured under *what* circumstances, in *what* population, and to say *what kind* of achievement, measured by by *what* instruments, or judged by *what* standards. *Always, the coefficient of correlation is purely relative to the circumstances under which it was obtained and should be interpreted in the light of those circumstances, very rarely, certainly, in any absolute sense* (Guilford,1965:105).

In commenting on the reliability of test instruments Guilford (1965) also noted the general tendency which increased practical use of tests had brought about, of accepting lower levels of reliability than had been

earlier proposed. For example, Kelley (1927:210) proposed that for a test used for discriminating between individuals, a reliability coefficient of at least 0.94 should be expected. Guilford (1965), however commented:-

> The higher standards are rarely attainable, and it is safe to say that most tests in use fail to meet them.....the fact remains that in practice we expect reliability coefficients to be in the upper brackets of *r* values, usually .70 to .98, and validity coefficients to be lower, usually .00 to .80 (p104).

The validity coefficient referred to above related to the predictive validity of a test such as the scores on an aptitude test, and measures of academic or vocational success.

The experimental results were interpreted in the light of the above comments as follows.

4.5.1 Continuous Assessment versus Achievement Test

The dilemma of continuous assessment was perceived in terms of correlation as - if continuous assessment did not correlate to a reasonable degree with an external examination, then it would be wrong to combine the continuous assessment scores and the examination scores into a single indicator of pupil performance. On the other hand, if it did correlate highly with the external examination, then why was it necessary to go to all the lengths of designing and operating a continuous assessment system with all the extra work which it entailed ?

The first part of the statement was seen as logical in that if continuous assessment was measuring totally different attributes to the final external examination, then to combine it with the examination score would lead to an ambiguous measure. A score of 50 percent, for example , in such a case could either represent 50 percent in both continuous assessment

and the examination, or zero in continuous assessment and 100 percent in the examination or vice versa. In a given subject area, with clearly stated objectives, which were being taught and examined by both continuous assessment and a final examination, a level of correlation should be apparent, and should be fairly strong. This condition should always be maintained since it would form the basis for any system of statistical moderation of continuous assessment, if this was to be applied at state or national level.

The second part of the argument could not be sustained, however. Although the "liberalisation of assessment" was the stated aim for introducing continuous assessment, the sub themes of continuous assessment were seen as strong. These were (i) more reliable assessment, (ii) guidance orientated assessment, (iii) assessment geared towards better teaching and learning.

These sub-themes could not be met by any final, single, examination. There was also the point that even with high correlations of the order anticipated, i.e. of about 0.6, a high degree of latitude still existed for a hard working pupil to make substantial score gains in continuous assessment to supplement, perhaps, a less substantial examination score.

The main thrust of this experiment was towards the area of the correlation of the final, accumulated, continuous assessment scores for the whole of the three year, Junior Secondary School course and the scores obtained in the externally set, final examination. These were exhibited in the Year Three results which showed consistently high correlation

coefficients for the whole Year Group and the two sub-groups Boys and Girls, with the values of 0.77, 0.78 and 0.74 respectively.

Within the conditions described by Guilford (1965) above, the continuous assessment scores were seen as adequate predictors of pupil performance on the final examination. The final examination itself had a reasonable split-half reliability coefficient of 0.85, though, as noted, it did not include a practical examination nor did it attempt to assess science process skills by any other means. The school based continuous assessment did, however, include this area.

The results for Years Two and One showed correlations of the same order as those obtained for Year Three :-

Year Two, whole group 0.77, Boys 0.70, Girls 0.83.

Year One, whole group 0.66, Boys 0.74, Girls 0.55

The test-retest reliabilty coefficient for the two examinations, of 0.81 for Year Two and 0.90 for Year One , though estimated differently from Year Three examination, were substantially the same in value, as were the correlation coefficients obtained. The variations observed could well have been the consequence of the composition of the samples, which, as noted earlier were not randomised or selected according to any criteria other than their presence in the school at the time of testing.

Basically, reasonable levels of correlation, as described above by Guilford (1965), between continuous assessment scores and the achievement tests were discovered, indicating that the system of continuous assessment was working and that it was a fair predictor of pupil performance on the

external measure. The most striking feature of the results was not the variation in the levels of correlation discovered, but rather the overall consistency, indicating a uniformity of performance on the part of the continuous assessment system, and, it must be added, the performance of the pupils.

4.5.2 Continuous Assessment versus Raven's Standard Progressive Matrices.

The generally lower levels of correlation between continuous assessment and the Raven's Standard Progressive Matrices scores were to be anticipated given the widely differing objectives which the two measures were assessing. This was an illustration of the point made in paragraph 4.5.1 above, that where tests were measuring different attributes of the testee, this will be evidenced by a lower level of correlation between the test results and to combine the two measures would result in an ambiguous total.

The most striking feature of this part of the experiment was the extremely high levels of split-half reliability coefficient obtained for the Raven's Standard Progressive Matrices results, for Year Three, 0.91, Year Two, 0.93 and for Year One, 0.96. These results corresponded with those reported in the literature. For example Sinha (1977) reported split-half correlations ranging from 0.89 to 0.95 with samples of school children in India, aged from 11 to 15 years. Baraheni (1974) similarly found split-half correlations of from 0.89 to 0.95, for different ages, of a sample of Iranian school children (N=4561).

Again, although the correlation coefficients were lower, they were consistently lower, being for the whole of Year Three, 0.44, for Year Two,

0.49 and for Year One, 0.37. Compared with the relationship discovered between continuous assessment and the achievement test which showed a consistently high level of correlation, these results indicated a lower level of correlation, but consistently lower.

Scores on Raven's Standard Progressive Matrices were reported as being sensitive to the age, and developmental level of the testee. Raven, Court and Raven (1983) in describing the results of a nationally representative sample of 3,500 British school children aged six to sixteen noted that the correlation between age and test scores on the Progressive Matrices was 0.7, with only 9 percent of the within age variation being explained by social background. No variation with regard to the sex of the candidates was discovered. Orme (1966) reported similar findings.

The mean ages for Years One, Two and Three were 13.33, 14.38 and 15.11 years respectively, while the mean scores on the Raven's Progressive Matrices were 37.91, 38.74 and 43.03 respectively. This again showed the consistency of the results obtained with those reported by other investigators and the sensitivity of Raven's Standard Progressive Matrices to the chronological age of the candidates.

4.5.3 Achievement Test versus Raven's Standard Progressive Matrices

Raven, Court and Raven (1983) in reviewing the relationship between Raven's Standard Progressive Matrices and concurrent achievement measures stated:-

> Correlations between SPM (Standard Progressive Matrices) and performance on achievement tests or actual scholastic measures are generally lower than correlations with intelligence tests, and even more variable, ranging from negligible to very high.....When the external criterion for comparison is actual

> school achievement assessed by school grades, examination results or teacher estimates, correlations generally fall between +0.2 and +0.6.....(p9)

Ogunlade (1978) reported an extremely low correlation, 0.15, between scores on Raven's Standard Progressive Matrices and an achievement test in Mathematics for a group of Nigerian children of mean age 14 years, consisting of 337 boys and 200 girls. He explained this low figure in terms of the narrowness of the Raven's Standard Progressive Matrices test in assessing only a limited range of the abilities required for success in Mathematics. Other investigators have found higher correlations. For example, Lazarowitz (1981) found correlations of 0.62 and 0.79 for 7th and 9th Grade pupils in Israel (N = 171 and 194 respectively) between Raven's Standard Progressive Matrices scores and a specially developed test in biological classification. Macarthur (1968) in a survey of 2000 native Canadian children reported a median correlation of Raven's Standard Progressive Matrices with school achievement of 0.52. Maderna and Valseschini (1967) tested 200 Italian secondary school students and found a correlation of 0.39, between Raven's Standard Progressive Matrices and scholastic achievement.

In the light of the above findings, the observed correlations between Raven's Standard Progressive Matrices and the achievement tests in integrated science for each of the whole groups of Years One, Two and Three of 0.44, 0.50 and 0.48 respectively, was well within the range of reported results, which gave confidence to the use of both the achievement tests and Raven's Standard Progressive Matrices in the investigation of the relationship between achievement test scores and those derived from continuous assessment.

CHAPTER 5

SUMMARY, GENERALISATIONS AND RECOMMENDATIONS

5.1 Summary

The experiment investigated the relationship between scores achieved under a system of continuous assessment and those found from achievement tests, in a particular subject, Integrated Science, and in a particular school, the junior secondary section of the Demonstration Secondary School, Ahmadu Bello University, Zaria. The junior secondary programme as defined by the National Policy on Education (1981) was of three years duration, and the opportunity was taken to view the progress of the system of continuous assessment in the school over the three year period.

Each of the three year groups in the school at the time of the experiment, were tested with an attainment test corresponding to the scheme of work for the year which they had just completed. Years One and Two were tested with specially devised attainment tests while for Year Three, the Junior Secondary Leaving Examination set by the Ministry of Education Kaduna State was used as the test instrument.

The use of the examination set by the Kaduna State Ministry of Education was seen as a valuable link with reality, in that without such a link to the 'real world', the experiment could have been dismissed as an academic exercise, and one divorced from the practicalities of the educational system.

The two specially designed tests were found, by the test-retest procedure to have reliabilities as follows :-

Year One achievement test, reliability 0.90

Year Two achievement test, reliability 0.81

The reliability of the Kaduna State Ministry of Education examination was assessed by the split-half correlation technique due to the long time gap between the availability of the candidates for testing. Its value was found to be :-

Year Three achievement test, reliability 0.85

The school was a mixed school and the opportunity was taken to compare the performances of the sub groups, boys and girls, on the test instruments.

The continuous assessment scores for each year group were accumulated using a scheme marketted by the Northern Nigeria Publishing Company which predicated the accumulation of three scores per term in respect of each pupil. These scores were added for each year to produce an annual total. The annual totals for each of the three years of the course were weighted to scores out of 10 for Year One, 20 for Year Two and 30 for Year Three according to a nationally agreed formula, and the simple accumulation of these three weighted scores represented the continuous assessment element of the junior secondary school performance total, being a score out of 60. The Junior Secondary Leaving Examination, administered by the State Ministries of Education was weighted out of 40 so that the direct addition of the continuous assessment scores and the state examination result gave a total score out of 100.

The hypotheses tested by the experiment related to the correlation between the scores accumulated under the continuous assessment system and the achievement tests for each of the three year groups of the school. These were tested on the assumption of the null hypotheses that there

would be no correlation between the continuous assessment scores and the achievement test scores. It was argued, however, that unless a substantial correlation existed between the continuous assessment scores and those of an achievement test such as the statewide Junior Secondary Leaving Examination, then it would have been wrong to combine the two scores since the combined score would be an ambiguous total, lacking in validity.

The composition of the three Year Groups was as follows:-

Year One Boys 69, mean age 13.43 yrs, Girls 69, mean age 13.24 yrs
Total 138, mean age 13.33 yrs.

Year Two Boys 91, mean age 14.38 yrs, Girls 69, mean age 14.20 yrs
Total 160, mean age 14.38 yrs.

Year Three Boys 87, mean age 15.26 yrs, Girls 61, mean age 14.94 yrs
Total 148, mean age 15.11 yrs.

The results of the experiment showed strong positive correlations to exist between the continuous assessment scores and the achievement test scores as follows:-

Year One, whole group (n=138), 0.66

Year Two, whole group (n=160), 0.77

Year Three,whole group(n=148), 0.77

The correlations discovered were all significant beyond the .001 level of significance and , within the limitations of the experiment as described in para 5.2 below, the results validated the procedure of adding the continuous assessment scores to the achievement test scores to produce a meaningful final result.

In order to relate the results of the experiment to a wider field of educational testing, a third and independent test instrument was used, namely Raven's Standard Progressive Matrices. This was an internationally validated intelligence test instrument, having the major characteristics of being non-verbal and being regarded as 'culture-free'. Sub-hypotheses were tested using this measure, based on the null hypotheses that there would be zero correlation between the results of this test and the other two measures, continuous assessment scores and the achievement tests. Positive correlations were, however, found to exist, though at a lower level than those discovered between continuous assessment and achievement test scores, as follows:-

Continuous assessment versus Raven's Progressive Matrices

Year One, whole group (n=138), 0.37

Year Two, whole group (n=160), 0.49

Year Three,whole group(n=148), 0.44

Achievement test scores versus Raven's Progressive Matrices

Year One, whole group (n=138), 0.44

Year Two, whole group (n=160), 0.50

Year Three,whole group(n=148), 0.48

These results too were all significant beyond the .001 level of significance and were squarely within the range of results reported by other investigators.This gave confidence to the interpretation of the results of the major relationship found between continuous assessment and achievement test scores in this particular school.

With regard to the differences in scores on the various instruments of the sub groups boys and girls, of the nine relationships tested (three test

instruments on each of the three year groups) only four were found to show significant differences, and at the .05 level only.

In Year One, no significant differences were discovered.

In Year Two, the differences in scores of boys and girls on both continuous assessment and Raven's Standard Progressive Matrices was found to be significant at the .05 level, in favour of the sub group boys.

In Year Three, two of the differences in the scores tested, those on the achievement test and Raven's Progressive Matrices, showed differences significant at the .05 level, again in favour of the sub group boys.

The conclusion here was that were no dramatic differences in the performances of the two sub groups on the three test instruments. The observations by Hoste and Bloomfield (1975) and Hills (1976) of superior performance by girls on continuous assessment was not replicated in this study.

5.2 Limitations

The major limitation of the study was the fact that it was essentially a case study of a working school system. The samples of pupils tested were those actually found in the classrooms. There was no attempt made to randomise the samples or correct for sex, age, socio-economic status or any other factor.

The desirability of conducting a case study of a working school was not simply one of convenience. The continuous assessment system relied largely on the organisational structure of the school and the inputs from the staff

members in teaching, testing and record keeping. Although the Northern Nigerian Publishing Company system described the organisational structures and procedures which would facilitate continuous assessment in a school, simply as a result of the variable inputs of principals and staff, some variations in school performance in continuous assessment were bound to occur. The case study at least answered the question, was continuous assessment working in this particular school context ?

It must be mentioned that the investigator was a former principal of the school under experiment and this may have led to a higher level of cooperation from both staff and pupils than that which a totally independent investigator might have secured. It was also the school in which the Northern Nigerian Publishing Company system was developed so there was a high level of familiarity with the system on the part of the staff and it was likely that the standard of assessment and record keeping was higher than in the average junior secondary school.

The test instruments themselves presented a further limitation to the study in that the three achievement tests used were 'home made', non standardised tests. There could be no avoidance of this since standardised tests on the junior secondary school Integrated Science programme did not exist. The tests showed a reasonable level of reliability, however, as indicated earlier.

The tests used by teachers in assessing the pupils for the continuous assessment scores were out of control of the investigator, since this was a post facto investigation in so far as continuous assessment scores were concerned. The fact that corelations of the order of 0.7 were achieved with

the achievement tests indicated that reliabilities of a similar order to those of the achievement tests were probably obtained.

The highest test reliabilities were obtained with the Raven's Standard Progressive Matrices tests which gave :-

Year One Raven's Standard Progressive Matrices reliability, 0.92

Year Two Raven's Standard Progressive Matrices reliability, 0.93

Year Three Raven's Standard Progressive Matrices reliabilty, 0.91

The fact that this highly reliable test gave lower correlations with the two other test instruments was seen as an indicator of the differing content areas which Raven's Standard Progressive Matrices assessed, as compared with the other two which, though of lower reliability, were covering common ground.

In the case of Year Three, another limitation on the experimental findings was the fact that the Raven's Standard Progressive Matrices test was administered when the pupils had resumed school after the break at the end of the junior secondary course. Unfortunately, of the 202 pupils who took the Kaduna State Junior Secondary Examination, only 148 re-appeared to take the senior secondary programme so that the original large sample was severely reduced in number, and particularly to the bottom end of the achievement scale, resulting in lower correlations than had been discovered in the preliminary investigations. The time lag between the administration of the achievement test and the Raven's Standard Progressive Matrices test of approximately seven months may have affected the significance of the Year Three findings to some extent.

5.3. Generalisations

Within the limitations mentioned above, the summary of the findings of this experiment indicated that reasonable levels of correlation between continuous assessment scores and those achieved on a well made achievement test could be expected. The experiment provided practical, empirical evidence that the intentions of the originators of the National Policy on Education could be realised at the junior secondary school level through the application of simple organisational and data collection principles such as those described in the Northern Nigerian Publishing Company's continuous assessment system.

The results obtained did not involve the statistical manipulation of scores at the school level, which indicated that such practices were a needless complication. It was obvious, however, that the school based assessments had to have reasonable levels of reliabilty and validity, and in the case investigated they clearly had these qualities as the levels of correlation showed.

5.4 Recommendations

The study showed that a simple system of continuous assessment could yield reliable results under average school conditions. Indeed, the effectiveness of the system may well have been a function of its simplicity. The limitation of the study as a result of the absence of standardised tests in Integrated Science showed up the need for the production of such tests. Standardised tests for each level of the three year junior secondary course would enable teachers to compare their own assessments with a

reliable measure and, if the results were incorporated with the continuous assessment scores, would increase the reliability of such scores. Standardised tests in all subjects, for each year of the junior secondary programme would enable principals to assess the progress of their own schools.

The procedure described by this experiment could be applied at the state level as a means of assessing the effectiveness of continuous assessment in schools by correlating the school's continuous assessment scores with the final state examination scores. This would require computerisation at the level of the state Evaluation Units since correlations are difficult to work out without electronic assistance. A system of moderation could also be based on the computerised results at this level.

It has to be admitted that the tests, both school-based and those external to the school, over emphasise recall and application of scientific facts at the expense of science process skills. Further research is needed into methods of teaching and assessing these skills at the school level and under the constraints of crowded classrooms and a shortage of science equipment. Another factor for the relatively high correlations observed in this study may well have been that both teacher made tests and the external measures were concentrating on the same, relatively small areas of pupil activity in science. A more detailed study of both the teacher made tests and the actual tuition given may confirm this. Continuous assessment as both a monitor and an aid to the teaching process has opened up schools to this type of investigation, which should lead to more effective teaching and learning.

