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C T S EXPERIMENT REPORT U–8

PHASE II

MATHEMATICS AND MATHEMATICS EDUCATION FOR ELEMENTARY SCHOOL PERSONNEL IN REMOTE REGIONS

Dr. G. Vervoort

JANUARY 1978 CONTRACT NUMBER 36100–5–0625

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January 1978

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TABLE OF CONTENT

TABLE OF CONTENT

PAGE 2

I EXPERIMENT U - 8

A) IDENTIFICATION:

1) Sponsor Number: U - 8

2) Title: Upgrading Mathematical Competence of Elementary School Teachers

3) Sponsor: Lakehead University

4) Experiment Leader: Dr. G. Vervoort

5) Contact Name: Same

6) Contact Address: Lakehead University, Thunder Bay, Ontario

7) Contact Telephone Number: 807 - 345 - 2121

B) OBJECTIVE:

To study the feasibility of the upgrading in both mathematics and mathematics Education of elementary school teachers in remote areas by means of satellite communication.

C) SUMMARY OF EXPERIMENT:

Every other evening for 30 weeks, a one hour interactive mathematics and mathematics education program was to be broadcast. Each hour of satellite presentation was to consist of a 20 minute video recorded lesson followed by a 10 minute two-way exchange by means of a two-way audio channel and a one-way telewriter signal. This was to be followed by another 20 minute video recorded lesson and a second live two-way telephone and one-way telewriter link. There were to be regular assignments as well as a text to complement the satellite presentation.

D) MILESTONE CHART:

September 1, 1974 - Funding for 20 minute pilot presentations completed.
Broad course outline completed.
Begin production of pilots.
Begin writing of supplementary materials.
Begin collecting pre-test data on teachers.
Establish initial contacts with other institutions.

March 1, 1975 - Four pilot 20 minute presentations dealing with the background and teaching of the metric system completed.
Begin formal approach to funding agencies.

May 1, 1975 - Finalize agreement with other institutions regarding their role in developing and evaluating the materials.

August 1, 1975	- Detailed course outline completed. Likely sources of funding established and tentative funding arrangements completed. Begin full scale production of 20 minute presentation.
August 31, 1976	- 20 minute mathematics content presentations completed. Writing of complementary mathematics content materials completed. Collecting of pre-test data on teachers completed.
April 1, 1977	- 20 minute mathematics education materials completed. Writing of complementary mathematics education materials completed.

E) OPERATIONAL PLAN:

1) Pre-experiment operations

a) development of experimental 20 minute presentations including some pre-testing.
b) development of written material and material packages which are to accompany the video presentation.
c) collecting of data on success of alternative delivery including regular extension.
d) determine suitable tests for measuring the result of the satellite presentations.
e) contact and familiarization with school personnel at remote site.
f) formal agreement with all cooperating institutions.
g) licencing requirements.

2) Operations

a) Systems description

i) A 30' dish at Shirley Bay was to be used to send the video signal of the pre-recorded sections of the program to the satellite, from where it would be rebroadcast to the various sites. Further rebroadcasting might have been arranged at each site if sufficient local interest existed.

The 8' dish at Thunder Bay was to be used primarily for the interaction with the audience. It was to be available for audio contact with various sites as required throughout the hour. Simultaneous with the broadcast from the 30' dish, a number of receiving stations were to be contacted, one at a time, for questions and comment. During the two 10 minute 'live' intermissions, a telewriter and audio signal were to be sent to all receiving stations simultaneously. Also comments from receiving stations were to be relayed 'live' to all stations during this period via the Thunder Bay dish.

The remaining on-site 8' dishes were to be used to receive the video, audio, and telewriter signals from Shirley Bay and Thunder Bay as well as for sending an audio signal to Thunder Bay during the interactive parts.

The participants with 3' dishes only would have to receive the pre-recorded programs via the postal service. They would run these tapes on their own machines and participate in the interactive audio-telewriter sessions only (see evaluation).

b) Content description

0:00 - 0:20 Pre-recorded television program (video & audio) from Shirley Bay to all 8' and 10' dishes.
Audio contact two-way between Thunder Bay and all receiving centers, one at a time.

0:20 - 0:30 Telewriter & audio signal from Thunder Bay to all 8' and 10' dishes simultaneously.
Audio signal only to all 3' dishes simultaneously.
Audio input to Thunder Bay from selected dishes for broadcast to all dishes simultaneously via the Thunder Bay dish.

0:30 - 0:50 Pre-recorded television program (video & audio) from Shirley Bay to all 8' and 10' dishes.
Audio contact two-way between Thunder Bay and all receiving centers, one at a time.

0:50 - 1:00 Telewriter & audio signals from Thunder Bay to all 8' and 10' dishes simultaneously.
Audio signal only to all 3' dishes simultaneously.
Audio input to Thunder Bay from selected dishes for broadcast to all dishes simultaneously via the Thunder Bay disc.

Participants: Elementary school personnel and members of the community who might be interested in upgrading their own or their children's mathematical competence.

F) EVALUATION PLAN:

1) Objectives

a) To measure the change in the mathematical competence of the participants.

b) To measure the change in the knowledge of mathematics education of the participants.

c) To measure the change in the mathematical competence of the children who are taught by the participants.

d) To compare the above results with results obtained by alternative modes and variation of course delivery.

2) Methodology

It is deemed important in experiments of this nature that the evaluation be objective as well as that it appears objective. For that reason OISE as an agency not immediately involved in project, was approached to do the evaluating.