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APPENDICES

YEAR ONE ACHIEVEMENT TEST

Ahmadu Bello University, Zaria
Department of Education
Science Education Section
ACHIEVEMENT TEST IN INTEGRATED SCIENCE

School.....

Pupil .....

Time 90 Minutes

INSTRUCTION: In Items 1 - 7 fill up the blank or blanks in each of the given sentences by choosing a word or words from those given after each of them.

Example 1 My mother is a .woman....(man, boy, child, woman)
Example 2 My.school. is in .Africa. (name, school, Asia, Europe, Africa)

1- The word ..... means everything that is around us. (environment, event, rock, air)

2- Another name for a living thing is .....
(photosynthesis, organism, organic matter, earth)

3- Food is important for ..... and .....
(growth, stone, gate, energy, paper, pen)

4- A unit of life on which all living things are built is called .....(nucleus, sytoplasm, cell, vacuole)

5- Some human activities are carried out for pleasure, while some others form the basis of our livelihood. The latter activities are called .....
(tools, occupations, hobby, entertainment)

6- Friction is bad sometimes. It causes ..... on the moving parts of machines.(repair, wear, lubrication, grease)

7- One celled animal called amoeba causes the disease known as .....(dysentry, tuberculosis, fever, leprosy)

INSTRUCTION: In Items 8 - 14 fill up the blanks using appropriate words.

8- ..... takes place when a sperm unites with an ovum.

9- ..... is made up of human faeces, urine, and waste water.

10-Moving air is called .....

11-.....is used to measure the hotness of a body.

12-..... is the active part of air.

13-Things that people throw away are called .....

14-..... means to rot or to decay.

INSTRUCTIONS: In Items 15 - 21 say if the following statements are TRUE or FALSE. You are to do so by drawing a line under the words "True" or "False" appearing near each statement.

Example True False My father is a woman.

15- True False There are animals that eat both other animals and plants. Such animals are called herbivores.
True False There are animals that eat both other animals and plants. Such animals are called omnivores.

16- True False All animals are mammals.
True False Some animals are mammals.

17- True False The temperature of boiling water and of melting ice are the same.
True False The temperature of boiling water and of ice are not the same.

18- True False If you fan air on to a fire, it burn brighter.
True False If you pour plenty of sand over a fire, it still burns brighter.

19- True False In order to reduce the nuissance of friction on machine parts, grease rather than petrol can be placed between two contacting surfaces.
True False In order to reduce the nuissance of friction on machine parts, petrol rather than grease can be placed between two contacting surfaces.

20- True False Drug is the substance our body produces in order to make germs harmless.
True False Antibody is the substance our body produces in order to make germs harmless.

21- True False Whe a person can resist infection by certain diseases, we say the person is addicted to them.
True False When a person can resist infection by certain diseases, we say the person is immune to them.

INSTRUCTION: In Items 22 - 28 write TWO sentences each on the following.

Example Herbivores

i. Herbivores are animals.

ii. Herbivores feed on plants.

22- Carnivores (i)

(ii)

23- Primates (i)

(ii)

24- Refuse (i)

(ii)

25- Parasite (i)

(ii)

26- Chloroplast (i)

(ii)

27- Diffusion (i)

(ii)

28- Why objects thrown up do not remain there.
(i)

(ii)

INSTRUCTION: Answer Items 29 - 36 as directed.

29- Give four examples of herbivorous animals you have seen.
i.
ii.
iii.
iv.

30- Name four mammals you have seen.
i.
ii.
iii.
iv.

31- Adamu is a six year old child. Name four food items that he needs in large quantities.
i.
ii.
iii.
iv.

32- Describe four ways in which you can keep your school compound clean.
i.
ii.
iii.
iv.

33- Name the occupation of your father or guardian.
He / She is a
Name thre tools he / she uses in the occupation.
i.
ii.
iii.

34- Write in one or two sentences how you would lubricate a pair of scissors.

i.

ii.

35- List two uses of the refuse or rubbish collected from the market place.

i.

ii.

36- Raheela comes from a very poor home where all her family members sleep together in the same poorly ventilated room. Name three diseases she can easily get from the other members of the family.

i.
ii.
iii.

INSTRUCTION: Study very closely the diagrams given below. Read very carefully what is required of you in the Items 37 - 50. Give your answers after thinking well.

37 & 38- Do you notice any difference between Figure 1 and Figure 2? Or again between Figure 3 and Figure 4? Give the answer by circling A or B or C or D below.

A I see no difference.

B I am not sure if there is any difference.

C There is some difference.

D It is difficult to say.

39 & 40- Write one sentence to explain your answer for the Items 37 & 38.

41 & 42- Can you guess a reason for what you notice about Figure 1 and Figure 2. Do so by drawing a circle around A or B or C or D below.

A Jar A and Jar B are both made of glass.

B Jar A and Jar B are close to each other.

C Jar A is closed while Jar B is always open.

D Jar A and Jar B both contain water.

43&44- Write one sentence about what you notice about Figure 2 and Figure 4.

45 & 46- Can you say why Jar B in Figure 2, and Jar D in Figure 4 appear as they look? Give the answer by circling A or B or C or D below.

A Jar B contain water while Jar D contain petrol and they are open.

B Jar B and Jar D both contain liquids.

C Jar B and Jar D are both made of glass.

D I can not say why.

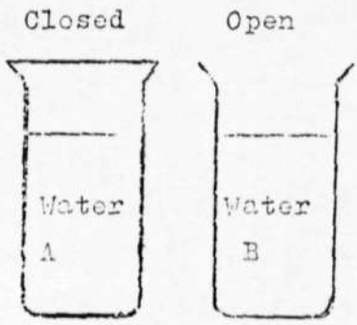


Figure 1

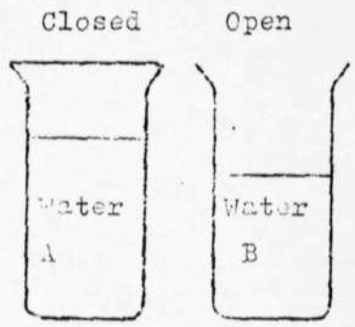


Figure 2

Figure 2 shows the appearance of the Jars A and B today.
Figure 1 shows their appearance last Monday.

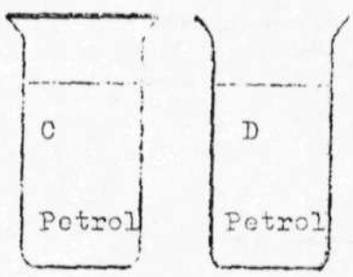


Figure 3

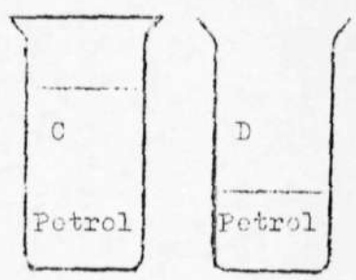


Figure 4

Figure 4 shows the appearance of Jars C and D today.
Figure 3 shows their appearance last Monday.
Jars A and C are closed tight.
Jars B and D are open always.
Study the pictures very carefully. Try answering the Items 37 - 48 using the information you derive from the pictures.

47 & 48- Write TWO sentences about what you think happened to the water and the petrol in the jars.

i.

ii.

49 & 50-

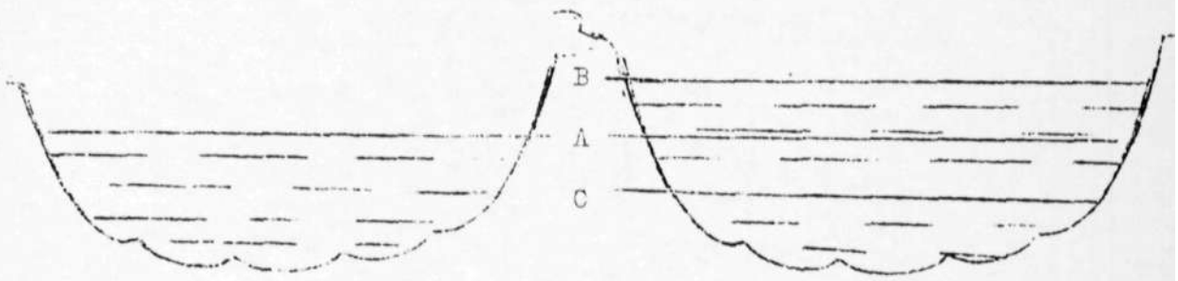


Figure 1

The appearance of a water pond on a rainy day.

Figure 2

The appearance of the same water pond after several sunny days without any more rain.

Predict the water level in Figure 2.

Do so by completing the sentence given below.

Choose letter A or B or C to fill up the blank in the sentence.

Water level in Figure 2 will be ----------.

(A, B, C)

------ooOoo------

Appendix II

YEAR TWO ACHIEVEMENT TEST

ACHIEVEMENT TEST IN INTEGRATED SCIENCE II

Time: 90 Mins

Instruction: In Items 1 - 7 fill up the blank space using the correct word among the given words.

1- The word ..... means group of cells that do a particular function (organs, tissues, cells, system).

2- A point at which two bones meet is called ..... (avertebrate, a socket, a joint, capsule).

3- .....helps us to move the bones in our body (tissue, muscle, skin, cartilage).

4- The alimentary canal is made of five main parts one of them is .....(Ligament, Bone, Small intestine, Bladder).

5- The word .....is one of the female reproductive organs of a flower. (anther, filament, stigma, petal)

6- Petroleum is a mixture of .....(gases, hydrocarbons, salts, acids).

7- When substances burn in oxygen they form (acids, alkalis, bases, oxides) .....

Instruction: Item 8 - 14 fill up the blank spaces using the correct answer.

8- Digested food enters into the blood stream through a structure called .....

9- One component of blood is .....

10- Urine is removed from the blood stream by the .....

11- Rickets can be caused by lack of .....

12- What type of gardening do people carry out i n your area?

.....

13- A substance which assists a chemical reaction to take place but is not itself changed in the reaction is called a .....

.....

14- In plants and animals substances which behave as in 13 above are called .....

Instruction: Items 15 - 21 say if the following statements are TRUE or FALSE. You are to do so by drawing a line under the words "TRUE" or "FALSE" appearing near each statement.

15- True False Okro can be grown twice a year

16- True False A germinating bean seed has no radicle

17- True False A kinds of places where plants and animals live are called Habitats.

18- True False Urine is stored in the Kidney

19- True False The process of taking in air is known as Inspiration.

20- True False Magnets can attract metals but not non-metals.

21- True False A generator is an example of an energy converter.

Instruction: In Items 22 - 28 write TWO sentences each on the following

22- Blood

(i)

(ii)

23- Teeth (i)

(ii)

24- Names of joints (i)

(ii)

25- Parts of urinary system

(i)

(ii)

26- Skin (i)

(ii)

27- Hydrogen (i)

(ii)

28- Oxygen (i)

(ii)

Instruction: Answer Items 29 - 36 as directed.

29- Give 4 parts of urinary system

(i)

(ii)

(iii)

(iv)

30- Name 4 blood components

(i)

(ii)

(iii)

(iv)

31- List any 4 parts of a tooth.

(i)

(ii)

(iii)

(iv)

32- Name any 4 classes of food.

(i)

(ii)

(iii)

(iv)

33- List any 4 vegetables you know.

(i)

(ii)

(iii)

(iv)

34- Give four examples of machines

(i)

(ii)

(iii)

(iv)

35- Give four examples of the occurrence of energy conversions.

(i)

(ii)

(iii)

(iv)

36- Give 4 examples of measuring instruments.

(i)

(ii)

(iii)

(iv)

Instruction: 37 Study the diagram given on the attached sheet. Label the numbers with the appropriate names of the parts of the flower.

42- Rearrange these organisms in a food chain, as orderly as possible, in section B.

Section A	Section B
Man	
Locust	
Bird	
Grass	
Snake	

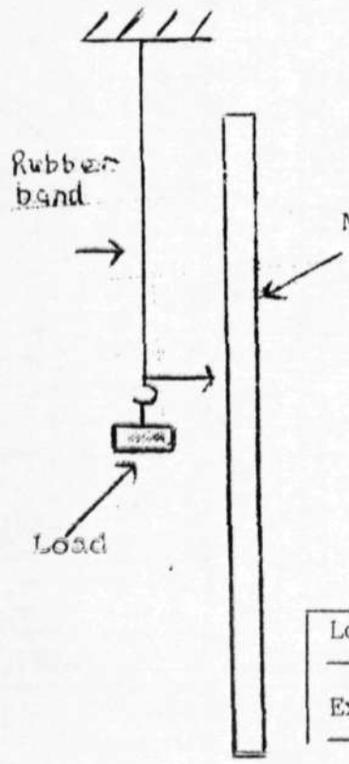
43- Instruction: Study this table below carefully and read the instruction below it.

Food Stuff	Starch	Vitamin	Protein	Fat	Minerals
Semovita					
Meat					
Egg					
Cassava					
Bread					
Cabbage					
Banana					
Magarine					

Instruction:

If there is no nutrient present in the food put a dash (-) beside the name of the food in the first column.
If there is a small quantify of nutrient present put a plus (+).
If there is a moderate amount present put two pluses (+ +).
If there is a large amount present put three pluses (+ + +).

44- In an experiment on the stretching of a rubber band, a student hung a series of different masses on the end of the suspended rubber band and measured the extension i.e. the increase in length which each produced, using an arrangement as shown on the left. The results she got are given in the table below:-



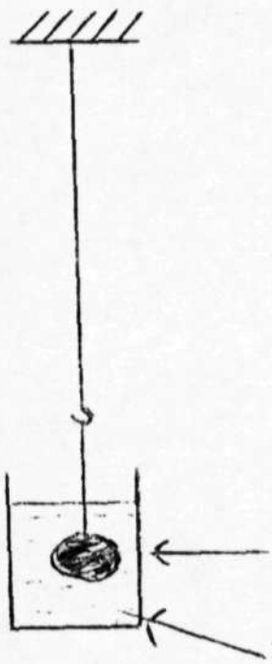
Load(Kg)	0.1	0.2	0.3	0.4	0.5	0.6
Extension(cm)	2.5	5.8	8.1	10.0	12.2	14.0

(i) Plot a graph of these results on the graph paper shown on the answer sheet.

(ii) The student was then given a stone which she hung on the rubber band. It produced an extension of 11.2 cm.

Using the graph, find the mass of the stone in Kg.

Mass of stone = ...Kg.



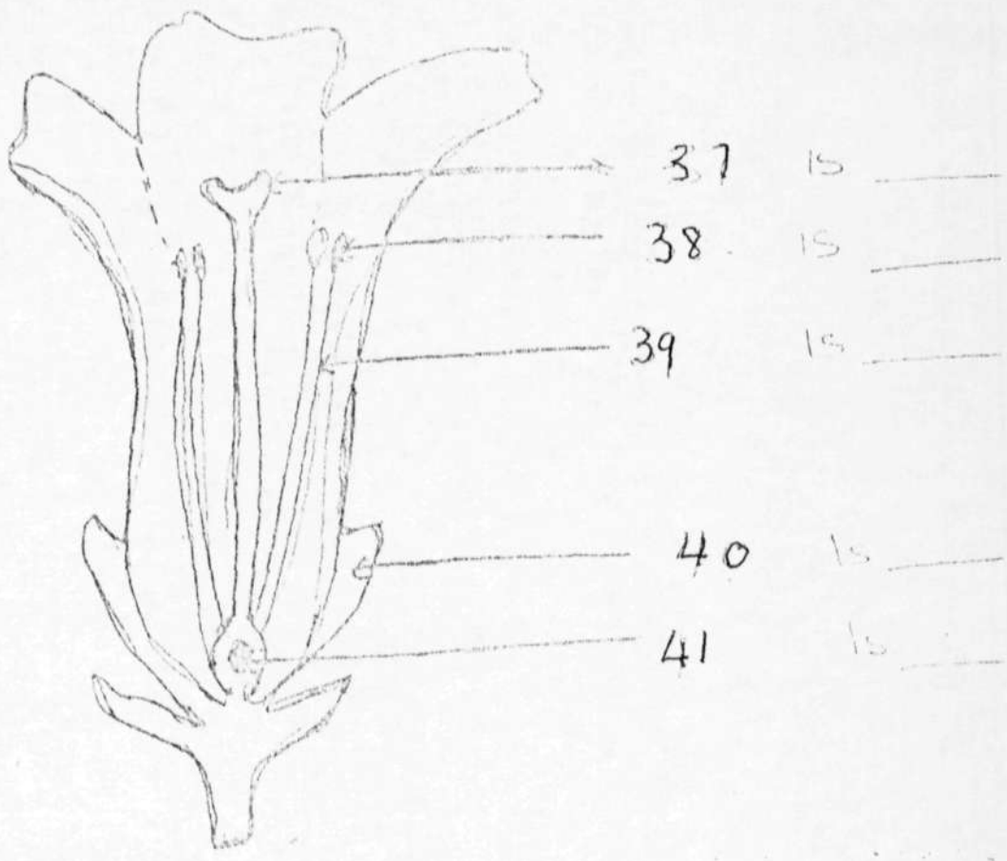
(iii) Later, the stone was suspended in a beaker of water as shown in the diagram. Do you think the extension of the rubber band would be <u>greater</u> or <u>less</u> than when the stone was out of the water? Explain your answer with a few words.

.....

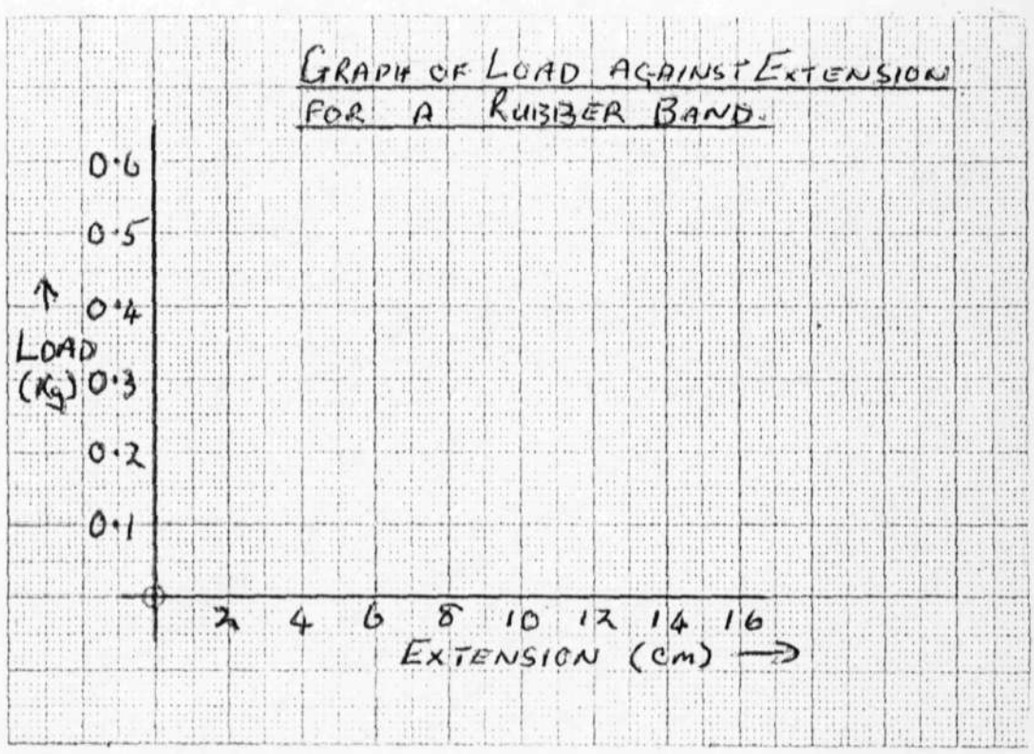
.....

.....

Q. 37-41


37 IS
38 IS
39 IS
40 IS
41 IS

Q. 44.


GRAPH OF LOAD AGAINST EXTENSION FOR A RUBBER BAND.
0·6
0·5
0·4
LOAD (Kg)
0·3
0·2
0·1
2 4 6 8 10 12 14 16
EXTENSION (cm) →

Appendix III

YEAR THREE ACHIEVEMENT TEST

KADUNA STATE MINISTRY OF EDUCATION
EDUCATIONAL RESOURCE CENTRE, ZARIA
JUNIOR SECONDARY SCHOOL EXAMINATION
JULY 1986

Code No. 09 INTEGRATED SCIENCE TIME: 1 hr 30 Mins.

PLEASE DO NOT OPEN THIS QUESTION BOOKLET UNTIL YOU ARE TOLD TO DO SO. WHILE YOU ARE WAITING READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. Write your Centre and Examination number where shown on top of the answer sheet you are given.

2. Also write your name in the space provided in the answer sheet.

3. Write name of the examination, the subject and the name of your school.

4. Read each question carefully before answering it.

5. Do not waste time on any question. If you find one difficult, go on to others and finish them beofe you come again to the difficult one (s).

6. After you have selected what you take to be the correct answer, go to your answer sheet and shade the space that corresponds with your choice.

7. There must not be more than one shading to an answer. Any shading more than one will be marked wrong.

8. If you change your mind about an answer, completely erase the first shading.

9. Use 2B pencils only.

10. Attempt all questions.

1. Anything that has weight and occupies a space is called:-

   A. Man

   B. Goat

   C. Matter

   D. Energy

   E. Force

2. Burning of firewood is an example of energy change from:-

   A. Chemical to electrical

   B. Chemical to heat

   C. Heat to chemical

   D. Electrical to chemical

   E. Heat to electrical.

3. Which one of these is not an act of indiscipline:-

   A. Drunkenness

   B. Laziness

   C. Prostitution

   D. Sense of responsibility

   E. Truancy.

4. Our body is generally made up of:-

   A. Water

   B. Cells

   C. Bones

   D. Hairs

   E. Muscles.

5. Drug abuse should not be allowed, so as:-

   A. To protect people from madness and abnormalities

   B. To keep the people antisocial

   C. To stop people normal life

   D. To stop people from taking medicine

   E. To make all people mad.

6. Which of the formulae is the correct formula for hydrochloric acid?

   A. CH

   B. SO_4

   C. Na_2SO_4

   D. H_2O

   E. HCl.

7. Which of these statements best describe deforestation?

   A. Clearing bushes and forest

   B. Clearing bushes but not forest

   C. Clearing only the climbers and twiners.

   D. Clearing the grass but leaving the stumps

   E. Clearing only the undergrown stems.

8. In which of these areas is the relative humidity almost Zero (0)?.

   A. Tropical rainforest
   B. Desert
   C. Sudan Savannah
   D. Southern guinea Savannah
   E. Northern guinea Savannah.

9. Mosquito is the carrier of micro-organism which causes:-

   A. Sleeping sickness
   B. Cholera
   C. Leprosy
   D. Dysentry
   E. Malaria.

10. When hydrogen combines with oxygen chemically, it results in production of:-

   A. Hydrogen oxygen
   B. Oxygen hydrogen
   C. Oxygen
   D. Water
   E. Hydrogen

11. Excess fats and oils are stored in the body in a form of:-

   A. Glucose
   B. Galactose
   C. Fats

D. Adipose tissues

E. Oils.

12. One of the methods of preventing soil erosion is by:-

A. Ploughing along slopes

B. Growing cover crops

C. Clearing all the bush

D. Allowing animals to graze all the grass

E. Felling trees and shrubs in the area.

13. The Joint of the bones which allows one plane movement to all directions is called:-

A. Hinge joint

B. Pivot joint

C. Ball and socket joint

D. Suture

E. Direct joint.

14. We can improve our personal cleanliness by the following except:-

A. Regular brushing of teeth.

B. Regular buying of cosmetics

C. Regular bathing

D. Regular washing of hair

E. Regular laundry of clothes.

15. Which of the following is not a chemical change.

A. Burning sugar B. Burning coal

C. Breaking glass into pieces

D. Heating iron and sulphur E. Heating magnesium

16. Which of the following insects shows incomplete metamorphosis?

A. Butterfly B. Mosquito C. Housefly
D. Cockroach E. Culex.

17. A material that helps in simplifying hard-work is

A. Strength B. Lever C. Engine
D. Car E. Lorry

18. The conditions necessary for rusting are the presence of:-

A. Air and moisture B. Moisture without air

C. Moisture, air and carbon D. Carbon and oxygen

E. None of the above.

19. A lever has three points to consider, thus force, load and:-

A. Power B. Strength C. Fulcrum

D. Leg E. Handle

20. Tests carried out in Science are known as:-

A. Properties B. Laws C. Hypothesis

D. Experiments E. None of the above.

21. A balanced diet is:-

A. A diet that contains the correct amount of all the food nutrients.

B. A diet that contains only carbohydrates

C. A diet that contains proteins

D. A diet that contains fats

E. A diet that contains mineral salts.

22. The force acting on a falling body is known as:-

A. Tension B. Magnetic force

C. Force of gravity D. Contact force

E. Non - magnetic force.

23. The word hypothesis in Science means:-

A. Classification B. Guesses C. Attraction

D. Observation E. Experiment.

24. Sugar not required immediately for the energy supply in the cells is stored in the liver in the form of:-

A. Protein B. Starch C. Glucose

D. Glycogen E. Amino acid.

25. What causes organic matter to break down?

A. Housefly B. Micro-organisms

C. Bacteria D. Mould E. Earth worm.

26. Which of the following is a good conductor of heat

A. Wood B. Glass C. Iron

D. Paper E. Rubber tube.

27. Unit of work is:-

A. Watt B. Joule C. Metre

D. Gramme E. Kilogramme.

28. One of the following acts both as a sense organ and an excretory organ:-

A. Kidney B. Lungs C. Liver

D. Skin E. Eye.

29. The purpose of using a machine is to:-

A. Make us lazy

B. Do work only when we fall sick

C. Do work more conveniently

D. Help us to relax well

E. None of the above.

30. The process in which the crude oil is separated is called:-

A. Chromotography B. Filtration

C. Extraction D. Separation

E. Fractional distillation.

31. The fusion of the male and female gametes to form a zygote is known as:-

A. Fertilization B. Fusion

C. Reproduction D. Ovulation

E. Menstruation.

32. The boiling point of water is:-

A. $40^{o}C$ B. $60^{o}C$ C. $80^{o}C$ D. $90^{o}C$

E. $100^{o}C$.

33. Plants are different from animals because of the presence of:-

A. Vacuole B. Chloroplast

C. Golgibodies D. Mitochondria E. Lysosomes.

34. A mango falls from the branch to the ground. Which of these tells the energy changes that has taken place?.

A. Kinetic _____ Potential _____ Sound

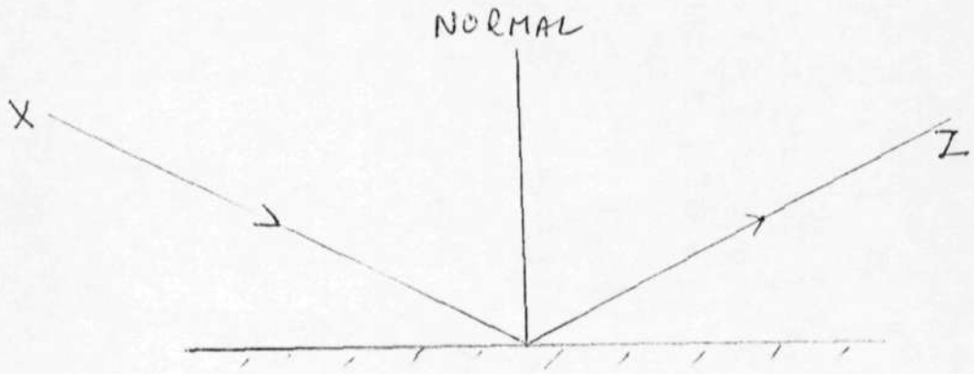
B. Potential _____ Sound _____ Kinetic

C. Sound _____ Potential _____ Kinetic

D. Kinetic _____ Sound _____ Potential

E. Potential _____ Kinetic _____ Sound.

Use this diagram to answer questions 35 and 36.



35. What is the name given to X?

A. Normal B. Angle of reflection

C. Angle of incidence D. Incident ray

E. Reflected ray.

36. What is the name given to Z?

A. Angle of reflection B. Reflected ray

C. Normal D. Angle of incidence

E. Incidence ray.

37. Which of the following represent the symbol of oxygen

A. O B. O_2 C. O_3 D. O^{-2} E O^{+2}.

38. What part of the eye does the same work as the film of a camera?

A. Pupils B. Lens C. Retina

D. Cornea E. Optic nerve.

39. If an atom has 17 electrons, how many electrons will be at the outer most shell:

A. 2 B. 17 C. 8 D. 10 E. 7

40. Exchange of materials between blood and cells takes place via:-

A. Veins B. Arteries C. Capillaries

D. Auricles E. Bones.

41. Which of the following statements is not true of metals?

A. They are good conductors of heat and electricity.

B. They are ductile and malleable

C. Their oxides are basic.

D. They can be used as insulators.

E. They are generally hard and strong.

42. Which class of machine (levers) does the tailor's scissors belong to?.

A. First class B. Second class

C. Third class D. Fourth class

E. Fifth class.

43. Which of the following is a product of petroleum

A. Palm oil B. Kerosine C. Soap

D. Detergent E. Milk.

44. Echo is produced as a result of:-

A. Reflection of sound B. Refraction of sound

C. Absorption of sound D. Due to heat

E. None of the above.

45. The mixture of two liquids which have different boiling points can be separated by:-

A. Distillation B. Fractional distillation

C. Evaporation D. Filtration

E. Decantation.

46. A man picked up a hot object and quickly dropped it. This type of action is:-

A. Voluntary action B. Simple action

C. Dropping action D. Involuntary action

E. Skin action.

47. The transfer of heat from one place to another takes place by:-

A. Conduction, Convection and radiation

B. Heating, feeling and eating

C. Moving, flying and running

D. Running, sitting and handing

E. None of the above,

48. What is the name given to a family that consists of man, wife and children?

A. Compound family B. Nuclear family

C. Social group D. Extended family

E. Divided family.

49. Each time we are able to apply a small force to produce a larger one (force) we say we have:-

A. Mechanical disadvantage B. Mechanical force

C. Pressure D. Force only

E. Mechanical advantage.

50. The nucleus of an atom contains:-

A. Neutron and Electron only

B. Proton and Neutron only

C. Proton, and Electrons only

D. Proton, Neutron and Electrons

E. Protons only.

51. Which among the following does not affect growth and development?

A. Exercise and Rest B. Heredity C. Blood

D. Disease E. Family

52. Gestation period is the:-

A. Copulation time B. Courtship period

C. Pregnancy period D. Menstural period

E. Period of puberty.

53. The process by which water vapour turns into clouds is called:-

A. Boiling point B. Converting point

C. Changing point D. Melting point

E. Condensation.

54. Which of the following is an example of omnivore?

A. Man B. Dog C. Goat D. Cat

E. Plants.

55. An instrument that supplies the natural conditions such as air, temperature and humidity required for hatching of eggs into chicks is called:-

A. Computer B. Amplifier C. Incubator

D. Monometer E. Hydrometer

56. Organisms that cause diseases are called:-

A. Carriers B. Vectors C. Agents

D. Hosts E. Intermmediate host.

57. Most living organisms start their lives as single cells called:-

A. Zygote B. Unicellular C. Multicellular

D. A cellular E. Cell membrane.

58. When a substance burns in air it means that the substance:-

A. Combines with all the gases in the air

B. Combines with oxygen in the air

C. Combines with nitrogen in the air

D. Combines with the inert gases in the air

E. Combines with air.

59. Light is produced when an electric bulb is connected to a battery. What type of energy conversion has taken place.

A. Potential energy to light energy

B. Electrical energy to light energy

C. Chemical energy to light energy.

D. Mechanical energy to light energy

E. Magnetic energy to light energy.

60. The moon revolves around the earth:-

A. Twice in about 30 days

B. Once in about 29 days

C. Once in about 15 days

D. Once in about 7 days

E. Twice in about 15 days.

61. The formula for finding the machanical advantage (M.A) of a machine is:-

A. $\frac{\text{Effort}}{\text{Load}}$ B. $\frac{\text{Work}}{\text{effort}}$ C. $\frac{\text{Load}}{\text{effort}}$

D. $\frac{\text{M.E.}}{\text{M.A}}$ E. $\frac{\text{M.A}}{\text{M.E}}$

62. Noise is a sound with:-

A. Irregular frequencies B. Regular frequencies

C. Loud pitch D. High overtunes

E. Low overtunes

63. Normal human body temperature is recorded as:-

A. $32^{o}C$ B. $35^{o}C$ C. $36^{o}C$ D. $37^{o}C$

E. $39^{o}C$

64. Muscles are attached to the bones by means of:-

A. Ligaments B. Cartilage C. Tendons

D. Synovial fluid E. Blood corpuscles

65. The planet nearest to the sun is:-

A. Mercury B. Venus C. Earth

D. Jupiter E. Moon.

66. Kwashiorkor is caused by lack of:-

A. Vitamins B. Carbonhydrates C. Proteins

D. Fats E. Acids.

67. What is the work done by a donkey that moves a load over 100 metres while exerting a force of 25 newtons:-

A. 1500 Joules B. 1725 Joules C. 950 Joules

D. 3500 Joules E. 2500 Joules

68. Mixture of iron filings and sulphur is best separated by:-

A. Chemical means

B. Both physical and chemical means

C. Physical means D. Solution means

E. Heating.

69. Car batteries contain:-

A. Hydrochloric acid B. Nitric acid

C. Sulphuric acid D. Nitrous oxide acid

E. Carbonic acid

70. Yankari Game reserve where animals are seen in their natural appearance is found in:-

A. Kano State B. Lagos State C. Bauchi State

D. Abuja E. Borno State.

71. The International organisation playing a leading part in assisting governments to develop their health programme is the:-

A. UNESCO B. W.H.O. C. UNICEF

D. OPEC E. OAU

72. Newton is the unit for measuring:-

A. electric charge B. Power C. Energy

D. Force E. Electric potential difference.

73. In a filtration process, the liquid that comes through the filter paper is called the:-

A. Filtrate B. Solute C. Solvent

D. Solution E. Impure liquid

74. Blood contains red and white blood cells it also contains platelets, which helps blood:-

A. to damage the cells of our body

B. to remove red cells from the body

C. to fight against disease germs which enter our body.

D. to clot wounds in our body

E. to allow germs into our body.

75. Sickle cell is another kind of blood disease, which affects the:-

A. Plasma B. Platelets C. White blood cell

D. Heart E. Red blood cell.

76. The theory of matter, that describes particles to be in continuous motion is known as:-

A. Dalton's theory B. Kinetic theory

C. Boyles law D. Charles law

E. Newton's law.

77. What phenomena best explains why a stone sinks in water pond, while a ball with similar size remains floating:-

A. Because the stone is heavier than the ball

B. Because the ball is very light while the stone is heavy.

C. Because the pond water is generally dirty and impure.

D. Because the pressure exerted by the stone on the water surface is greater while the pressure exerted from the water to the ball surface also is greater.

E. Because the density of the water is greater than air.

78. A meteorologist is a scientist who studies:-

A. Rain fall B. The weather

C. Predicts time D. Resets the thermometer

E. Soil

79. Balloon filled with hydrogen gas when released goes up into the sky because:-

A. Hydrogen is denser than air

B. Air is lighter than gas

C. Air moves faster than hydrogen

D. Hydrogen is the lightest gas and air is denser than hydrogen.

E. Air can support combustion.

80. Animals without backbones are called:-

A. Herbovores B. Carnivores

C. Invertebrates D. Vertebrates

E. Small animals.

APPENDICES IV to X

File Descriptions, Data analyses

and Data Files.