II REPORT ON PHASE II

A) SUMMARY OF PROPOSAL:

It was proposed that the year March 1, 1975 - March 1, 1976 be devoted primarily to the writing of necessary outlines, background materials, scripting video tape outlines, and producing a detailed evaluation protocol. The writing in turn would necessitate a detailed search for available and suitable video materials. It was expected that several scholars of other institutions would be sharing in this aspect of the undertaking.

In the proposal it was pointed out that the effective coordination of personnel and materials for a task of this complexity would require a full time coordinator and a secretary in order to assure the proper integration and sequencing of all mathematical and educational concepts into the scripts and guides. The coordinator would also be expected to consult with various experts,--mathematical, educational, and technical,--and meet frequently with such representatives of OISE, OECA, DOC, the Ministry of Education, and others, who might contribute to the development and evaluation of all materials. In addition the coordinator would consult with the school personnel and other members of the small Northern communities, both for informal pretesting of some of the materials and for collecting data for the formal evaluation.

B) PROGRESS REPORT:

A reduction of funding for the year to approximately 60% of the requested amount led to immediate, severe difficulties. Salaries for new graduates from teachers' colleges, without classroom experience, started at $12,000.00 for 9 months of teaching. The project was limited to a scale of $1,000.00 per month without any of the perks and benefits that accrue to the classroom teachers. A significant handicap was the fact that no commitment for employment could be given beyond March 1, 1976, a date which was particularly ill-suited for the traditional academic year. Also the relatively late date of the announcement, mid April, contributed to further difficulties in recruitment as even those who might have been willing, had already signed contracts when the announcement of the position reached them. As a result it proved impossible to attract suitable candidates for the coordinator position, i.e. individuals with a knowledge of both mathematics and mathematics education, teaching experience, facility to deal with the public, teachers, and funding agencies, as well as writing ability.

Repeated approaches to all of the Canadian faculties of education and departments of mathematics led to a grand total of two applicants. Both were recent Ph.D. graduates in pure mathematics of foreign extraction with limited knowledge of the English language and, unfortunately, without any experience with the North American school system.

Finally, a prospect was located in the U.S. The candidate had only just recently returned from work in Africa and as a result was still uncommitted. While some serious reservations were expressed regarding the suitability of the individual, it was decided no viable alternative existed. The new coordinator started in the middle of September. Unfortunately, the initial misgiving proved to be well founded. With the first snap of cold weather in November, the person resigned without having made any contribution of significance to the experiment. A qualified teacher, temporarily out of work due to family circumstances, was hired as a replacement. While intelligent and willing, this person was engaged by the project for too short a time to make the contribution she might have made otherwise. As a result, the bulk of writing, coordinating and meeting rested on the shoulders of the primary investigator.

Meanwhile, two separate developments at Lakehead University affected the satellite project. The academic vice-president of the university, Dr. Eldon, resigned to accept a new position with the Energy Board. He had been the primary facilitator and supporter of the project in the senior administration and provided the overall coordination between the project and the university. He was not replaced. A second unfortunate development related to the general economic condition and the cutbacks in university funding. This resulted in rearranging of internal priorities. This in turn coupled with the departure of Dr. Eldon meant a significantly lesser degree of support from Lakehead University than expected. The release of all or most teaching duties of the primary investigator had been held out as a distinct possibility at an earlier date. This was no longer deemed feasible. Instead circumstances dictated that his teaching assignments were actually increased by some 33%. These facts, further aggravated by some health problem of the primary investigator, meant that he could not always assign the experiment the number of hours it deserved and needed.

Earlier it has been hoped and expected that other investigators at other institutions would participate and share in the development of the materials. A number of individual scholars from the University of Minnesota, Winnipeg, OISE, even the Israel Institute of Technology in Haifa, had expressed a willingness to participate. Again the lateness and shortfall in funding meant that these people were unable to make the necessary adjustments in their own schedules at such a short notice.

In order to solve the critical financial problem, a number of time-consuming approaches and proposals were made to various private foundations and governmental institutions. While expressing more than polite interest and even encouragement, the respondents did not make any financial commitments to the project.

A further source of discouragement was the lack of cooperation and disinterest by the provincial bodies such as the Ministries in Toronto and the OECA. As time passed the primary investigator concluded that OECA had little desire to see this project succeed. For instance, the one 20 minute pilot produced by OECA during the previous year was not only twice as costly as one produced privately elsewhere, but also ill-suited for its intended purpose. In fact, in the investigators' opinion, it would have to be completely redone. Also while the video tape was produced by the end of March 1975, its delivery was delayed until Christmas 1976.

Their attitude was in sharp contrast with the response from private producers and distributors of mathematical films. They leaned over backwards to stretch regulations and conditions to allow free use of their materials for purposes of the experiment. Alas, not many of the available films were suitable for incorporation in the course as planned. The project involved a combined media approach with an interactive component but few of the existing materials were designed for that purpose. Of the more than 100 films which were viewed and evaluated for possible inclusion in the program, not more than 6 could be used without major modification. The available 'Open University' materials produced elsewhere were equally unsuited.

The evaluation component for the project was designed under the direction of Drs. H. Russell and R. Traub from OISE. A copy of the various evaluation forms and protocol developed for that purpose is included in the appendix. The support by OISE for the project was excellent. Additional excellent cooperation was received from the local Ministry of Education and the school boards who made many man hours of personnel and classrooms available to the project for the gathering of materials and the local production of an experimental video tape. The members of the Department of Communications, indeed the whole federal service in Ottawa, was most supportive throughout. They did the utmost to make every experiment succeed. In particular, Mr. Terry Kerr was a source of support and encouragement for many experimenters.