ORDER OF DATA PRESENTATION FOR EACH YEAR GROUP

1. Descriptive statistics of the continuous assessment scores for the entire Form showing:-
   - Number of observations
   - Missing observations
   - Arithmetic mean
   - Harmonic mean
   - Quadratic mean
   - Median
   - Mode
   - First quartile
   - Third quartile
   - Sum of y
   - Sum of y squared
   - Variance
   - Standard deviation
   - Coefficient of variation
   - Maximum score
   - Minimum score
2. Descriptive statistics of the continuous assessment scores for the sub-sample, boys, for the Form.
3. Descriptive statistics of the continuous assessment scores for the sub-sample, girls, for the Form.
4. Descriptive statistics of the attainment test scores for the entire Form
5. Descriptive statistics of the attainment test scores for the sub-sample, boys, for the Form.
6. Descriptive statistics of the attainment test scores for the sub-sample, girls, for the Form.
7. Descriptive statistics of the progressive matrices test scores for the entire Form.
8. Descriptive statistics of the progressive matrices test scores for the sub-sample, boys, for the Form.
9. Descriptive statistics of the progressive matrices test scores for the sub-sample, girls, for the Form.
10. Frequency table and Histogram of the continuous assessment scores for the entire Form
11. Frequency table and Histogram of the attainment test scores for the entire Form
12. Frequency table and Histogram of the progressive matrices test scores for the entire Form

13. Correlation matrix and variance,co-variance matrix for continuous assessment, attainment test and progressive matrices scores for the entire Form.

14. Correlation matrix and variance,co-variance matrix for continuous assessment,attainment test and progressive matrices scores for the sub-sample, boys, for the Form.

15. Correlation matrix and variance,co-variance matrix for continuous assessment, attainment test and progressive matrices scores for the sub-sample, girls, for the Form

16. Results of the t test comparing the continuous assessment scores of the sub-samples boys and girls in the Form.

17. Results of the t test comparing the attainment test scores of the sub-samples boys and girls in the Form.

18. Results of the t test comparing the progressive matrices scores of the sub-samples boys and girls in the Form.

19. Correlation matrix and variance,co-variance matrix for the split-half test applied to the odd and even items of the progressive matrices scores for the entire Form.

20. Descriptive statistics for Test-retest sample for attainment test, original and retest scores.

21. Correlation matrix and variance,co-variance matrix for Test-retest data on attainment test sample.

FILE TITLES

Each of the three Year Groups, or Forms as they were described to the computer, has data stored on computer 'files' labelled for easy identification according to the following system :-

- each Form is identified as f1, f2 or f3
- each instrument is identified as ca, for continuous assessment; at for attainment test; and pm for the non verbal intelligence test (Raven's progresive matrices)
- where the results of an entire Form are listed this is represented by the suffix all. Where boys only are listed this is reprented by the suffix b, and for girls g.

For example a set of results listed as f3pmb would be Form 3, progressive matrices scores for boys only; f1caall represents Form 1, continuous assessment scores for the entire form.

A further system of coding was introduced when dealing with the question of test instrument reliability. Two methods were used, test-retest in the case of the attainment tests used for Forms 1 and 2, and the split-half correlation test in the case of the attainment test for Form 3 and for all the progressive matrices tests. Again a series of identifying suffixes was used as follows :-

- TRT identifies test-retest plus an additional indicator of ori, for original scores and rte for the retest scores e.g. f1TRTori represents the Form 1 sample in the test-retest experiment, original scores, f1TRTrte being the retest scores.
- in the case of the split-half results these have the suffixes she, for even numbered items and sho for the odd numbered items e.g f3atsho represents Form 3 attainment test scores for odd numbered items.

Appendix V

Year One descriptive data, histograms, correlation matrices, t-tests and test reliability data.

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
*** COPYRIGHT GOODE SOFTWARE 1986 ***

FILENAME = flcaall

Number of observations	=	138
Missing observations	=	0
Arithmetric mean	=	60.83333
Harmonic mean	=	55.77361
Quadratic mean	=	62.91293
Median	=	62
Mode	=	66
First quartile	=	49
Third quartile	=	73
Sum of y	=	8395
Sum of y squared	=	546209
Variance	=	259.2202
Standard deviation	=	16.10032
Coefficient of variation	=	26.46628
Maximum	=	97
Minimum	=	21

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = flcab

Number of observations	=	69
Missing observations	=	0
Arithmetric mean	=	59.65217
Harmonic mean	=	53.31173
Quadratic mean	=	62.22423
Median	=	62
Mode	=	66
First quartile	=	44
Third quartile	=	73.5
Sum of y	=	4116
Sum of y squared	=	267158
Variance	=	318.0832
Standard deviation	=	17.83489
Coefficient of variation	=	29.89813
Maximum	=	97
Minimum	=	21

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
*** COPYRIGHT GOODE SOFTWARE 1986 ***

FILENAME = flcag

Number of observations	=	69
Missing observations	=	0
Arithmetric mean	=	62.01449
Harmonic mean	=	58.47388
Quadratic mean	=	63.59416
Median	=	62
Mode	=	45
First quartile	=	51.5
Third quartile	=	70
Sum of y	=	4279
Sum of y squared	=	279051
Variance	=	201.3381
Standard deviation	=	14.18937
Coefficient of variation	=	22.88073
Maximum	=	91
Minimum	=	26

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = flatall

Number of observations	=	138
Missing observations	=	0
Arithmetric mean	=	55.15217
Harmonic mean	=	50.11579
Quadratic mean	=	57.3875
Median	=	53
Mode	=	53
First quartile	=	43
Third quartile	=	68.5
Sum of y	=	7611
Sum of y squared	=	454479
Variance	=	253.4001
Standard deviation	=	15.91855
Coefficient of variation	=	28.86296
Maximum	=	95
Minimum	=	21

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
*** COPYRIGHT GOODE SOFTWARE 1986 ***

FILENAME = flatb

Number of observations	=	69
Missing observations	=	0
Arithmetric mean	=	54.36232
Harmonic mean	=	49.43712
Quadratic mean	=	56.52973
Median	=	53
Mode	=	34
First quartile	=	41.5
Third quartile	=	67.5
Sum of y	=	3751
Sum of y squared	=	220497
Variance	=	243.8815
Standard deviation	=	15.61671
Coefficient of variation	=	28.72708
Maximum	=	89
Minimum	=	23

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
*** COPYRIGHT GOODE SOFTWARE 1986 ***

FILENAME = flatg

Number of observations	=	69
Missing observations	=	0
Arithmetric mean	=	55.46377
Harmonic mean	=	50.50007
Quadratic mean	=	57.64622
Median	=	53
Mode	=	53
First quartile	=	43.5
Third quartile	=	69
Sum of y	=	3827
Sum of y squared	=	229293
Variance	=	250.4877
Standard deviation	=	15.8268
Coefficient of variation	=	28.53539
Maximum	=	93
Minimum	=	21

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = flpmall

Number of observations	=	138
Missing observations	=	0
Arithmetric mean	=	37.91304
Harmonic mean	=	31.28186
Quadratic mean	=	39.67842
Median	=	40
Mode	=	46
First quartile	=	32.5
Third quartile	=	46
Sum of y	=	5232
Sum of y squared	=	217264
Variance	=	137.9777
Standard deviation	=	11.74639
Coefficient of variation	=	30.98245
Maximum	=	55
Minimum	=	7

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = flpmb

Number of observations	=	69
Missing observations	=	0
Arithmetric mean	=	39.27536
Harmonic mean	=	33.16639
Quadratic mean	=	40.85677
Median	=	42
Mode	=	46
First quartile	=	34.5
Third quartile	=	47
Sum of y	=	2710
Sum of y squared	=	115180
Variance	=	128.5848
Standard deviation	=	11.33953
Coefficient of variation	=	28.87185
Maximum	=	54
Minimum	=	9

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = flpmg

Number of observations	=	69
Missing observations	=	0
Arithmetric mean	=	36.53623
Harmonic mean	=	29.59434
Quadratic mean	=	38.44609
Median	=	39
Mode	=	46
First quartile	=	30.5
Third quartile	=	46
Sum of y	=	2521
Sum of y squared	=	101989
Variance	=	145.3112
Standard deviation	=	12.05451
Coefficient of variation	=	32.9933
Maximum	=	55
Minimum	=	7

QUASAR - FREQUENCY ROUTINE
Release 1.4
*** COPYRIGHT GOODE SOFTWARE 1986 ***

FILENAME = flcaall

VALUE	FREQUENCY	PERCENT	CUM PERCENT
0	0	0	0
10	0	0	0
20	0	0	0
30	5	3.62	3.62
40	11	7.97	11.59
50	19	13.77	25.36
60	29	21.01	46.37
70	34	24.64	71.01
80	23	16.67	87.68
90	14	10.14	97.82
100	3	2.17	100
Totals	138	100	100

HISTOGRAM OF FREQUENCIES FILENAME = flcaall

```
Value
        I-------I-------I-------I-------I-------I
 0      I
 10     I
 20     I
 30     I*****
 40     I**********
 50     I******************
 60     I****************************
 70     I************************************
 80     I************************
 90     I*************
 100    I***
        I-------I-------I-------I-------I-------I
        0       8.5     17      25.5    34      42.5
```

Each star is equal to approximately 1.0625

QUASAR - FREQUENCY ROUTINE
Release 1.4
*** COPYRIGHT GOODE SOFTWARE 1986 ***

FILENAME = flatall

VALUE	FREQUENCY	PERCENT	CUM PERCENT
0	0	0	0
10	0	0	0
20	0	0	0
30	8	5.8	5.8
40	18	13.04	18.84
50	29	21.01	39.85
60	29	21.01	60.86
70	28	20.29	81.15
80	18	13.04	94.19
90	8	4.35	98.54
100	2	1.45	100
Totals	138	100	100

HISTOGRAM OF FREQUENCIES FILENAME = flatall

```
Value
        I-------I-------I-------I-------I-------I
 0      I
 10     I
 20     I
 30     I*********
 40     I*********************
 50     I***********************************
 60     I***********************************
 70     I**********************************
 80     I*********************
 90     I********
 100    I**
        I-------I-------I-------I-------I-------I
        0       7.25    14.5    21.75   29      36.25
```

Each star is equal to approximately 0.90625

QUASAR - FREQUENCY ROUTINE
Release 1.4
*** COPYRIGHT GOODE SOFTWARE 1986 ***

FILENAME = flpmall

VALUE	FREQUENCY	PERCENT	CUM PERCENT
0	0	0	0
5	0	0	0
10	4	2.9	2.9
15	6	4.35	7.25
20	8	5.8	13.05
25	4	2.9	15.95
30	8	5.8	21.75
35	14	10.14	31.89
40	26	18.84	50.73
45	24	17.39	68.12
50	32	23.19	91.31
55	12	8.7	100
Totals	138	100	100

HISTOGRAM OF FREQUENCIES FILENAME = flpmall

```
Value
        I-------I-------I-------I-------I-------I
 0      I
 5      I
 10     I****
 15     I******
 20     I********
 25     I****
 30     I********
 35     I**************
 40     I**************************
 45     I************************
 50     I********************************
 55     I************
        I-------I-------I-------I-------I-------I
        0       8       16      24      32      40
```

Each star is equal to approximately 1

QUASAR - CORRELATION ROUTINE
Release 1.3
*** COPYRIGHT GOODE SOFTWARE 1986 ***

CORRELATION MATRIX

		flca all	flat all	flpm all
flca all	*	1.0000		
flat all	*	0.6623	1.0000	
flpm all	*	0.3711	0.4441	1.0000

VARIANCE CO-VARIANCE MATRIX

		flca all	flat all	flpm all
flca all	*	259.2203		
flat all	*	169.7336	253.4001	
flpm all	*	70.18248	83.03513	137.9778

QUASAR - CORRELATION ROUTINE
Release 1.3
*** COPYRIGHT GOODE SOFTWARE 1986 ***

CORRELATION MATRIX

		flca boys	flat boys	flpm boys
flca boys	*	1.0000		
flat boys	*	0.7397	1.0000	
flpm boys	*	0.5056	0.5374	1.0000

VARIANCE CO-VARIANCE MATRIX

		flca boys	flat boys	flpm boys
flca boys	*	318.0832		
flat boys	*	206.025	243.8814	
flpm boys	*	102.2443	95.16338	128.5848

QUASAR - CORRELATION ROUTINE
Release 1.3
*** COPYRIGHT GOODE SOFTWARE 1986 ***

CORRELATION MATRIX

	flca girls	flat girls	flpm girls
flca girls*	1.0000		
flat girls*	0.5514	1.0000	
flpm girls*	0.2434	0.3726	1.0000

VARIANCE CO-VARIANCE MATRIX

	flca girls	flat girls	flpm girls
flca girls*	201.3378		
flat girls*	123.8313	250.4876	
flpm girls*	41.63925	71.08594	145.3111

STATISTICAL TEST 9
t test (independent samples)

RESULTS
Data set one taken from flcab
Number of observations = 69
Mean of data set one = 59.65217

Data set two taken from flcag
Number of observations = 69
Mean of data set two = 62.01449

t-statistic (pooled) = -0.8610008
t-statistic (separate) = -0.8610008
Degrees of freedom = 136

STATISTICAL TEST 9
t test (independent samples)

RESULTS
Data set one taken from flatb
Number of observations = 69
Mean of data set one = 54.36232

Data set two taken from flatg
Number of observations = 69
Mean of data set two = 55.46377

t-statistic (pooled) = -0.4114935
t-statistic (separate) = -0.4114935
Degrees of freedom = 136

STATISTICAL TEST 9
t test (independent samples)

RESULTS
Data set one taken from flpmb
Number of observations = 69
Mean of data set one = 39.27536

Data set two taken from flpmg
Number of observations = 69
Mean of data set two = 36.53623

t-statistic (pooled) = 1.374816
t-statistic (separate) = 1.374816
Degrees of freedom = 136

QUASAR - CORRELATION ROUTINE
Release 1.3
*** COPYRIGHT GOODE SOFTWARE 1986 ***

CORRELATION MATRIX

	flpmsh odd	flpmsh even
flpmsh odd*	1.0000	
flpmsh even *	0.9171	1.0000

VARIANCE CO-VARIANCE MATRIX

	flpmsh odd	flpmsh even
flpmsh odd*	39.24686	
flpmsh even *	33.0759	33.1396

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
*** COPYRIGHT GOODE SOFTWARE 1986 ***

FILENAME = f1TRTori

Number of observations	=	30
Missing observations	=	0
Arithmetric mean	=	56.6
Harmonic mean	=	49.17366
Quadratic mean	=	59.74947
Median	=	53
Mode	=	53
First quartile	=	43
Third quartile	=	73
Sum of y	=	1698
Sum of y squared	=	107100
Variance	=	379.0759
Standard deviation	=	19.46987
Coefficient of variation	=	34.39906
Maximum	=	95
Minimum	=	23

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f1TRTrte

Number of observations	=	30
Missing observations	=	0
Arithmetric mean	=	57.26667
Harmonic mean	=	50.79673
Quadratic mean	=	60.08882
Median	=	58
Mode	=	67
First quartile	=	46.5
Third quartile	=	67
Sum of y	=	1718
Sum of y squared	=	108320
Variance	=	342.6161
Standard deviation	=	18.50989
Coefficient of variation	=	32.32228
Maximum	=	100
Minimum	=	25

QUASAR - CORRELATION ROUTINE
Release 1.3
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CORRELATION MATRIX

		f1TRTori	f1TRTrte
f1TRTori	*	1.0000	
f1TRTrte	*	0.9001	1.0000

VARIANCE CO-VARIANCE MATRIX

		f1TRTori	f1TRTrte
f1TRTori	*	379.076	
f1TRTrte	*	324.3863	342.6161

Year Two descriptive data, histograms, correlation matrices, t-tests and test reliability data.

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f2caall

Number of observations	=	160
Missing observations	=	0
Arithmetric mean	=	163.1
Harmonic mean	=	141.92
Quadratic mean	=	171.3829
Median	=	161.5
Mode	=	96
First quartile	=	123.5
Third quartile	=	202.5
Sum of y	=	26096
Sum of y squared	=	4699538
Variance	=	2787.927
Standard deviation	=	52.80082
Coefficient of variation	=	32.37328
Maximum	=	280
Minimum	=	41

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f2cab

Number of observations	=	91
Missing observations	=	0
Arithmetric mean	=	173.8132
Harmonic mean	=	156.1447
Quadratic mean	=	180.4745
Median	=	177
Mode	=	139
First quartile	=	139
Third quartile	=	210
Sum of y	=	15817
Sum of y squared	=	2963965
Variance	=	2386.242
Standard deviation	=	48.84919
Coefficient of variation	=	28.10442
Maximum	=	280
Minimum	=	41

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f2cag

Number of observations	=	69
Missing observations	=	0
Arithmetric mean	=	148.9565
Harmonic mean	=	126.6853
Quadratic mean	=	158.5853
Median	=	142
Mode	=	189
First quartile	=	110
Third quartile	=	189
Sum of y	=	10278
Sum of y squared	=	1735300
Variance	=	3004.778
Standard deviation	=	54.81584
Coefficient of variation	=	36.79989
Maximum	=	271
Minimum	=	45

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f2atall

Number of observations	=	160
Missing observations	=	0
Arithmetric mean	=	71.74375
Harmonic mean	=	61.66931
Quadratic mean	=	74.54665
Median	=	74
Mode	=	76
First quartile	=	60.5
Third quartile	=	87
Sum of y	=	11479
Sum of y squared	=	889153
Variance	=	412.6195
Standard deviation	=	20.31304
Coefficient of variation	=	28.31332
Maximum	=	108
Minimum	=	9

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f2atb

Number of observations	=	91
Missing observations	=	0
Arithmetric mean	=	74.30769
Harmonic mean	=	64.04163
Quadratic mean	=	76.4409
Median	=	76
Mode	=	76
First quartile	=	67
Third quartile	=	87
Sum of y	=	6762
Sum of y squared	=	531732
Variance	=	325.1487
Standard deviation	=	18.03189
Coefficient of variation	=	24.26651
Maximum	=	106
Minimum	=	9

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f2atg

Number of observations	=	69
Missing observations	=	0
Arithmetric mean	=	68.36232
Harmonic mean	=	58.79679
Quadratic mean	=	71.97231
Median	=	67
Mode	=	65
First quartile	=	54
Third quartile	=	88
Sum of y	=	4717
Sum of y squared	=	357421
Variance	=	514.058
Standard deviation	=	22.67285
Coefficient of variation	=	33.16571
Maximum	=	108
Minimum	=	21

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f2pmall

Number of observations	=	160
Missing observations	=	0
Arithmetric mean	=	38.7375
Harmonic mean	=	33.49665
Quadratic mean	=	40.01563
Median	=	39.5
Mode	=	37
First quartile	=	35
Third quartile	=	45.5
Sum of y	=	6198
Sum of y squared	=	256200
Variance	=	101.2892
Standard deviation	=	10.06425
Coefficient of variation	=	25.98065
Maximum	=	56
Minimum	=	6

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f2pmb

Number of observations	=	91
Missing observations	=	0
Arithmetric mean	=	40.12088
Harmonic mean	=	37.6375
Quadratic mean	=	40.99384
Median	=	41
Mode	=	46
First quartile	=	36
Third quartile	=	46
Sum of y	=	3651
Sum of y squared	=	152925
Variance	=	71.59633
Standard deviation	=	8.461461
Coefficient of variation	=	21.08992
Maximum	=	55
Minimum	=	13

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
*** COPYRIGHT GOODE SOFTWARE 1986 ***

FILENAME = f2pmg

Number of observations	=	69
Missing observations	=	0
Arithmetric mean	=	36.91304
Harmonic mean	=	29.25219
Quadratic mean	=	38.68771
Median	=	38
Mode	=	37
First quartile	=	32
Third quartile	=	45
Sum of y	=	2547
Sum of y squared	=	103275
Variance	=	136.1394
Standard deviation	=	11.66788
Coefficient of variation	=	31.60909
Maximum	=	56
Minimum	=	6

Release 1.4
*** COPYRIGHT GOODE SOFTWARE 1986 ***

FILENAME = f2caall

VALUE	FREQUENCY	PERCENT	CUM PERCENT
0	0	0	0
20	0	0	0
40	0	0	0
60	3	1.88	1.88
80	9	5.63	7.51
100	11	6.88	14.39
120	13	8.13	22.52
140	22	13.75	36.27
160	19	11.88	48.15
180	16	10	58.15
200	25	15.63	73.78
220	17	10.63	84.41
240	14	8.75	93.16
260	7	4.38	97.54
280	4	2.5	100
Totals	160	100	100

HISTOGRAM OF FREQUENCIES FILENAME = f2caall

```
Value
        I-------I-------I-------I-------I-------I
 0      I
 20     I
 40     I
 60     I****
 80     I*************
 100    I***************
 120    I******************
 140    I*****************************
 160    I************************
 180    I********************
 200    I*********************************
 220    I************************
 240    I******************
 260    I**********
 280    I*****
        I-------I-------I-------I-------I-------I
        0       6.25    12.5    18.75   25      31.25
```

Each star is equal to approximately 0.78125

Release 1.4
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FILENAME = f2atall

VALUE	FREQUENCY	PERCENT	CUM PERCENT
0	0	0	0
10	1	0.63	0.63
20	1	0.63	1.26
30	6	3.75	5.01
40	7	4.38	9.39
50	7	4.38	13.77
60	18	11.25	25.02
70	26	16.25	41.27
80	42	26.25	67.52
90	24	15	82.52
100	20	12.5	95.02
110	8	5	100
Totals	160	100	100

HISTOGRAM OF FREQUENCIES FILENAME = f2atall

```
Value
        I-------I-------I-------I-------I-------I
 0      I
 10     I*
 20     I*
 30     I******
 40     I******
 50     I******
 60     I***************
 70     I**********************
 80     I************************************
 90     I*******************
 100    I****************
 110    I*******
        I-------I-------I-------I-------I-------I
        0       10.5    21      31.5    42      52.5
```

Each star is equal to approximately 1.3125

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FILENAME = f2pmall

VALUE	FREQUENCY	PERCENT	CUM PERCENT
0	0	0	0
5	0	0	0
10	4	2.5	2.5
15	3	1.88	4.38
20	3	1.88	6.26
25	5	3.13	9.39
30	10	6.25	15.64
35	22	13.75	29.39
40	40	25	54.39
45	33	20.63	75.02
50	21	13.12	88.14
55	18	11.25	99.39
60	1	0.63	100
Totals	160	100	100

HISTOGRAM OF FREQUENCIES FILENAME = f2pmall

```
Value
        I-------I-------I-------I-------I-------I
 0      I
 5      I
 10     I***
 15     I**
 20     I**
 25     I****
 30     I********
 35     I******************
 40     I**********************************
 45     I****************************
 50     I*****************
 55     I**************
 60     I*
        I-------I-------I-------I-------I-------I
        0       10      20      30      40      50
```

Each star is equal to approximately 1.25

*** COPYRIGHT GOODE SOFTWARE 1986 ***

CORRELATION MATRIX

		f2caall	f2atall	f2pmall
f2caall	*	1.0000		
f2atall	*	0.7676	1.0000	
f2pmall	*	0.4871	0.504	1.0000

VARIANCE CO-VARIANCE MATRIX

		f2caall	f2atall	f2pmall
f2caall	*	2787.928		
f2atall	*	823.3019	412.6195	
f2pmall	*	258.8376	103.0456	101.2891

QUASAR - CORRELATION ROUTINE
Release 1.3
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CORRELATION MATRIX

		f2cab	f2atb	f2pmb
f2cab	*	1.0000		
f2atb	*	0.6955	1.0000	
f2pmb	*	0.3779	0.433	1.0000

VARIANCE CO-VARIANCE MATRIX

		f2cab	f2atb	f2pmb
f2cab	*	2386.242		
f2atb	*	612.5917	325.1486	
f2pmb	*	156.2118	66.0625	71.59635

CORRELATION MATRIX

		f2cag	f2atg	f2pmg
f2cag	*	1.0000		
f2atg	*	0.8278	1.0000	
f2pmg	*	0.5511	0.5387	1.0000

VARIANCE CO-VARIANCE MATRIX

		f2cag	f2atg	f2pmg
f2cag	*	3004.776		
f2atg	*	1028.81	514.0579	
f2pmg	*	352.4963	142.5025	136.1394

STATISTICAL TEST 9
t test (independent samples)

RESULTS
Data set one taken from f2cab
Number of observations = 91
Mean of data set one = 173.8132

Data set two taken from f2cag
Number of observations = 69
Mean of data set two = 148.9565

t-statistic (pooled) = 3.023464
t-statistic (separate) = 2.975833
Degrees of freedom = 158

STATISTICAL TEST 9
t test (independent samples)

RESULTS
Data set one taken from f2atb
Number of observations = 91
Mean of data set one = 74.30769

Data set two taken from f2atg
Number of observations = 69
Mean of data set two = 68.36232

t-statistic (pooled) = 1.847396
t-statistic (separate) = 1.790712
Degrees of freedom = 158

STATISTICAL TEST 9
t test (independent samples)

RESULTS
Data set one taken from f2pmb
Number of observations = 91
Mean of data set one = 40.12088

Data set two taken from f2pmg
Number of observations = 69
Mean of data set two = 36.91304

t-statistic (pooled) = 2.01586
t-statistic (separate) = 1.930958
Degrees of freedom = 158

QUASAR - CORRELATION ROUTINE
Release 1.3
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CORRELATION MATRIX

	f2pmsh odd	f2pmsh even
f2pmsh odd*	1.0000	
f2pmsh even *	0.8719	1.0000

VARIANCE CO-VARIANCE MATRIX

	f2pmsh odd	f2pmsh even
f2pmsh odd*	30.57852	
f2pmsh even *	24.19211	25.17827

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f2TRTori

Number of observations	=	34
Missing observations	=	0
Arithmetric mean	=	71
Harmonic mean	=	64.13748
Quadratic mean	=	73.27304
Median	=	72.5
Mode	=	64
First quartile	=	63.5
Third quartile	=	85
Sum of y	=	2414
Sum of y squared	=	182544
Variance	=	337.8788
Standard deviation	=	18.38148
Coefficient of variation	=	25.88941
Maximum	=	107
Minimum	=	21

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f2TRTrte

Number of observations	=	34
Missing observations	=	0
Arithmetric mean	=	74.70588
Harmonic mean	=	67.28074
Quadratic mean	=	76.91592
Median	=	78
Mode	=	78
First quartile	=	65.5
Third quartile	=	85.5
Sum of y	=	2540
Sum of y squared	=	201146
Variance	=	345.2442
Standard deviation	=	18.58075
Coefficient of variation	=	24.87187
Maximum	=	111
Minimum	=	20

QUASAR - CORRELATION ROUTINE
Release 1.3
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CORRELATION MATRIX

		f2TRTori	f2TRTrte
f2TRTori	*	1.0000	
f2TRTrte	*	0.8097	1.0000

VARIANCE CO-VARIANCE MATRIX

		f2TRTori	f2TRTrte
f2TRTori	*	337.8788	
f2TRTrte	*	276.5454	345.2443

Appendix VII

Year Three descriptive data, histograms, correlation matrices, t-tests and test reliability data.

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f3caall

Number of observations	=	148
Missing observations	=	0
Arithmetric mean	=	34.30405
Harmonic mean	=	32.32573
Quadratic mean	=	35.2448
Median	=	34
Mode	=	32
First quartile	=	28
Third quartile	=	40
Sum of y	=	5077
Sum of y squared	=	183845
Variance	=	65.87289
Standard deviation	=	8.116212
Coefficient of variation	=	23.65963
Maximum	=	57
Minimum	=	17

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f3cab

Number of observations	=	87
Missing observations	=	0
Arithmetric mean	=	35.10345
Harmonic mean	=	33.06859
Quadratic mean	=	36.03542
Median	=	35
Mode	=	32
First quartile	=	29
Third quartile	=	42
Sum of y	=	3054
Sum of y squared	=	112974
Variance	=	67.07056
Standard deviation	=	8.189662
Coefficient of variation	=	23.33008
Maximum	=	53
Minimum	=	17

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f3cag

Number of observations	=	61
Missing observations	=	0
Arithmetric mean	=	33.26229
Harmonic mean	=	31.37472
Quadratic mean	=	34.20934
Median	=	33
Mode	=	33
First quartile	=	27
Third quartile	=	38
Sum of y	=	2029
Sum of y squared	=	71387
Variance	=	64.9634
Standard deviation	=	8.059989
Coefficient of variation	=	24.23161
Maximum	=	57
Minimum	=	18

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f3atall

Number of observations	=	148
Missing observations	=	0
Arithmetric mean	=	25.07432
Harmonic mean	=	24.28288
Quadratic mean	=	25.45518
Median	=	25
Mode	=	23
First quartile	=	22
Third quartile	=	28.5
Sum of y	=	3711
Sum of y squared	=	95899
Variance	=	19.37539
Standard deviation	=	4.401749
Coefficient of variation	=	17.5548
Maximum	=	34
Minimum	=	15

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f3atb

Number of observations	=	87
Missing observations	=	0
Arithmetric mean	=	25.94253
Harmonic mean	=	25.23449
Quadratic mean	=	26.27332
Median	=	26
Mode	=	23
First quartile	=	23
Third quartile	=	29
Sum of y	=	2257
Sum of y squared	=	60055
Variance	=	17.4734
Standard deviation	=	4.18012
Coefficient of variation	=	16.113
Maximum	=	33
Minimum	=	16

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f3atg

Number of observations	=	61
Missing observations	=	0
Arithmetric mean	=	23.83607
Harmonic mean	=	23.04349
Quadratic mean	=	24.2406
Median	=	23
Mode	=	23
First quartile	=	21
Third quartile	=	26.5
Sum of y	=	1454
Sum of y squared	=	35844
Variance	=	19.77268
Standard deviation	=	4.446649
Coefficient of variation	=	18.65513
Maximum	=	34
Minimum	=	15

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f3pmall

Number of observations	=	148
Missing observations	=	0
Arithmetric mean	=	43.03378
Harmonic mean	=	40.50243
Quadratic mean	=	43.85456
Median	=	45
Mode	=	45
First quartile	=	39
Third quartile	=	49
Sum of y	=	6369
Sum of y squared	=	284637
Variance	=	71.80158
Standard deviation	=	8.47358
Coefficient of variation	=	19.69053
Maximum	=	57
Minimum	=	13

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f3pmb

Number of observations	=	87
Missing observations	=	0
Arithmetric mean	=	44.41379
Harmonic mean	=	42.51877
Quadratic mean	=	45.06804
Median	=	46
Mode	=	47
First quartile	=	41
Third quartile	=	50
Sum of y	=	3864
Sum of y squared	=	176708
Variance	=	59.22212
Standard deviation	=	7.69559
Coefficient of variation	=	17.32703
Maximum	=	57
Minimum	=	15

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f3pmg

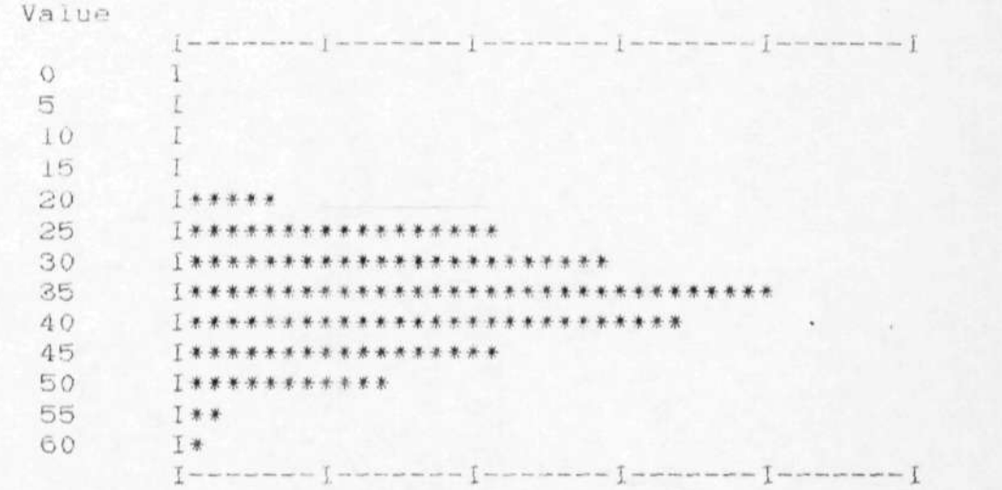
Number of observations	=	61
Missing observations	=	0
Arithmetric mean	=	41.06557
Harmonic mean	=	37.93656
Quadratic mean	=	42.06338
Median	=	44
Mode	=	45
First quartile	=	36
Third quartile	=	48
Sum of y	=	2505
Sum of y squared	=	107929
Variance	=	84.32896
Standard deviation	=	9.18308
Coefficient of variation	=	22.36199
Maximum	=	55
Minimum	=	13

Release 1.4
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FILENAME = f3caall

VALUE	FREQUENCY	PERCENT	CUM PERCENT
0	0	0	0
5	0	0	0
10	0	0	0
15	0	0	0
20	5	3.38	3.38
25	19	12.84	16.22
30	25	16.89	33.11
35	35	23.65	56.76
40	30	20.27	77.03
45	19	12.84	89.87
50	12	8.11	97.98
55	2	1.35	99.33
60	1	0.68	100
Totals	148	100	100

HISTOGRAM OF FREQUENCIES FILENAME = f3caall



Each star is equal to approximately 1.09375

QUASAR - FREQUENCY ROUTINE
Release 1.4
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FILENAME = f3atali

VALUE	FREQUENCY	PERCENT	CUM PERCENT
0	0	0	0
4	0	0	0
8	0	0	0
12	0	0	0
16	3	2.03	2.03
20	21	14.19	16.22
24	49	33.11	49.33
28	38	25.68	75.01
32	29	19.59	94.6
36	8	5.41	100
Totals	148	100	100

HISTOGRAM OF FREQUENCIES FILENAME = f3atall

```
Value
        I-------I-------I-------I-------I-------I
 0      I
 4      I
 8      I
 12     I
 16     I**
 20     I**************
 24     I**********************************
 28     I************************
 32     I********************
 36     I*****
  .     I-------I-------I-------I-------I-------I
        0       12.25   24.5    36.75   49  .    61.25

        Each star is equal to approximately 1.53125
```

QUASAR - FREQUENCY ROUTINE
Release 1.4
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FILENAME = f3pmall

VALUE	FREQUENCY	PERCENT	CUM PERCENT
0	0	0	0
5	0	0	0
10	0	0	0
15	3	2.03	2.03
20	0	0	2.03
25	3	2.03	4.06
30	9	6.08	10.14
35	11	7.43	17.57
40	15	10.14	27.71
45	39	26.35	54.06
50	45	30.41	84.47
55	20	13.51	97.98
60	3	2.03	100
Totals	148	100	100

HISTOGRAM OF FREQUENCIES FILENAME = f3pmall

```
Value
        I-------I-------I-------I-------I-------I
 0      I
 5      I
 10     I
 15     I**
 20     I
 25     I**
 30     I******
 35     I********
 40     I************
 45     I****************************
 50     I************************************
 55     I**************
 60     I**
        I-------I-------I-------I-------I-------I
        0       11.25   22.5    33.75   45      56.25

        Each star is equal to approximately 1.40625
```

QUASAR - CORRELATION ROUTINE
Release 1.3
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CORRELATION MATRIX

		f3ca all	f3at all	f3pm all
f3ca all	*	1.0000		
f3at all	*	0.7662	1.0000	
f3pm all	*	0.442	0.4794	1.0000

VARIANCE CO-VARIANCE MATRIX

		f3ca all	f3at all	f3pm all
f3ca all	*	65.87287		
f3at all	*	27.37176	19.37537	
f3pm all	*	30.39775	17.8818	71.80166

QUASAR - CORRELATION ROUTINE
Release 1.3
*** COPYRIGHT GOODE SOFTWARE 1986 ***

CORRELATION MATRIX

		f3ca boys	f3at boys	f3pm boys
f3ca boys	*	1.0000		
f3at boys	*	0.7797	1.0000	
f3pm boys	*	0.4303	0.5216	1.0000

VARIANCE CO-VARIANCE MATRIX

		f3ca boys	f3at boys	f3pm boys
f3ca boys	*	67.07059		
f3at boys	*	26.69204	17.47338	
f3pm boys	*	27.11955	16.77989	59.2222