When the writing dimly appeared on the wall, a decision was to be made regarding the future of the project. The following alternatives and combinations thereof were considered:

1) Reduce the experiment to the mathematics component only. Consequences of such a curtailment were thought to include

   a) a drastic reduction in enrollment. It was argued that it was precisely the promise of the mathematics education component with its constant references and applications for classroom behaviour that would entice the teachers to take the course in the first place. Without it few, if any, sections would be viable. The resulting small sample would prevent the drawing of any significant conclusions.
   b) without the education component there would be little effect on the mathematical achievement of the student which was to be one of the goals of the experiment.

Therefore, this alternative was rejected.

2) Reduce the experiment to the mathematics education component only. Consequences were thought to include

a) a greatly watered down content of the presentation. It was considered not feasible to approach the 'how to teach' until at least the 'what to teach' was mastered.
b) a drastic reduction in the experimental population if (a) was replaced by a qualifying test, resulting in a sample too small for drawing any significant conclusions.

Therefore, this alternative was rejected.

3) Reduce the experiment in length to a few weeks of even a few days only. Consequences of this decision would have included

a) the denial of university credit of the course for the participants.
b) a drastic reduction in the number of participants resulting in a sample too small for drawing any significant conclusion.
c) a denial of provincial university funding for these students resulting in even higher experimental costs.
d) the effects of such a short course on the learning achievement of the participants would be minimal in difference with learning resulting from another media combination.

In consideration of this, the alternative was rejected.

4) Reduce the experimental program to a live program only. Likely consequences were thought to include

a) a program that consisted almost entirely of the "talking face" format. Since the Stanford Study showed that remote learning depends as much or more on how the medium is used than on which medium is used, the results of a study based on poor materials would have little or no validity.
b) the program described in (a) would likely result in high drop-out rates which might be attributed erroneously to the satellite rather than the format thus harming future experiments.

In consideration of this, the alternative was rejected.

5) Rely entirely on existing materials and modify accordingly. This would in effect have reduced the project to another study on educational television without in any way making use of the additional potential of the satellite. In terms of the proposed research, this would be misleading and unnecessary.

Therefore, this alternative was rejected.

6) The final alternative was to reduce the study to a demonstration project, broadcasting live with interactive component from the DOC compound in Shirley Bay to campus. The audience would consist of teacher-students from Northern communities who had come to summer school. Thus at least some experience with the medium and audience reaction might be collected. However, due to low early registration that year, Lakehead University was unable to guarantee that the course would go.

Thus the last alternative had to be aborted.

As a result of the above considerations, Mr. Terry Kerr of DOC was informed experiment U - 8 was withdrawn.

C) <u>CONCLUSIONS AND RECOMMENDATIONS:</u>

1) The rational for conducting a study on the feasibility and the relative effectiveness of satellite communication as a vehicle for delivery of higher education to people in remote areas, remains as valid as ever.

a) The development of educational communication resources to take full advantage of technology offers a means for restraining the enormous increase of educational costs and simultaneously coping with the knowledge explosion.
b) The justification for satellite technology, and any technology, is its social utility and effectiveness in comparison with other technologies.
c) No valid conclusions regarding its social utility and effectiveness can be drawn until extensive experimentation has been completed.
d) No experimentation is valid unless it is complete, i.e. until it explores the full range of possibilities.

2) Meaningful satellite experimentation for educational purposes will require

a) <u>adequate funding</u> for the acquisition of such staff and materials as are necessary for the experiment. It appears that at present there exists a gross imbalance between funding for technology and funding for use of the technology. As a result educational experiments frequently end in failure or yield trivial or even misleading results.

The Alaska ATS - 6 experience is typical:

> In scheduling, the series was allotted ½ hour each week and funding for such an expanded program became a problem.
>
> A lecture series originally broadcast was discontinued because of overwhelming disinterest by the rural teachers, and the remainder of the programs have been studio interviews, panel discussions and slide presentations on topics requested by the teachers. This program series also includes interaction time, but few village teachers respond consistently. This can be attributed either to the time the program is broadcast, lack of free time for teachers, or lack of any motivation within the series itself to encourage teachers to watch. Few teachers have responded to written requests for evaluation of the series.

b) <u>long range funding</u>, perhaps with an original commitment of three years with further support dependent on satisfactory evidence of work accomplished.

i) <u>Cooperation and commitment of faculty from different institutions</u>--researchers need to be assured of this since a project of this type requires the cooperation of many people from many institutions and involves coordinating sabbatical leaves, release time, weighing of priorities, etc. Academic support could have mushroomed but under the circumstances no outsiders were willing to commit significant amounts of research time to what was perceived as a gamble.

ii) <u>Recruitment of qualified staff</u>--competent support staff is difficult to recruit when no assurances of any kind can be given beyond the coming month of March. This matter is further aggravated by the fact that the academic year runs from September until August.

iii) <u>Long range planning adequate for the task</u>--there is a time lag of two or more years between the design of quality educational materials and production. This is the case even in such products as elementary school text books. It is likely to be larger with more complicated productions.

c) <u>the production of suitable experimental materials.</u> Few existing video materials could be incorporated in a meaningful way into the proposal. A casual survey of programs from satellite experiments elsewhere leaves one with the impression that the biggest contaminating factor for scientific analysis is the persistent lack of quality of the materials.

d) <u>formal commitment of support from</u>

i) <u>one or more policymaking bodies</u> such as the Council of Ministers of Education, the Ministry of Colleges and Universities, or others. By the nature of the experiment there will always remain a number of unforeseen happenings and difficulties. However, the formal and real support of such an influential group make it much more likely that these obstacles will be overcome in a satisfactory manner.

ii) <u>the sponsoring universities</u> to ensure the smooth integration of the research project with the teaching and research of the department(s) involved. Such an agreement should include provision regarding

I alternate researcher(s) in the case of long term illness, death, or resignation.