QUASAR - CORRELATION ROUTINE
Release 1.3
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CORRELATION MATRIX

	f3ca girls	f3at girls	f3pm girls
f3ca girls*	1.0000		
f3at girls*	0.7443	1.0000	
f3pm girls*	0.4353	0.3807	1.0000

VARIANCE CO-VARIANCE MATRIX

	f3ca girls	f3at girls	f3pm girls
f3ca girls*	64.96341		
f3at girls*	26.67702	19.77266	
f3pm girls*	32.21589	15.54427	84.3289

STATISTICAL TEST 9
t test (independent samples)

RESULTS
Data set one taken from f3cab
Number of observations = 87
Mean of data set one = 35.10345

Data set two taken from f3cag
Number of observations = 61
Mean of data set two = 33.26229

t-statistic (pooled) = 1.355
t-statistic (separate) = 1.35883
Degrees of freedom = 146

STATISTICAL TEST 9
t test (independent samples)

RESULTS
Data set one taken from f3atb
Number of observations = 87
Mean of data set one = 25.94253

Data set two taken from f3atg
Number of observations = 61
Mean of data set two = 33.83607

t-statistic (pooled) = 2.939159
t-statistic (separate) = 2.907238
Degrees of freedom = 146

STATISTICAL TEST 9
t test (independent samples)

RESULTS
Data set one taken from f3pmb
Number of observations = 87
Mean of data set one = 44.41379

Data set two taken from f3pmg
Number of observations = 61
Mean of data set two = 41.06557

t-statistic (pooled) = 2.404306
t-statistic (separate) = 2.331028
Degrees of freedom = 146

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f3atsho

Number of observations	=	148
Missing observations	=	0
Arithmetric mean	=	26.90541
Harmonic mean	=	25.79885
Quadratic mean	=	27.38095
Median	=	28
Mode	=	29
First quartile	=	23
Third quartile	=	31
Sum of y	=	3982
Sum of y squared	=	110958
Variance	=	25.99098
Standard deviation	=	5.098135
Coefficient of variation	=	18.94837
Maximum	=	37
Minimum	=	12

QUASAR - DESCRIPTIVE ROUTINE
Release 1.4
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FILENAME = f3atshe

Number of observations	=	148
Missing observations	=	0
Arithmetric mean	=	25.46622
Harmonic mean	=	24.46361
Quadratic mean	=	25.96112
Median	=	25
Mode	=	22
First quartile	=	22
Third quartile	=	29
Sum of y	=	3769
Sum of y squared	=	99749
Variance	=	25.62471
Standard deviation	=	5.062086
Coefficient of variation	=	19.87765
Maximum	=	38
Minimum	=	14

QUASAR - CORRELATION ROUTINE
Release 1.3
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CORRELATION MATRIX

	f3atsh odd	f3atsh even
f3atsh odd*	1.0000	
f3atsh even *	0.7461	1.0000

VARIANCE CO-VARIANCE MATRIX

	f3atsh odd	f3atsh even
f3atsh odd*	25.99096	
f3atsh even *	19.25526	25.62468

QUASAR - CORRELATION ROUTINE
Release 1.3
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CORRELATION MATRIX

	f3pmsh odd	f3pmsh even
f3pmsh odd*	1.0000	
f3pmsh even *	0.8284	1.0000

VARIANCE CO-VARIANCE MATRIX

	f3pmsh odd	f3pmsh even
f3pmsh odd*	18.31495	
f3pmsh even *	16.27753	21.08195

Appendix VIII

Results listings Year One

QUASAR - DATA FILE EDITOR
Release 1.3
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Listing of flcaall

Case No	Observation	Case No	Observation	Case No	Observation
1	51	49	59	97	89
2	64	50	73	98	58
3	52	51	40	99	87
4	76	52	91	100	51
5	84	53	82	101	82
6	43	54	58	102	58
7	74	55	67	103	29
8	72	56	39	104	58
9	69	57	42	105	54
10	76	58	70	106	48
11	73	59	62	107	60
12	57	60	77	108	53
13	51	61	74	109	64
14	61	62	71	110	83
15	87	63	80	111	52
16	45	64	89	112	65
17	26	65	49	113	77
18	66	66	65	114	73
19	37	67	75	115	65
20	38	68	27		
21	62	69	44		
22	52	70	57		
23	71	71	48	116	44
24	51	72	54	117	66
25	97	73	82	118	62
26	66	74	57	119	76
27	94	75	63	120	62
28	45	76	69	121	32
29	53	77	61	122	34
30	52	78	67	123	39
31	55	79	66	124	53
32	26	80	60	125	70
33	39	81	70	126	82
34	49	82	34	127	65
35	21	83	76	128	68
36	45	84	56	129	42
37	44	85	81	130	45
38	77	86	86	131	49
39	42	87	75	132	82
40	67	88	66	133	66
41	57	89	65	134	72
42	90	90	61	135	68
43	74	91	75	136	54
44	41	92	70	137	58
45	74	93	54	138	48
46	70	94	71		
47	61	95	45		
48	38	96	34		

QUASAR - DATA FILE EDITOR
Release 1.3
*** COPYRIGHT GOODE SOFTWARE 1986 ***

Listing of flcab

Case No	Observation	Case No	Observation
1	52	50	83
2	76	51	52
3	84	52	77
4	74	53	73
5	72	54	65
6	73	55	44
7	87	56	76
8	66	57	32
9	37	58	34
10	38	59	39
11	62	60	70
12	52	61	82
13	97	62	65
14	66	63	68
15	94	64	42
16	53	65	49
17	55	66	66
18	26	67	72
19	39	68	68
20	49	69	58
21	21		
22	45		
23	77		
24	42		
25	41		
26	73		
27	40		
28	42		
29	71		
30	80		
31	75		
32	27		
33	44		
34	82		
35	57		
36	67		
37	66		
38	76		
39	56		
40	81		
41	75		
42	71		
43	34		
44	58		
45	58		
46	29		
47	48		
48	60		
49	53		

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Listing of flcag

Case No	Observation	Case No	Observation
1	51	49	61
2	64	50	75
3	43	51	70
4	69	52	54
5	76	53	45
6	57	54	89
7	51	55	87
8	61	56	51
9	45	57	82
10	26	58	58
11	71	59	54
12	51	60	64
13	45	61	65
14	52	62	66
15	44	63	62
16	67	64	62
17	57	65	53
18	90	66	45
19	74	67	82
20	74	68	54
21	70	69	48
22	61		
23	38		
24	59		
25	91		
26	82		
27	58		
28	67		
29	39		
30	70		
31	62		
32	77		
33	74		
34	89		
35	49		
36	65		
37	57		
38	48		
39	54		
40	63		
41	69		
42	61		
43	60		
44	70		
45	34		
46	86		
47	66		
48	65		

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Listing of flatall

Case No	Observation	Case No	Observation	Case No	Observation
1	47	49	46	97	58
2	75	50	73	98	58
3	40	51	47	99	71
4	66	52	58	100	27
5	75	53	69	101	76
6	46	54	42	102	35
7	63	55	43	103	46
8	61	56	44	104	69
9	69	57	59	105	37
10	73	58	84	106	53
11	82	59	69	107	52
12	53	60	57	108	67
13	46	61	72	109	31
14	53	62	52	110	63
15	76	63	82	111	50
16	34	64	73	112	56
17	36	65	70	113	63
18	71	66	59	114	71
19	47	67	72	115	53
20	34	68	40		
21	68	69	34		
22	58	70	41		
23	66	71	73	116	41
24	53	72	53	117	63
25	95	73	59	118	53
26	62	74	48	119	54
27	89	75	30	120	79
28	53	76	41	121	34
29	50	77	30	122	29
30	84	78	42	123	51
31	46	79	51	124	44
32	25	80	61	125	68
33	33	81	65	126	70
34	42	82	45	127	52
35	23	83	84	128	62
36	61	84	33	129	46
37	43	85	57	130	45
38	62	86	79	131	36
39	68	87	53	132	73
40	56	88	48	133	69
41	64	89	49	134	50
42	93	90	37	135	31
43	60	91	72	136	62
44	41	92	58	137	48
45	65	93	21	138	52
46	70	94	72		
47	38	95	36		
48	36	96	29		

Listing of flatb

Case No	Observation	Case No	Observation
1	40	49	67
2	66	50	63
3	75	51	50
4	63	52	63
5	61	53	71
6	82	54	53
7	76	55	41
8	71	56	54
9	47	57	34
10	34	58	29
11	68	59	51
12	58	60	68
13	75	61	70
14	62	62	52
15	89	63	62
16	50	64	46
17	40	65	36
18	25	66	69
19	33	67	50
20	42	68	31
21	23	69	48
22	61		
23	62		
24	68		
25	41		
26	73		
27	47		
28	59		
29	52		
30	82		
31	72		
32	40		
33	34		
34	59		
35	48		
36	42		
37	51		
38	84		
39	33		
40	57		
41	53		
42	72		
43	29		
44	58		
45	35		
46	46		
47	53		
48	52		

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Listing of flatg

Case No	Observation	Case No	Observation
1	47	49	37
2	75	50	72
3	46	51	58
4	68	52	21
5	73	53	36
6	53	54	58
7	46	55	71
8	53	56	27
9	34	57	76
10	36	58	69
11	66	59	37
12	53	60	31
13	53	61	56
14	84	62	63
15	43	63	53
16	50	64	79
17	64	65	44
18	93	66	45
19	60	67	73
20	65	68	62
21	70	69	52
22	38		
23	36		
24	46		
25	58		
26	69		
27	42		
28	43		
29	44		
30	84		
31	69		
32	57		
33	72		
34	73		
35	70		
36	59		
37	41		
38	73		
39	53		
40	30		
41	41		
42	30		
43	61		
44	65		
45	45		
46	79		
47	48		
48	49		

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Listing of flpmall

Case No	Observation	Case No	Observation	Case No	Observation
1	39	49	20	97	26
2	39	50	35	98	38
3	22	51	47	99	51
4	43	52	55	100	15
5	46	53	50	101	46
6	27	54	46	102	16
7	49	55	11	103	39
8	46	56	33	104	46
9	46	57	50	105	38
10	46	58	31	106	46
11	46	59	50	107	39
12	37	60	28	108	52
13	7	61	11	109	40
14	17	62	30	110	38
15	53	63	39	111	43
16	33	64	49	112	42
17	40	65	45	113	47
18	49	66	9	114	49
19	9	67	43	115	49
20	9	68	42		
21	43	69	24		
22	34	70	35		
23	43	71	34	116	38
24	37	72	13	117	50
25	50	73	51	118	44
26	29	74	41	119	51
27	44	75	37	120	39
28	40	76	19	121	15
29	18	77	31	122	40
30	33	78	45	123	46
31	26	79	39	124	39
32	12	80	49	125	45
33	18	81	43	126	49
34	41	82	30	127	32
35	23	83	40	128	53
36	42	84	51	129	46
37	54	85	48	130	33
38	38	86	46	131	33
39	47	87	46	132	45
40	30	88	44	133	39
41	50	89	25	134	51
42	50	90	36	135	45
43	35	91	43	136	45
44	37	92	45	137	41
45	42	93	36	138	49
46	51	94	54		
47	17	95	38		
48	18	96	32		

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Listing of f1pmb

Case No	Observation	Case No	Observation
1	22	49	52
2	43	50	38
3	46	51	43
4	49	52	47
5	46	53	49
6	46	54	49
7	53	55	38
8	49	56	51
9	9	57	15
10	9	58	40
11	43	59	46
12	34	60	45
13	50	61	48
14	29	62	32
15	44	63	53
16	18	64	46
17	26	65	33
18	12	66	39
19	18	67	51
20	41	68	45
21	23	69	41
22	42		
23	38		
24	47		
25	37		
26	35		
27	47		
28	50		
29	30		
30	39		
31	43		
32	42		
33	24		
34	51		
35	41		
36	45		
37	39		
38	40		
39	51		
40	48		
41	46		
42	54		
43	32		
44	38		
45	16		
46	39		
47	46		
48	39		

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Listing of flpmg

Case No	Observation	Case No	Observation
1	39	49	36
2	39	50	43
3	27	51	45
4	46	52	36
5	46	53	38
6	37	54	26
7	7	55	51
8	17	56	15
9	33	57	46
10	40	58	46
11	43	59	38
12	37	60	40
13	40	61	42
14	33	62	50
15	54	63	44
16	30	64	39
17	51	65	39
18	49	66	33
19	35	67	45
20	42	68	45
21	51	69	49
22	17		
23	18		
24	20		
25	55		
26	50		
27	46		
28	11		
29	33		
30	31		
31	50		
32	28		
33	11		
34	49		
35	45		
36	9		
37	35		
38	34		
39	13		
40	37		
41	19		
42	31		
43	49		
44	43		
45	30		
46	46		
47	44		
48	25		

Listing of flpmshe

Case No	Observation	Case No	Observation	Case No	Observation
1	5	49	14	97	21
2	3	50	17	98	22
3	3	51	16	99	21
4	6	52	16	100	23
5	10	53	16	101	24
6	9	54	18	102	24
7	9	55	19	103	25
8	10	56	19	104	25
9	11	57	21	105	25
10	11	58	23	106	7
11	12	59	20	107	14
12	15	60	22	108	14
13	14	61	22	109	14
14	17	62	23	110	18
15	16	63	24	111	16
16	18	64	23	112	18
17	19	65	25	113	22
18	21	66	26	114	22
19	18	67	26	115	20
20	20	68	24	116	23
21	20	69	26		
22	18	70	26		
23	22	71	27		
24	21	72	8	117	23
25	22	73	7	118	23
26	21	74	8	119	21
27	20	75	9	120	22
28	23	76	12	121	24
29	22	77	10	122	23
30	20	78	14	123	23
31	21	79	14	124	25
32	21	80	16	125	22
33	24	81	15	126	26
34	23	82	18	127	25
35	25	83	20	128	25
36	25	84	17	129	26
37	5	85	17	130	26
38	6	86	16	131	25
39	5	87	17	132	25
40	4	88	18	133	27
41	10	89	18	134	26
42	12	90	19	135	27
43	11	91	19	136	28
44	13	92	19	137	27
45	14	93	20	138	25
46	16	94	21		
47	13	95	21		
48	16	96	22		

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Listing of flpmsho

Case No	Observation	Case No	Observation	Case No	Observation
1	2	50	18	99	25
2	6	51	19	100	25
3	6	52	19	101	25
4	6	53	21	102	27
5	7	54	20	103	26
6	9	55	20	104	26
7	9	56	23	105	29
8	11	57	21	106	8
9	12	58	20	107	18
10	15	59	25	108	19
11	15	60	24	109	19
12	14	61	25	110	20
13	19	62	24	111	22
14	16	63	25	112	21
15	18	64	27	113	17
16	19	65	25	114	17
17	18	66	24	115	19
18	18	67	24		
19	22	68	26		
20	20	69	25		
21	21	70	28	116	17
22	24	71	28	117	17
23	21	72	5	118	18
24	22	73	8	119	21
25	22	74	8	120	21
26	24	75	10	121	20
27	25	76	13	122	22
28	23	77	16	123	22
29	24	78	16	124	20
30	26	79	17	125	23
31	25	80	16	126	20
32	25	81	21	127	21
33	25	82	18	128	21
34	26	83	17	129	21
35	25	84	21	130	23
36	27	85	21	131	24
37	4	86	22	132	24
38	5	87	22	133	22
39	6	88	21	134	24
40	13	89	22	135	24
41	8	90	22	136	25
42	8	91	24	137	24
43	13	92	24	138	27
44	15	93	24		
45	16	94	24		
46	14	95	24		
47	18	96	24		
48	17	97	25		
49	20	98	24		

Listing of flTRTori

Case No	Observation
1	47
2	75
3	40
4	75
5	46
6	61
7	69
8	82
9	53
10	46
11	53
12	76
13	34
14	36
15	71
16	34
17	68
18	66
19	53
20	95
21	62
22	89
23	53
24	50
25	84
26	46
27	25
28	23
29	61
30	25

Listing of flTRTrte

Case No	Observation
1	58
2	79
3	46
4	58
5	48
6	61
7	87
8	78
9	66
10	50
11	58
12	67
13	38
14	41
15	67
16	26
17	53
18	67
19	50
20	87
21	67
22	100
23	47
24	51
25	67
26	47
27	25
28	28
29	69
30	32

Results listings Year Two

Appendix IX

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Listing of f2caall

1	*	161	56	*	261	111	*	161
2	*	242	57	*	123	112	*	199
3	*	190	58	*	251	113	*	104
4	*	203	59	*	203	114	*	183
5	*	218	60	*	182	115	*	145
6	*	160	61	*	131	116	*	96
7	*	127	62	*	183	117	*	208
8	*	202	63	*	73	118	*	221
9	*	136	64	*	72	119	*	241
10	*	126	65	*	113	120	*	197
11	*	271	66	*	231	121	*	106
12	*	189	67	*	237	122	*	122
13	*	179	68	*	183	123	*	175
14	*	208	69	*	205	124	*	174
15	*	97	70	*	123	125	*	78
16	*	236	71	*	199	126	*	186
17	*	172	72	*	41	127	*	86
18	*	45	73	*	144	128	*	238
19	*	129	74	*	86	129	*	79
20	*	253	75	*	161	130	*	113
21	*	182	76	*	138	131	*	66
22	*	234	77	*	252	132	*	97
23	*	98	78	*	179	133	*	139
24	*	124	79	*	190	134	*	116
25	*	267	80	*	146	135	*	179
26	*	75	81	*	121	136	*	96
27	*	177	82	*	57	137	*	151
28	*	190	83	*	159	138	*	202
29	*	136	84	*	241	139	*	173
30	*	160	85	*	69	140	*	111
31	*	137	86	*	83	141	*	188
32	*	160	87	*	147	142	*	147
33	*	192	88	*	219	143	*	184
34	*	128	89	*	237	144	*	135
35	*	213	90	*	109	145	*	188
36	*	151	91	*	210	146	*	230
37	*	189	92	*	185	147	*	117
38	*	76	93	*	207	148	*	167
39	*	227	94	*	129	149	*	223
40	*	280	95	*	143	150	*	185
41	*	159	96	*	133	151	*	162
42	*	115	97	*	208	152	*	139
43	*	153	98	*	178	153	*	220
44	*	225	99	*	221	154	*	136
45	*	112	100	*	96	155	*	138
46	*	115	101	*	234	156	*	248
47	*	205	102	*	103	157	*	191
48	*	218	103	*	184	158	*	153
49	*	145	104	*	91	159	*	94
50	*	223	105	*	178	160	*	162
51	*	200	106	*	142			
52	*	158	107	*	76			
53	*	189	108	*	111			
54	*	216	109	*	159			
55	*	198	110	*	139			