II safeguards against policy shifts resulting from changes in the senior administration.

III adequate facilities and release time for the primary investigator(s).

e) formal agreement between federal and provincial authorities regarding rights, responsibilities and degree of support committed to the experiment. In Ontario such an agreement should include references to

i) the Ministry of Colleges and Universities which during the preparation for the experiment did not indicate any support or interest regarding the project.

ii) OECA which rather than contribute to the success of the experiment was perceived as a hindrance.

In summary, in spite of the withdrawal of experiment U - 8, the broader results of the total satellite project reflect foresight, courage, persistence, cooperation, and participation from many individuals, agencies, and institutions, who have been willing to commit time, spirit, energy, and resources to search for new ways of humanizing the technology offered by the Canadian satellites.

APPENDICES

CONTENT OUTLINE AND GENERAL OBJECTIVES FOR MATHEMATICS COURSE

Course Objectives:

1) to remedy existing deficiencies in the students' ability to handle the basic operations

2) to provide a foundation and a logical development of the basic concepts and algorithms of elementary school mathematics

3) to provide the students with a collection of mathematical examples and illustrations which can be passed on to the elementary school pupil

4) if necessary, to change attitudes towards mathematics from passive endurance to a participating, appreciative acceptance

I THE LANGUAGE OF MATHEMATICS

a) Introduction:

Mathematics all around us

Outline:

Common and uncommon examples of the importance of mathematics
Reasons for learning and teaching mathematics, individual and societal
Changes in mathematics program in the school
Goals, objectives, and approach of course
Relation to consequent mathematics education course

Instance:

Extension of concept of "unknown" to include operations

Objectives:

The student will demonstrate
- (a) an understanding of the role of mathematics in the modern world
- (b) a rational for the learning and teaching of mathematics

b) The nature of mathematics:

The importance of vacabulary OR Did Mary walk around the squirrel?

Outline:

Mathematics as a science of necessary conclusions
Need for unambiguous vacabulary
Necessity for undefined terms
Necessity of axioms
Necessity for formal rules of logic

Instance:

Distinction of walking around a tree and walking around a squirrel
Ambiguity of common expressions such as: "bigger than" (2 3), "surprise", etc.

Objectives:

Student will demonstrate
- (a) an understanding of both the power and limitations of a mathematical argument
- (b) an appreciation of the necessity of a common collection of undefined terms and axioms
- (c) an appreciation of the need to formalize the rules of logic

c) Sets, OR What you always wanted to know about sets, but were afraid to ask

Outline:

Review of necessity of undefined terms
Set, subset, null set, element, universal set
Set short hand, "set builder notation"
Equaltiy, unequality of sets
Contains, contained in

Instance:

Chess set, set of dishes

Objectives:

The student will demonstrate an ability to
- (a) write unabiguous descriptions of sets
- (b) describe a set by its elements
- (c) apply the concepts and notations of set, subset, null set, element, containment, universal set, equality and unequality of sets

d) One-to-one correspondence OR Why some things are more equal than others

Outline:

Ambiguity of "more", "less", "just as many"
Basic notion of counting
1-1 correspondence
Equivalent sets
Finite and infinite sets
Equivalence relation
Symmetric
Reflexive
Transitive

Instance:

Ambiguity of just as many

Objectives:

The student will
- (a) recognize 1-1 correspondence between sets, finite or infinite
- (b) demonstrate 1-1 correspondence where possible or recognize when it is impossible
- (c) determine when sets are equivalent
- (d) distinguish between equivalent and equal
- (e) define, recognize, and be able to give examples of the equivalence relation and its components (reflexive, symmetric, transitive)

e) Set operations

Outline:

Intersection and union of given sets
Short hand
Venn diagrams, union and intersection
Intersection and union by set builder notation
Relative and absolute complement
Properties of union and intersection

Instance:

L.C.M. and G.C.D.
Finding number of people in a group given overlapping numbers

Objectives:

The student will be able to
- (a) find the intersection of given sets by example, Venn diagrams, and "set builder" notation
- (b) find the union of given sets by example, Venn diagrams, and "set builder" notation
- (c) find the relative and absolute complement by example, Venn diagram and "set builder notation"
- (d) demonstrate commutative, associative, and distributive properties of union and intersection by example
- (e) define multiple union of intersection
- (f) verify such statements as $(A \cap B)^1 = A^1 \cap B^1$, etc. using Venn diagrams

f) Logic and common sense

Outline:

Distinction logic and common sense - watch which runs 60 sec. late
Review nature of mathematics and need for formal logic
Complete truth tables for union and intersection
Open versus closed sentences
Conjunction, disjunction, and truth tables
Negations, double negations, complement
Logical equivalence, proof of properties of intersection and union
Converse, inverse, contrapositive
Conditional, biconditional

Instance:

Isomorphism between hypothesis, convers, inverse, contrapositive table and multiplication of odd integers modulo 8

Objectives:

The student will be able to

(a) complete truth tables for union and intersection
(b) define and prove commutative, associative and distributive properties of union and intersection by truth tables
(c) define and recognize open and closed sentences
(d) define and recognize conjunction, disjunction and determine the truth value of the result
(e) formulate negations and double negations of open sentences
(f) state what is meant by logical equivalence and apply it to prove simple statements
(g) complete the truth table for the conditional and biconditional
(h) complete the truth table for converse, inverse, and contrapositive
(i) complete truth tables for combinations and negations of the above

g) Cartesian products of sets

Outline:

Cartesian product as basis for multiplication
Ordered pair
Cartesian product of two sets
Cartesian product of empty and non-empty set
Difference Ax(BxC) and (AxB)xC
Equivalence of (AxB)xC and Ax(BxC)

Instance:

Origin of terminology: Descartes, abscissa (scissors), etc.

Objectives:

The students will demonstrate

(a) an understanding of the concept of ordered pairs
(b) an ability to define the Cartesian product of two or more sets
(c) an ability to deal with expressions such as $A \times \phi$, $\phi \times A$, $\phi \times \phi$
(d) that $A \times B \neq B \times A$ and that in general $A\times(B\times C) \neq (A\times B)\times C$
(e) that $A\times(B\times C) \sim (A\times B)\times C \sim B \times A \times C$ etc.

h) Operation OR When ignorance is bliss

Outline:

Operations as an unknown
Concept of isomorphism
C-group versus rotation of triangle-versus permutations
Associative and commutative properties closure, identity

Instance:

Logarithm

Objectives:

Student will be able

(a) to read and interpret a finite table
(b) define and recognize an identity element in a table
(c) define and recognize an inverse
(d) define the commutative property in general and tell whether or not a table is commutative
(e) define the associative property and test for selected cases
(f) define and recognize the closure property

II THE ARITHMETIC OF WHOLE NUMBERS

a) Counting and writing of numerals

Outline:

Survey of historical numeration systems
Egyptian
Babylonian
Chinese
Roman
American Indian
Hindu-Arabic

Instance:

Kensington stone

Objectives:

The student will
- (a) have an appreciation and some knowledge of the development of the number symbols and the decimal system
- (b) be able to translate roman numerals into hindu-arabic and vice-versa

b) Place value systems and bases OR What was the matter with Alice in Wonderland

Outline:

Rational for exploring other bases
Demonstration of base 4
Demonstration of other number bases
Application of special properties of base 2
Operations with non-decimal bases
Mixed base operations of the pocket calculator

Instance:

Counting with Alice
Card sorting process

Objectives:

Student will demonstrate
- (a) ability to regroup according to a given base
- (b) translation from decimal to non-decimal base and vice-versa
- (c) writing of a sequence of numbers in a non-decimal base
- (d) understanding of decimal system by performing parallel operations in non-decimal base

c) Restrictions and advantages of other numeration systems

Outline:

Roman multiplication
Finger multiplication
Pro and con of small versus large bases
Number versus numeral

Instance:

Greek development of geometry operations with figurate numbers

Objectives:

Student will be able to
- (a) demonstrate finger multiplication
- (b) list advantages and disadvantages of other numeration systems and other number bases
- (c) define difference between number and numeral

d) Definition of whole numbers and counting

Outline:

Review sets
Review 1-1 correspondence
Definition of whole number by standard sets
Cardinal number
Properties of cardinal numbers of finite sets

Instance:

Bertrand Russell

Objectives:

The student will be able
- (a) to give a definition of a standard set
- (b) to recognize the special properties of standard sets
- (c) to define the cardinal number of a finite set
- (d) to apply the defintion of cardinal number
- (e) know the properties of the cardinal number of finite sets

e) Operations and properties

Outline:

Review set operation
Unary, binary, ternary operations
Meaning of parenthesis (hamburger + mustard) + milk
Associative, commutative, distributive properties
Identities
Inverses

Instance:

Redefinition of addition, subtaraction and multiplication without "carrying", exploration of properties of this system

Objectives:

Student will be able

(a) to define and recognize unary, binary, and ternary operations
(b) to define, recognize, and illustrate the associative, commutative, and distributive properties in unfamiliar numerical operations
(c) to define, and recognize the identity and inverse in unfamiliar numerical operations

f) Mathematical definition of addition and its consequences

Outline:

Review properties of set operations
Apply set properties of standard sets to define addition
Distinguish between addition of whole numbers and sets
Derive associative and commutative properties for addition
Generalization of properties
Equals added to equals law
Cancellation law for addition

Instance:

Objectives:

The student will be able to

(a) define the sum of two whole numbers in set-theoretic setting
(b) use these definitions to prove addition statements such as 2 + 2 = 4
(c) use the definitions and corresponding set properties to
(d) generalize the associative and commutative properties and prove special cases
(e) give a mathematical explanation of the cancellation law for addition

g) Mathematical definition of subtraction

Outline:

Definition of inequality
Tricotomy law
Properties of inequalities
Definition of subtraction as inverse
Proof of basic subtraction theorems
i.e. if $a - c = b - c$ then $a = b$
$(a+c) - (b+d) = (a-b) + (c-d)$
$(a-b) = (a+c) - (b+c)$
Proof of basic inequality theorems
$a<b$ and $c<d$, then $(a+c) < (b+d)$
$(a+c) < (b+c)$, then $a < b$
$a = b$ then $a - c = b - c$
$a-(b+c) = (a-b)-c$
$(a+b) - b = a$

Instance:

Objectives:

to define the inequalities < and >
to know the properties of inequalities
to define subtraction
to know the properties of subtraction
to be able to prove some basic subtraction theorems
to be able to prove some basic inequality theorems

h) Algorithms for Addition and Subtraction - When what is borrowed need not be returned

Outline:

Addition of 2 digit and 1 digit number in any base
Addition of series of whole numbers
Addition of 3 digit numbers by "carrying"
Subtraction by basic method
Subtraction by regrouping
Subtraction by complements
Subtraction by addition

Instance:

Ethical child who returned all that was borrowed

Objectives:

The student shall be able to

(a) write the basic addition table relative to any base ≤ 10
(b) justify the "carrying" process
(c) justify the procedure for adding a sequence of whole numbers (one digit)
(d) use an addition table as a subtraction table in any base ≤ 10
(e) justify subtraction by basic method
(f) justify subtraction by regrouping
(g) justify subtraction by complements
(h) justify subtraction by addition

i) Mathematical Definition of Multiplication

Outline:

Review cartesian product
Definiton of product of whole numbers
Commutative property of multiplication
Associative property of multiplication
Generalized commutative property
Cancellation law
Identity
Proofs of
$a \cdot 1 = a$
$a \cdot 0 = 0$
if $a \cdot b = o$, then $a = 0$ or $b = 0$

Instance:

Objectives:

The student shall be able

(a) to define and elaborate on the definition of a product of whole numbers
(b) to state and prove the commutative property for multiplication of whole numbers
(c) to state and prove the associative property for multiplication of whole numbers
(d) to state the generalized commutative property for multiplication of whole numbers and prove special cases such as $(a \cdot b) \cdot c = (c \cdot a) \cdot b$ for multiplication
(e) to state the cancellation law of whole number
(f) to contrast the identities for addition and multiplication
(g) to prove $a \cdot 1 = a$, $a \cdot 0 = 0$, if $a \cdot b = 0$, then $a = 0$ or $b = 0$

j) Mathematical Definition of Division

Outline:

Definition of division as inverse of multiplication
Lack of closure, commutative and associative properties
Basic facts for division by zero
Proof of $(b \neq 0)$
$(a \cdot b) \div b = a$
Cancellation law for division
Dividend, divisor, quotient, remainder

Instance:

Objectives:

The student shall be able
- (a) to define the quotient of 2 whole numbers
- (b) to give counter examples for division of whole numbers with respect to closure, the commutative property, and the associative property
- (c) to state and explain the facts regarding devision by zero
- (d) to prove $(a \cdot b) \div b = a$
- (e) to illustrate the definition of devidend, divisor, quotient and remainder

k) The distributive properties

Outline:

Review distributive properties of union over intersection and intersection over union
Distributive properties of cartesian product over union and intersection
Distributive properties of multiplication over addition and subtraction
Removal of parenthesis and common factors
Multiplication as repeated addition
Generalized distributive property of * over ⊙

Instance:

Application of distributive property on pocket calculator to do problems such as (8÷2) + (6÷3)

Objectives:

The student shall be able

(a) to state and illustrate the distributive properties of cartesian product over union and intersection
(b) to state and prove the distributive property of multiplication over addition
(c) to apply the distributive property for removal of parenthesis and common factors
(d) to state, verify, and prove other ofrms of the distributive properties and extensions such as ax(b+c+d) = ab + ac + ad
(e) to state the meaning of the distributive property of * over ⊙ and verify it in finite fields
(f) to show that multiplication is distributive over subtraction
(g) to recognize and verify which operations of arithmetic distribute over which

ℓ) Algorithms for multiplication

Outline:

"Russian Peasant" algorithm
Many-digit by one digit number in any base
Product of many-digit numbers in any base
Matrix multiplication
Napiers bones
Finger multiplication and proof
Short cuts in multiplication

Instance:

Russian Peasant multiplication and base two

Objectives:

The student shall be able

(a) to write the basic multiplication table in any base
(b) to use and justify the "Russian Peasant" algorithm
(c) to multiply a many-digit number by a single digit number and justify the process
(d) to multiply a many-digit number by a many-digit number and justify the process
(e) to multiply many-digit numbers
(f) to use and justify matrix multiplication, napiers bones and finger multiplication
(g) to use and justify short cuts in multiplication based on the distributive property

m) Algorithms for division

Outline:

Review the definition of division with remainder
Strategy for division
Division of many-digit number by single digit number in any base
Standard division algorithm

Instance:

Child's view of division process

Objectives:

The student shall be able
- (a) to carry out division with remainder using a multiplication table in any base ≤ 12
- (b) to divide a many-digit number by a single digit number showing all details
- (c) to divide by a many digit number and explain each step of the process

n) Division and divisibility - Rules for casting out nines and other pearls

Outline:

Development of rules of divisibility for 2, 4, 5, 8, 10
Development of rules of divisibility for 3, 9
Development of rules of divisibility for 11
Combination of divisibility rules for 6, 12, 15, 18, etc.
Modification of divisibility rules in other bases
Casting out nines
Casting out (k-1) in other number bases

Instance:

A number in base k is divisible by (k-1) if and only if the sum of the digits is divisible by (k-1)

Objectives:

The student shall be able
- (a) to apply and justify the rules of divisibility for 2, 3, 4, 5, 6, 8, 9, 10, 11, 12 and combinations of these
- (b) to modify the rules of divisibility as required for other number bases
- (c) to use the rule for casting out nines in multiplication problems

o) Common divisors and common multiples

Outline:

Factorization, prime numbers, sieve of Erastostencs
Fundamental theorem of arithmetic
Sets of divisors and their intersection
Greatest common divisor
Sets of multiples and their intersection
Least common multiple
Product of g.c.d. and l.c.m.