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Listing of f2cab

Case No	Observation	Case No	Observation
1	161	50	210
2	242	51	185
3	190	52	207
4	203	53	143
5	126	54	133
6	208	55	178
7	97	56	221
8	236	57	96
9	172	58	234
10	129	59	91
11	182	60	159
12	234	61	139
13	98	62	161
14	267	63	199
15	75	64	104
16	177	65	183
17	136	66	145
18	160	67	241
19	136	68	197
20	160	69	106
21	192	70	78
22	213	71	185
23	151	72	238
24	280	73	113
25	225	74	139
26	218	75	179
27	145	76	96
28	223	77	151
29	216	78	202
30	198	79	173
31	261	80	147
32	123	81	184
33	251	82	188
34	203	83	117
35	231	84	167
36	237	85	223
37	183	86	162
38	205	87	139
39	199	88	138
40	41	89	248
41	161	90	153
42	138	91	162
43	190		
44	146		
45	121		
46	159		
47	147		
48	219		
49	237		

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Listing of f2cag

Case No	Observation	Case No	Observation
1	218	49	111
2	160	50	96
3	127	51	208
4	202	52	221
5	136	53	122
6	271	54	175
7	189	55	174
8	179	56	86
9	45	57	79
10	253	58	66
11	124	59	97
12	190	60	116
13	128	61	111
14	189	62	188
15	76	63	135
16	227	64	230
17	159	65	185
18	115	66	220
19	153	67	136
20	112	68	191
21	115	69	94
22	205		
23	200		
24	158		
25	189		
26	182		
27	131		
28	183		
29	73		
30	72		
31	113		
32	123		
33	144		
34	86		
35	252		
36	179		
37	57		
38	241		
39	69		
40	83		
41	109		
42	129		
43	208		
44	103		
45	184		
46	178		
47	142		
48	76		

Listing of f2atall

Case No	Observation	Case No	Observation	Case No	Observation
1	71	56	87	111	76
2	90	57	81	112	96
3	79	58	100	113	67
4	52	59	75	114	69
5	75	60	88	115	79
6	65	61	64	116	57
7	67	62	69	117	95
8	84	63	29	118	108
9	49	64	46	119	74
10	76	65	61	120	77
11	107	66	98	121	56
12	55	67	80	122	65
13	74	68	73	123	80
14	77	69	76	124	80
15	64	70	62	125	9
16	90	71	57	126	79
17	89	72	25	127	48
18	21	73	71	128	97
19	73	74	60	129	30
20	97	75	70	130	53
21	69	76	80	131	24
22	96	77	104	132	58
23	66	78	98	133	100
24	36	79	75	134	56
25	104	80	60	135	88
26	43	81	34	136	60
27	89	82	47	137	86
28	65	83	72	138	80
29	78	84	88	139	74
30	72	85	39	140	68
31	85	86	70	141	91
32	48	87	72	142	93
33	85	88	87	143	70
34	64	89	99	144	59
35	82	90	88	145	86
36	52	91	92	146	101
37	98	92	63	147	61
38	32	93	73	148	77
39	90	94	24	149	78
40	106	95	75	150	94
41	87	96	76	151	74
42	51	97	82	152	64
43	65	98	75	153	105
44	76	99	87	154	77
45	38	100	16	155	60
46	72	101	93	156	92
47	80	102	38	157	91
48	88	103	92	158	83
49	56	104	38	159	53
50	71	105	67	160	76
51	100	106	63		
52	88	107	43		
53	69	108	55		
54	101	109	78		
55	62	110	71		

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Listing of f2atb

Case No	Observation	Case No	Observation
1	71	49	99
2	90	50	92
3	79	51	63
4	52	52	73
5	76	53	75
6	77	54	76
7	64	55	75
8	90	56	87
9	89	57	16
10	73	58	93
11	69	59	38
12	96	60	78
13	66	61	71
14	104	62	76
15	43	63	96
16	89	64	67
17	78	65	69
18	72	66	79
19	85	67	74
20	48	68	77
21	85	69	56
22	82	70	9
23	52	71	79
24	106	72	97
25	76	73	53
26	88	74	100
27	56	75	88
28	71	76	60
29	101	77	86
30	62	78	80
31	87	79	74
32	81	80	93
33	100	81	70
34	75	82	86
35	98	83	61
36	80	84	77
37	73	85	78
38	76	86	74
39	57	87	64
40	25	88	60
41	70	89	92
42	80	90	83
43	75	91	76
44	60		
45	34		
46	72		
47	72		
48	87		

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Listing of f2atg

Case No	Observation	Case No	Observation
1	75	49	55
2	65	50	57
3	67	51	95
4	84	52	108
5	49	53	65
6	107	54	80
7	55	55	80
8	74	56	48
9	21	57	30
10	97	58	24
11	36	59	58
12	65	60	56
13	64	61	68
14	98	62	91
15	32	63	59
16	90	64	101
17	87	65	94
18	51	66	105
19	65	67	77
20	38	68	91
21	72	69	53
22	80		
23	100		
24	88		
25	69		
26	88		
27	64		
28	69		
29	29		
30	46		
31	61		
32	62		
33	71		
34	60		
35	104		
36	98		
37	47		
38	88		
39	39		
40	70		
41	88		
42	24		
43	82		
44	38		
45	92		
46	67		
47	63		
48	43		

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Listing of f2pmall

Case No	Observation	Case No	Observation	Case No	Observation
1	42	56	49	111	49
2	37	57	48	112	55
3	45	58	46	113	31
4	35	59	42	114	38
5	31	60	45	115	37
6	40	61	36	116	23
7	9	62	44	117	37
8	35	63	39	118	45
9	35	64	40	119	37
10	40	65	37	120	44
11	45	66	37	121	35
12	30	67	46	122	31
13	28	68	37	123	51
14	40	69	41	124	32
15	28	70	48	125	39
16	45	71	35	126	42
17	29	72	24	127	15
18	19	73	53	128	48
19	34	74	41	129	33
20	44	75	39	130	42
21	29	76	32	131	6
22	28	77	55	132	37
23	39	78	50	133	46
24	10	79	46	134	37
25	48	80	18	135	46
26	32	81	42	136	30
27	35	82	34	137	42
28	38	83	43	138	51
29	46	84	55	139	52
30	40	85	6	140	38
31	36	86	32	141	51
32	31	87	49	142	45
33	38	88	40	143	24
34	35	89	55	144	37
35	43	90	33	145	46
36	28	91	51	146	56
37	38	92	39	147	36
38	40	93	45	148	42
39	51	94	36	149	52
40	41	95	13	150	46
41	41	96	41	151	39
42	37	97	53	152	48
43	50	98	43	153	51
44	38	99	47	154	41
45	41	100	18	155	52
46	31	101	38	156	51
47	34	102	27	157	50
48	52	103	35	158	45
49	23	104	43	159	44
50	43	105	38	160	46
51	38	106	41		
52	15	107	22		
53	45	108	26		
54	37	109	54		
55	39	110	39		

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Listing of f2pmb

Case No	*	Observation	Case No	*	Observation
1	*	42	49	*	55
2	*	37	50	*	51
3	*	45	51	*	39
4	*	35	52	*	45
5	*	40	53	*	13
6	*	40	54	*	41
7	*	28	55	*	43
8	*	45	56	*	47
9	*	29	57	*	18
10	*	34	58	*	38
11	*	29	59	*	43
12	*	28	60	*	54
13	*	39	61	*	39
14	*	48	62	*	49
15	*	32	63	*	55
16	*	35	64	*	31
17	*	46	65	*	38
18	*	40	66	*	37
19	*	36	67	*	37
20	*	31	68	*	44
21	*	38	69	*	35
22	*	43	70	*	39
23	*	28	71	*	42
24	*	41	72	*	48
25	*	38	73	*	42
26	*	52	74	*	46
27	*	23	75	*	46
28	*	43	76	*	30
29	*	37	77	*	42
30	*	39	78	*	51
31	*	49	79	*	52
32	*	48	80	*	45
33	*	46	81	*	24
34	*	42	82	*	46
35	*	37	83	*	36
36	*	46	84	*	42
37	*	37	85	*	52
38	*	41	86	*	39
39	*	35	87	*	48
40	*	24	88	*	52
41	*	39	89	*	51
42	*	32	90	*	45
43	*	46	91	*	46
44	*	18			
45	*	42			
46	*	43			
47	*	49			
48	*	40			

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Listing of t2pmg

Case No	Observation	Case No	Observation
1	31	49	26
2	40	50	23
3	9	51	37
4	35	52	45
5	35	53	31
6	45	54	51
7	30	55	32
8	28	56	15
9	19	57	33
10	44	58	6
11	10	59	37
12	38	60	37
13	35	61	38
14	38	62	51
15	40	63	37
16	51	64	56
17	41	65	46
18	37	66	51
19	50	67	41
20	41	68	50
21	31	69	44
22	34		
23	38		
24	15		
25	45		
26	45		
27	36		
28	44		
29	39		
30	40		
31	37		
32	48		
33	53		
34	41		
35	55		
36	50		
37	34		
38	55		
39	6		
40	32		
41	33		
42	36		
43	53		
44	27		
45	35		
46	38		
47	41		
48	22		

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Listing of r2pmshe

Case No	Observation	Case No	Observation	Case No	Observation
1	5	56	22	111	19
2	6	57	22	112	19
3	7	58	24	113	20
4	12	59	24	114	20
5	11	60	26	115	19
6	11	61	26	116	23
7	15	62	23	117	22
8	11	63	24	118	21
9	16	64	25	119	20
10	15	65	25	120	20
11	15	66	25	121	23
12	17	67	27	122	19
13	16	68	2	123	23
14	15	69	8	124	24
15	19	70	10	125	22
16	14	71	12	126	24
17	15	72	15	127	26
18	16	73	18	128	28
19	17	74	17	129	26
20	18	75	19	130	27
21	16	76	20	131	29
22	19	77	17	132	30
23	18	78	19	133	10
24	18	79	21	134	17
25	19	80	19	135	18
26	17	81	21	136	22
27	20	82	23	137	20
28	21	83	21	138	18
29	19	84	22	139	23
30	21	85	23	140	22
31	20	86	24	141	22
32	23	87	25	142	23
33	22	88	24	143	22
34	22	89	25	144	24
35	9	90	24	145	22
36	11	91	25	146	23
37	13	92	35	147	26
38	15	93	27	148	25
39	15	94	27	149	25
40	15	95	30	150	24
41	15	96	28	151	23
42	17	97	28	152	24
43	20	98	3	153	27
44	19	99	7	154	27
45	18	100	6	155	27
46	18	101	8	156	27
47	19	102	11	157	26
48	18	103	12	158	27
49	21	104	14	159	25
50	20	105	14	160	28
51	21	106	16		
52	23	107	15		
53	20	108	16		
54	21	109	19		
55	20	110	16		

Listing of i2pmsho

Case No	Observation	Case No	Observation	Case No	Observation
1	4	56	21	111	16
2	4	57	21	112	18
3	12	58	20	113	17
4	16	59	21	114	18
5	17	60	19	115	19
6	17	61	20		
7	14	62	23		
8	18	63	24		
9	15	64	24	116	15
10	16	65	25	117	17
11	17	66	26	118	18
12	17	67	25	119	21
13	19	68	4	120	22
14	20	69	5	121	19
15	16	70	8	122	24
16	21	71	12	123	19
17	20	72	17	124	20
18	20	73	14	125	23
19	20	74	16	126	23
20	20	75	15	127	22
21	22	76	15	128	21
22	20	77	19	129	23
23	22	78	18	130	24
24	22	79	18	131	25
25	21	80	20	132	25
26	23	81	19	133	14
27	22	82	18	134	13
28	23	83	20	135	18
29	26	84	19	136	15
30	24	85	19	137	17
31	25	86	19	138	19
32	23	87	20	139	15
33	24	88	22	140	17
34	25	89	23	141	19
35	6	90	25	142	19
36	12	91	25	143	20
37	15	92	26	144	20
38	16	93	26	145	23
39	19	94	26	146	22
40	21	95	25	147	20
41	22	96	27	148	21
42	20	97	27	149	21
43	17	98	3	150	22
44	18	99	8	151	23
45	20	100	11	152	24
46	20	101	10	153	23
47	19	102	11	154	24
48	21	103	11	155	24
49	18	104	12	156	24
50	20	105	13	157	25
51	19	106	15	158	25
52	18	107	16	159	27
53	21	108	16	160	24
54	20	109	13		
55	22	110	17		

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Listing of f2TRTori

Case No	Observation
1	71
2	90
3	79
4	52
5	75
6	65
7	67
8	84
9	49
10	76
11	107
12	55
13	74
14	77
15	64
16	90
17	89
18	21
19	73
20	97
21	69
22	96
23	66
24	36
25	43
26	89
27	65
28	78
29	72
30	63
31	85
32	48
33	85
34	64

Listing of f2TRTrte

Case No	Observation
1	100
2	111
3	81
4	73
5	73
6	78
7	57
8	84
9	40
10	79
11	100
12	76
13	50
14	87
15	68
16	87
17	83
18	20
19	82
20	91
21	78
22	99
23	72
24	47
25	47
26	83
27	63
28	78
29	69
30	62
31	81
32	77
33	88
34	76

Appendix X

Results listings Year Three

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Listing of f3caa11

Case No	Observation	Case No	Observation	Case No	Observation
1	24	50	38	99	33
2	39	51	36	100	45
3	25	52	40	101	29
4	37	53	26	102	42
5	37	54	40	103	42
6	32	55	24	104	24
7	38	56	47	105	43
8	34	57	30	106	28
9	28	58	49	107	35
10	35	59	28	108	34
11	18	60	40	109	29
12	46	61	36	110	31
13	36	62	45	111	41
14	57	63	38	112	55
15	27	64	44	113	40
16	50	65	44	114	26
17	27	66	42	115	29
18	33	67	23	116	39
19	38	68	26	117	31
20	50	69	27	118	34
21	34	70	47	119	33
22	44	71	44	120	44
23	30	72	39	121	43
24	19	73	37	122	26
25	41	74	28	123	25
26	32	75	44	124	31
27	32	76	23	125	39
28	31	77	33	126	32
29	42	78	35	127	36
30	22	79	23	128	40
31	53	80	29	129	34
32	33	81	48	130	34
33	32	82	36	131	37
34	46	83	47	132	28
35	24	84	42	133	32
36	33	85	33	134	46
37	41	86	32	135	33
38	27	87	37	136	33
39	25	88	46	137	21
40	36	89	34	138	36
41	30	90	31	139	24
42	32	91	37	140	42
43	18	92	25	141	35
44	25	93	37	142	30
45	25	94	30	143	26
46	42	95	40	144	32
47	36	96	20	145	25
48	34	97	17	146	28
49	30	98	21	147	38
				148	25

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Listing of f3cab

Case No	*	Observation	Case No	*	Observation
1	*	24	50	*	37
2	*	38	51	*	46
3	*	28	52	*	34
4	*	46	53	*	31
5	*	36	54	*	37
6	*	27	55	*	25
7	*	50	56	*	37
8	*	33	57	*	46
9	*	38	58	*	17
10	*	50	59	*	21
11	*	34	60	*	45
12	*	44	61	*	42
13	*	30	62	*	35
14	*	19	63	*	29
15	*	41	64	*	31
16	*	32	65	*	40
17	*	31	66	*	39
18	*	42	67	*	31
19	*	22	68	*	44
20	*	53	69	*	43
21	*	32	70	*	25
22	*	46	71	*	39
23	*	41	72	*	32
24	*	27	73	*	40
25	*	25	74	*	34
26	*	30	75	*	37
27	*	32	76	*	28
28	*	25	77	*	32
29	*	25	78	*	46
30	*	42	79	*	33
31	*	36	80	*	33
32	*	36	81	*	21
33	*	40	82	*	42
34	*	26	83	*	35
35	*	24	84	*	30
36	*	49	85	*	26
37	*	36	86	*	32
38	*	44	87	*	28
39	*	44			
40	*	42			
41	*	47			
42	*	44			
43	*	37			
44	*	28			
45	*	23			
46	*	29			
47	*	48			
48	*	42			
49	*	33			

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Listing of f3cag

Case No	*	Observation	Case No	*	Observation
1	*	39	50	*	29
2	*	25	51	*	34
3	*	37	52	*	33
4	*	37	53	*	26
5	*	32	54	*	31
6	*	34	55	*	36
7	*	35	56	*	34
8	*	18	57	*	36
9	*	57	58	*	24
10	*	27	59	*	25
11	*	32	60	*	38
12	*	33	61	*	25
13	*	24			
14	*	33			
15	*	36			
16	*	18			
17	*	34			
18	*	30			
19	*	38			
20	*	40			
21	*	47			
22	*	30			
23	*	28			
24	*	40			
25	*	46			
26	*	38			
27	*	23			
28	*	26			
29	*	27			
30	*	39			
31	*	44			
32	*	23			
33	*	33			
34	*	35			
35	*	36			
36	*	47			
37	*	32			
38	*	30			
39	*	20			
40	*	33			
41	*	29			
42	*	42			
43	*	24			
44	*	43			
45	*	28			
46	*	34			
47	*	41			
48	*	55			
49	*	26			