Instance:

Ullam's spirals and modern painters

Objectives:

The student shall be able
(a) to determine whether any number ≤ 500 is prime or composite
(b) to state the fundamental theorem of arithmetic
(c) to determine and define g.c.d. and l.c.m. in terms of set intersection
(d) to find the g.c.d. and l.c.m. for three or more numbers
(e) to explain why one is considered neither prime nor composite

p) Perfect and amicable numbers - How to make a mathematical valentine

Outline:

Deficient and abundant numbers
Definition of perfect numbers
Perfect numbers and the Pythagoreans
Definition of amicable numbers
Number families
Some properties and problems with perfect numbers

Instance:

Mathematical valentine of 220 and 284 and some of its history

Objectives:

The student shall be able
(a) to determine whether a number is deficient or abundant
(b) to state and apply the definition of perfect number
(c) to state the definition of amicable pairs and verify it with the pair (220, 284)
(d) to read and understand some passages regarding the history of numbers

q) Working with other number systems - When $2 + 2 \neq 4$

Outline:

Properties of odd and even numbers
Clock arithmetic
Congruence modulo m
Addition and multiplication of congruence classes
Subtraction and division of congruence classes (when possible)
Review of casting out nines

Instance:

Formula to determine what day one is born

Objectives:

The student shall be able
- (a) to state and apply the properties of even and odd numbers
- (b) to demonstrate an intuitive understanding of modular arithmetic in concrete instances
- (c) to determine when two whole numbers are congruent modulo m through use of remainders
- (d) to state the properties of congruence
- (e) to state, prove, and apply the rules for addition and multiplication of congruences classes
- (f) to state and apply the rules for subtraction and division of congruence classes and realize that division is not always possible

r) From guessing to mathematical induction

Outline:

Domino lines
Ladders
Sequence of igniting matches
Analysis of inductive process
Examples of informal proof by induction

Instance:

George Polya's example of number of parts into which space is divided

Objectives:

The student shall be able
(a) to justify the inductive process with the aid of concrete materials
(b) to identify the steps in the inductive process
(c) to supply reasons for the steps in a given inductive proof

s) The lure of large numbers

Outline:

Nomenclature of large numbers
Disappearance of comma
Googol, googolplex
Examples
Scientific notation
Powers
Rules for multiplication and division by addition and subtraction of exponents

Instance:

Billion in Britain and the U.S. invention of the game of chess

Objectives:

The student shall be able

(a) to spell and order the terms million, billion, trillion, quadrillion, quintillion, sextillion, septillion, octillion
(b) to correctly write the numerals correspondeing to these numbers
(c) to translate large numbers into scientific notation and vice versa
(d) to manipulate expressions in scientific notation
(e) to state, explain, and apply the rules for multiplication and division by addition and subtraction of exponents

III CREATING THE SYSTEM OF INTEGERS

a) Creating negative integers - Your bank would not want to do without them

Outline:

Summary how the whole numbers are going to be extended by closure via the operations of subtraction, division, algebraic and transcendental numbers
Need for additional numbers
Number line
Raised signs
Absolute value
Interpretations of negative numbers

Instance:

Count down Satellite launching

Objectives:

The student shall be able
- (a) to find the inverse of an integer
- (b) to find the absolute value of an integer
- (c) to find the value of expression involving both inverses and absolute value
- (d) to distinguish between the concepts of "minus" "negative"
- (e) to locate positive and negative numbers on the numberline
- (f) to apply the notion of opposite quantities i.e. positive and negative in novel situations

b) Basic operations with integers - Why the product of two negatives is positive

Outline:

Need to extend the definitions of multiplication and division and to examine the properties of the extended system
Definition of addition for integers, associative and commutative properties, closure, identity, inverse
Subtraction for integers
Some basic theorems regarding addition and subtraction of integers
Definition of multiplication for integers, first using patterns to establish the rules of operation, then proof for numerical examples only
Associative, commutative, distributive properties for multiplication, closure, identity
Some basic theorems regarding multiplication of integers
Definition of quotient $a \div b$ when $b \neq 0$
Properties of division of integers
Trichotomy law

Instance:

Number line for addition and subtraction
Pattern grit for multiplication

Objectives:

The student shall be able

(a) to state why the operations need to be redefined for the integers and why the properties have to be re-investigated
(b) to define the sum of any two integers ($^{+}n + ^{+}m$, $^{-}n + ^{-}m$, $^{+}n + ^{-}n$, $^{+}n + 0$, $^{-}n + 0$, $^{+}n + ^{-}m$ for $n > m$, $^{+}n + ^{-}m$ for $n < m$)
(c) to find the sum of two or more integers
(d) to prove $a = b$ if and only if $a + c = b + c$
$a = b$ if and only if $\text{opp } a = \text{opp } b$
(e) to state and apply the definition of subtraction of integers
(f) to evaluate simple and complex combinations of addition and subtraction
(g) to prove $a = b$ if and only if $a - c = b - c$
$a + b = 0$ if and only if $a = \text{opp } b$
$\text{opp}(a+b) = \text{opp } a + \text{opp } b$
$a - b = (a+c) - (b+c)$
(h) assuming associativity, commutativity and distributive property to prove that
$a \cdot 0 = 0$
$a \cdot \text{opp } b = \text{opp } a \cdot b = \text{opp}(a \cdot b)$
$\text{opp } a \cdot \text{opp } b = a \cdot b$
(i) to find the product of two or more integers
(j) to prove for all integers
$(a+b)^2 = a^2 + 2ab + b^2$
$(a+b) \cdot c = ac + bc$
$a(b-c) = ab - ac$
(k) to evaluate complicated expressions involving multiplication, addition and subtraction of integers

(ℓ) to define the quotient $a \div b$ when $b \neq 0$

(m) to state and justify the properties of integers

(n) to evaluate simple and complex expressions involving the operation of division of integers such as $[(({}^{+}12 \div {}^{-}3) + 4) \cdot 2] \div [(4 - {}^{-}5) \div 3]$

(o) to state the trichotomy law for integers

(p) to verify basic statements on equality such as if $a < b$, is ${}^{-}a < {}^{-}b$