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Listing of f3atall

Case No	Observation	Case No	Observation	Case No	Observation
1	21	50	25	99	24
2	23	51	27	100	28
3	23	52	29	101	25
4	29	53	20	102	18
5	24	54	29	103	27
6	28	55	19	104	21
7	27	56	32	105	27
8	21	57	23	106	22
9	23	58	31	107	27
10	24	59	21	108	21
11	15	60	27	109	23
12	33	61	23	110	30
13	24	62	31	111	30
14	34	63	23	112	33
15	20	64	26	113	30
16	32	65	29	114	21
17	24	66	29	115	24
18	23	67	18	116	28
19	31	68	23	117	26
20	33	69	22	118	27
21	21	70	32	119	20
22	24	71	33	120	31
23	25	72	26	121	30
24	21	73	23	122	23
25	28	74	20	123	22
26	25	75	26	124	20
27	26	76	25	125	29
28	25	77	21	126	28
29	29	78	23	127	21
30	16	79	19	128	25
31	32	80	26	129	22
32	31	81	31	130	23
33	22	82	23	131	26
34	31	83	33	132	31
35	21	84	30	133	26
36	22	85	23	134	30
37	31	86	23	135	23
38	23	87	31	136	24
39	25	88	27	137	20
40	28	89	23	138	23
41	24	90	24	139	18
42	27	91	28	140	27
43	15	92	20	141	30
44	27	93	33	142	29
45	19	94	24	143	21
46	28	95	27	144	26
47	26	96	18	145	19
48	18	97	20	146	20
49	20	98	18	147	33
				148	20

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Listing of f3atb

Case No	Observation	Case No	Observation
1	21	50	31
2	27	51	27
3	23	52	23
4	33	53	24
5	24	54	28
6	20	55	20
7	32	56	33
8	23	57	27
9	31	58	20
10	33	59	18
11	21	60	28
12	24	61	27
13	25	62	27
14	21	63	23
15	28	64	30
16	26	65	30
17	25	66	28
18	29	67	26
19	16	68	31
20	32	69	30
21	22	70	22
22	31	71	29
23	31	72	28
24	23	73	25
25	25	74	22
26	24	75	26
27	27	76	31
28	27	77	26
29	19	78	30
30	28	79	23
31	26	80	24
32	27	81	20
33	29	82	27
34	20	83	30
35	19	84	29
36	31	85	21
37	23	86	26
38	26	87	20
39	29		
40	29		
41	32		
42	33		
43	23		
44	20		
45	19		
46	26		
47	31		
48	30		
49	23		

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Listing of f3atg

Case No	Observation	Case No	Observation
1	23	49	21
2	23	50	24
3	29	51	27
4	24	52	20
5	28	53	23
6	21	54	20
7	24	55	21
8	15	56	23
9	34	57	23
10	24	58	18
11	25	59	19
12	31	60	33
13	21	61	20
14	22		
15	28		
16	15		
17	18		
18	20		
19	25		
20	29		
21	32		
22	23		
23	21		
24	27		
25	31		
26	23		
27	18		
28	23		
29	22		
30	26		
31	26		
32	25		
33	21		
34	23		
35	23		
36	33		
37	23		
38	24		
39	18		
40	24		
41	25		
42	18		
43	21		
44	27		
45	22		
46	21		
47	30		
48	33		

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Listing of f3pmall

Case No	Observation	Case No	Observation	Case No	Observation
1	25	50	52	99	51
2	30	51	47	100	44
3	45	52	47	101	39
4	36	53	29	102	45
5	48	54	48	103	49
6	37	55	44	104	40
7	41	56	41	105	44
8	37	57	41	106	45
9	44	58	50	107	46
10	35	59	45	108	52
11	23	60	43	109	29
12	57	61	43	110	39
13	34	62	46	111	46
14	54	63	35	112	51
15	28	64	50	113	51
16	53	65	48	114	48
17	36	66	46	115	43
18	47	67	44	116	54
19	46	68	45	117	52
20	50	69	49	118	39
21	31	70	45	119	41
22	31	71	56	120	48
23	53	72	44	121	50
24	41	73	45	122	46
25	47	74	15	123	38
26	29	75	40	124	48
27	56	76	29	125	54
28	44	77	42	126	50
29	53	78	41	127	49
30	47	79	47	128	49
31	47	80	49	129	46
32	44	81	42	130	37
33	34	82	50	131	50
34	50	83	49	132	35
35	52	84	47	133	41
36	48	85	42	134	50
37	53	86	46	135	40
38	43	87	42	136	48
39	52	88	42	137	42
40	33	89	49	138	55
41	44	90	45	139	46
42	43	91	48	140	41
43	25	92	36	141	45
44	32	93	55	142	51
45	36	94	28	143	37
46	49	95	46	144	49
47	45	96	13	145	15
48	27	97	32	146	42
49	33	98	51	147	52
				148	30

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Listing of f3pmb

Case No	Observation	Case No	Observation
1	25	49	42
2	41	50	42
3	44	51	42
4	57	52	49
5	34	53	45
6	28	54	48
7	53	55	36
8	47	56	55
9	46	57	46
10	50	58	32
11	31	59	51
12	31	60	44
13	53	61	49
14	41	62	46
15	47	63	29
16	56	64	39
17	44	65	51
18	53	66	54
19	47	67	52
20	47	68	48
21	34	69	50
22	50	70	38
23	53	71	54
24	43	72	50
25	52	73	49
26	44	74	46
27	43	75	50
28	32	76	35
29	36	77	41
30	49	78	50
31	45	79	40
32	47	80	48
33	47	81	42
34	29	82	41
35	44	83	45
36	50	84	51
37	43	85	37
38	50	86	49
39	48	87	42
40	46		
41	45		
42	56		
43	45		
44	15		
45	47		
46	49		
47	42		
48	47		

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Listing of f3pmg

Case No	Observation	Case No	Observation
1	30	50	43
2	45	51	39
3	36	52	41
4	48	53	46
5	37	54	48
6	37	55	49
7	35	56	37
8	23	57	55
9	54	58	46
10	36	59	15
11	29	60	52
12	44	61	30
13	52		
14	48		
15	33		
16	25		
17	27		
18	33		
19	52		
20	48		
21	41		
22	41		
23	45		
24	43		
25	46		
26	35		
27	44		
28	45		
29	49		
30	44		
31	40		
32	29		
33	42		
34	41		
35	50		
36	49		
37	46		
38	28		
39	13		
40	51		
41	39		
42	45		
43	40		
44	44		
45	45		
46	52		
47	46		
48	51		
49	48		

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Listing of f3atshe

Case No	*	Observation	Case No	*	Observation	Case No	*	Observation
1	*	23	50	*	33	99	*	25
2	*	22	51	*	26	100	*	31
3	*	24	52	*	31	101	*	25
4	*	28	53	*	22	102	*	18
5	*	25	54	*	31	103	*	24
6	*	29	55	*	17	104	*	21
7	*	29	56	*	35	105	*	26
8	*	21	57	*	22	106	*	24
9	*	22	58	*	32	107	*	29
10	*	22	59	*	20	108	*	21
11	*	14	60	*	27	109	*	23
12	*	32	61	*	26	110	*	31
13	*	24	62	*	30	111	*	30
14	*	38	63	*	20	112	*	35
15	*	20	64	*	23	113	*	33
16	*	32	65	*	27	114	*	23
17	*	23	66	*	38	115	*	22
18	*	21	67	*	20	116	*	29
19	*	33	68	*	25	117	*	28
20	*	34	69	*	25	118	*	28
21	*	25	70	*	33	119	*	22
22	*	22	71	*	37	120	*	30
23	*	25	72	*	29	121	*	33
24	*	21	73	*	24	122	*	23
25	*	29	74	*	21	123	*	23
26	*	23	75	*	26	124	*	19
27	*	26	76	*	26	125	*	29
28	*	27	77	*	22	126	*	26
29	*	27	78	*	23	127	*	19
30	*	19	79	*	21	128	*	26
31	*	35	80	*	27	129	*	20
32	*	34	81	*	32	130	*	22
33	*	18	82	*	22	131	*	25
34	*	32	83	*	32	132	*	33
35	*	17	84	*	30	133	*	25
36	*	22	85	*	22	134	*	29
37	*	32	86	*	25	135	*	21
38	*	21	87	*	32	136	*	26
39	*	25	88	*	27	137	*	18
40	*	26	89	*	24	138	*	21
41	*	22	90	*	23	139	*	20
42	*	30	91	*	32	140	*	26
43	*	20	92	*	19	141	*	29
44	*	31	93	*	36	142	*	32
45	*	20	94	*	24	143	*	23
46	*	30	95	*	26	144	*	25
47	*	25	96	*	17	145	*	19
48	*	19	97	*	19	146	*	18
49	*	25	98	*	15	147	*	32
						148	*	19

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Listing of f3atcho

Case No	Observation	Case No	Observation	Case No	Observation
1	20	50	32	99	29
2	26	51	26	100	30
3	27	52	30	101	25
4	33	53	21	102	23
5	23	54	30	103	28
6	29	55	23	104	21
7	30	56	34	105	33
8	23	57	27	106	24
9	24	58	33	107	30
10	26	59	23	108	23
11	16	60	29	109	28
12	34	61	24	110	29
13	25	62	34	111	31
14	30	63	26	112	37
15	24	64	28	113	33
16	33	65	33	114	18
17	25	66	33	115	24
18	26	67	14	116	34
19	31	68	19	117	28
20	34	69	32	118	34
21	23	70	32	119	21
22	31	71	34	120	31
23	26	72	29	121	34
24	22	73	27	122	25
25	29	74	24	123	19
26	23	75	31	124	21
27	31	76	30	125	34
28	26	77	21	126	29
29	32	78	26	127	29
30	17	79	18	128	28
31	27	80	24	129	23
32	31	81	36	130	27
33	29	82	20	131	32
34	33	83	34	132	32
35	22	84	33	133	30
36	22	85	25	134	31
37	31	86	28	135	31
38	29	87	35	136	28
39	30	88	31	137	20
40	32	89	23	138	24
41	27	90	24	139	20
42	26	91	27	140	28
43	12	92	20	141	28
44	31	93	32	142	29
45	22	94	25	143	18
46	29	95	30	144	23
47	32	96	22	145	20
48	20	97	24	146	19
49	18	98	18	147	29
				148	21

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Listing of f3pmshe

Case No	Observation	Case No	Observation	Case No	Observation
1	13	50	24	99	25
2	12	51	21	100	18
3	22	52	21	101	18
4	16	53	13	102	21
5	24	54	25	103	24
6	18	55	21	104	19
7	20	56	20	105	21
8	17	57	19	106	21
9	21	58	25	107	24
10	17	59	21	108	27
11	10	60	20	109	10
12	28	61	19	110	18
13	13	62	25	111	24
14	26	63	17	112	24
15	12	64	23	113	25
16	25	65	22	114	23
17	16	66	22	115	20
18	25	67	19	116	27
19	22	68	20	117	25
20	26	69	23	118	17
21	13	70	20	119	17
22	12	71	28	120	22
23	26	72	21	121	24
24	20	73	21	122	21
25	22	74	9	123	17
26	14	75	17	124	25
27	28	76	15	125	27
28	20	77	20	126	25
29	25	78	19	127	24
30	22	79	24	128	24
31	23	80	23	129	22
32	22	81	20	130	20
33	16	82	24	131	25
34	23	83	24	132	13
35	27	84	20	133	20
36	24	85	17	134	24
37	28	86	22	135	17
38	19	87	19	136	23
39	27	88	19	137	22
40	14	89	23	138	28
41	20	90	21	139	20
42	20	91	22	140	18
43	13	92	16	141	20
44	17	93	26	142	25
45	16	94	14	143	17
46	22	95	22	144	23
47	22	96	6	145	7
48	12	97	16	146	19
49	16	98	24	147	26
				148	13

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Listing of f3pmsho

Case No	Observation	Case No	Observation	Case No	Observation
1	12	50	28	99	26
2	18	51	26	100	26
3	23	52	26	101	21
4	20	53	16	102	24
5	24	54	23	103	25
6	19	55	23	104	21
7	21	56	21	105	23
8	20	57	22	106	24
9	23	58	25	107	22
10	18	59	24	108	25
11	13	60	23	109	19
12	29	61	24	110	21
13	21	62	21	111	22
14	28	63	18	112	27
15	16	64	27	113	26
16	28	65	26	114	25
17	20	66	24	115	23
18	22	67	25	116	27
19	24	68	25	117	27
20	24	69	26	118	22
21	19	70	25	119	24
22	19	71	28	120	26
23	27	72	23	121	26
24	21	73	24	122	25
25	25	74	6	123	21
26	15	75	23	124	23
27	28	76	14	125	27
28	24	77	22	126	25
29	28	78	22	127	25
30	25	79	21	128	25
31	24	80	26	129	24
32	22	81	22	130	17
33	18	82	26	131	25
34	27	83	25	132	22
35	25	84	27	133	21
36	24	85	25	134	26
37	25	86	24	135	23
38	24	87	23	136	25
39	25	88	23	137	20
40	19	89	26	138	27
41	24	90	24	139	26
42	23	91	26	140	23
43	12	92	20	141	25
44	15	93	29	142	26
45	20	94	14	143	20
46	27	95	24	144	26
47	23	96	7	145	7
48	15	97	16	146	23
49	17	98	27	147	26
				148	17

Examples of Continuous Assessment Tests

Demonstration Secondary School, A.B.U.,Zaria.

Term I, First Test. JSS 3 A,B,C and D.

Integrated Science

25 marks 50 mins

1 a) Name the three systems that make up the nervous system.

b) What are neurones ? Name any two that you know stating their function.

2. Name four types of eye defects. Mention the correction for each of them.

3. a) Explain the term heredity.

b) Distinguish between dominant and recessive traits using an example.

c) How does the environment affect inherited genes ?

Demonstration Secondary School, A.B.U., Zaria

Second Term Examination. Form 2

Subject: Integrated Science Practical Examination Time: 40 mins.

Name of Student: ..... Class: .....

INSTRUCTIONS: ANSWER ALL QUESTIONS IN THE SPACES PROVIDED.

(1a) Identify Specimen A.

_____

(1b) Give TWO reasons for your identification.

(i) _____

(ii) _____

(1c) What is the function of Specimen A?

_____

_____

(2) Add a drop of solution X to specimen B.

(a) Write your observation _____

_____

(b) What do you conclude form your observation?

_____

_____

_____

(3) Look at Specimens C,D,E and F then complete the table below.

SPECIMEN	NAME OF SPECIMEN	STORAGE ORGAN	TYPE OF FOOD STORED.
C			
D			
E			
F			

GOOD LUCK

SJE/OGUNDELE (MRS).

Demonstration Secondary School, A.B.U., Zaria

Second Term Examination. Form

Subject: Integrated Science Time: 1 Hour

Name of Student: ..... Class: .....

INSTRUCTIONS: Answer all questions in the spaces provided.

(1) What is the dental formula for a man? .....
.....

(2) Write a dental formula for a named herbivore .....
(a) .....
(b) .....

(3) Leaves that are not evenly covered with chlorophyll are called: .....leaves.
(b) Give TWO examples of such leaves.
(i) .....
(ii) .....

(4) What is the most important chemical reaction in the world?
.....
.....

(5) A carbohydrate is made up of the elements
(a) .....
(b) .....
(c) .....

(6) What are Stomata? .....
.....
(b) What is diffusion? .....
.....
(c) Name TWO parts of a plant where diffusion take place.
(a) .....
(b) .....

(7) Make up a simple food web from the following:
(a) Hawk
(b) Termite
(c) Jackal
(d) Snake
(e) Small bird
(f) Green plants
(g) Snail

(8) How can we test for Starch in a leaf? .....
.....
.....
.....
.....
.....
.....
.....
.....
.....

(9) What happens in the Kidneys when the blood flows through the Kidneys.
.....
.....
.....
.....
.....
.....

(10) a. What is respiration? .....
.....
.....

b. Draw the diagram of the respiratory system.

c. Describe how the lungs perform that function during respiration.

GOOD LUCK

Correspondence Appendix XII

NCE/CC/SCED/2

NCE by Correspondence Division
Institute of Education
Ahmadu Bello University
Zaria

9 Sept 1986

The Principal,
Demonstration secondary School,
Ahmadu Bello University,
Zaria.

Dear Mrs Jaja,

Testing of Forms I,II and III.

Further to our discussions, this is to formally request your permission to be allowed to test Forms I, II and III as part of my researches into the continuous assessment system. I will also need access to the CA 2 forms in respect of the children concerned.

2. Without your approval, and the active cooperation of your staff this research will not be successful. I am happy therefore to have your assurances in that regard.

With all good wishes,

Yours sincerely,

Paul Turton.

INSTITUTE OF EDUCATION

Vice Chancellor: Professor A. N. Mohammed B.Sc., D.A.P. & E., (Lond.), Ph.D(ABU), F.N.S.P.

Your Ref.

Our Ref. NCE/CC/[illegible]

31 March 1987

The Director,
Educational Resource Centre,
Ministry of Education,
Kaduna State,
Zaria.

(for attention of [illegible])

Dear Sir,

Request to analyse the 1986 Integrated Science results sheets from the Demonstration Secondary School, A.B.U., Zaria.

As part of my on going research project into the relationship between scores achieved by students in their continuous assessment as compared with final examinations, I would like to have the opportunity of analysing the results sheets of the Form III students of the Demonstration Secondary School, ABU, Zaria, to assess the split half reliability of the Integrated Science examination, so far as these students were concerned, in 1986.

2. I would need to have the actual answer sheets for a couple of days to carry out the analysis. I would be able to keep the scripts in a secure place at all times and would let you have a copy of the results obtained.

3. I hope that you will be able to oblige me in this regard.

Yours faithfully,

Paul Turton
Coordinator Science Education
NCE by Correspondence Division.

NCE/CC/SCED/22

18th May, 1987

The Director,
Educational Resource Centre,
Ministry of Education,
Kaduna State,
Zaria.

(for atten: Head of Evaluation Unit)

Dear Mr. Ajani,

Analysis of Results of Form III Leaving Examination in Integrated Science.

Herewith, returned with thanks, are the answer scripts for the Demonstration Secondary School, A.B.U., Zaria, for Integrated Science, 1986.

2. Analysis of the scripts using the split-half technique gave, after correction, a value of 0.85 for the reliability coefficient which is satisfyingly high for this type of test.

3. I must thank you and Mrs. Shok for the assistance given me in this research.

Yours sincerely,

P. Turton.

Paul Turton