(q) to state the properties of the additive identity and inverse and the multiplicative identity

c) Short cuts in calculation - How to do it faster and with less effort

Outline:

$(8274 + 99) = (8274 + 100) - 1$
$(24 \times 26) = (20 + 4)(20 + 6)$
$= (20 \times 30) + (4 + 6)$
$(24 \times 36) = (30 - 6)(30 + 6)$
$= 30^2 - 36$
$(a \cdot 25) = 100(a \div 4)$
$a \cdot 5 = 10(a \div 2)$
Multiplication by 11

Instance:

"magic" number tricks

Objectives:

The student shall be able
- (a) to justify some of the common calculation short cuts
- (b) to apply these short cuts to find the correct answer within a set time limit
- (c) to justify some "magic" number tricks
- (d) to create some "magic" number tricks on her/his own

IV THE RATIONAL FOR RATIONAL NUMBERS

a) Development of rational number system

Outline:

Review development whole numbers to integers
Need to extend number system to satisfy closure of division
Representation of fractions as parts of objects and as points on number line
Definition of unit fractions
Definition of fractions
Definition of equivalent fractions
Review g.c.d.
Definition of fraction "in lowest terms"
Positive and negative numerators and denominators
Comparison of fractions

Instance:

Objectives:

The student shall be able

(a) to justify a further extension of the number system
(b) to represent fractions as parts of objects, and on the number line
(c) to state and apply the definition of fraction in concrete situation
(d) to define equivalent fractions
(e) to translate a given fraction into another with given numerator or denominator
(f) to know the meaning of a fraction "in lowest terms"
(g) to reduce a given fraction to lowest terms
(h) to define and correctly use the symbols

$^-(\frac{a}{b})$, $(\frac{-a}{b})$, $(\frac{a}{-b})$

(i) to insert the correct inequality sign between different fractions

b) Operations with fractions

Outline:

Distribution fraction and rational number
Addition of fractions with same denominators
Addition of fractions with different denominators
Properties of addition of rational numbers
Subtraction of fractions
Properties of subtraction of rational numbers
Multiplication of fraction with natural number
Multiplication of fractions
Properties of multiplication
Division of fractions
Properties of division
Mixed numbers

Instance:

Grit system for addition and multiplication of fractions

Objectives:

The student shall be able
(a) to distinguish between fraction and rational number
(b) to add fractions
(c) to state the properties of addition of rational numbers
(d) to subtract fractions
(e) to state the properties of subtraction of rational numbers
(f) to multiply fractions
(g) to state the properties of multiplication of rational numbers
(h) to divide fractions
(i) to state the properties of division of rational numbers
(j) to supply reasons for individual steps in given proofs of theorems dealing with operations on fractions
(k) to translate mixed numbers into standard notation and vice versa
(ℓ) to do arithmetic operations on mixed numbers

c) Decimal fractions

Outline:

Growing importance of decimal fractions
Change of decimal point to decimal comma
Translation of fractions to terminating decimal and vice versa
Decimals and percentages
Operations on decimals, rules for decimal comma
Review of laws of exponents, positive and negative
Decimal fractions and scientific notation
Repeating decimals
Translation of fractions to repeating decimals and vice versa

Instance:

$.\overline{9} = 1$?

Objectives:

The student shall be able

(a) to use the correct notation for decimal fractions, terminating or non-terminating
(b) to determine whether a fraction can be changed to a terminating decimal
(c) to translate any fraction to a decimal and vice versa
(d) to translate decimal fractions to percentages and vice versa
(e) to carry out and justify the rules for basic operations with decimal fractions
(f) to translate any decimal, large or small to scientific notation
(g) to state, explain and apply the rules for operations with exponents, both positive and negative

d) Calculating with calculators

Outline:

Calculator gadget or godsend?
Experiences with basic calculators
Order of operations
Constant key
Floating decimal point
Operations with fractions
Operations beyond capacity
π
Compound interest
Square root

Instance:

Demonstration (or hands on experience) with different types of calculators

Objectives:

The student shall be able

(a) to operate a claculator in natural mode
(b) to illustrate and describe advantages of constant key
(c) to illustrate and describe advantages of a floating decimal point
(d) to list and describe main desirable calculator features
(e) to write a "program" for adding, subtracting, multiplying and dividing fractions without storage
(f) to write a "program" for finding square root with storage
(g) to distinguish which "program" or order of operations will result in the least cumulative error
(h) to state that

$\frac{355}{113}$ is a more desirable approximation of π than $\frac{22}{7}$

V THE WORLD OF GEOMETRY

a) Shapes and concepts

Outline:

Undefined terms: point, line, plane, space
Names for common planar figures
Names for common 3-dimensional figures
Names for 5 regular solids
Half lines, lines, segments, rays, notation
Angles and angle measure
Sum angles of a triangle
Curves, simple, closed
Definition of circle and sphere

Instance:

Objectives:

The student shall be able

(a) to distinguish between geometric terms as abstractions and their physical representation
(b) to name the common planar figures and describe their characteristic properties
(c) to name the common 3-dimensional figures and describe their characteristic properties
(d) to name and construct the 5 platonic solids and state the number of vertices, edges and faces of each
(e) to distinguish between line, segment, half line and ray
(f) to state the incidence properties of points and lines in the plane
(g) to state the separation properties of a plane by a line
(h) to define the measure of an angle and to identify a 45°, 60°, 90°, 135°, angle
(i) to state and demonstrate with concrete materials that the sum of angles of a triangle is 180°
(j) to recognize and give examples of closed curves, simple curves, simple closed curves
(k) to define a circle and a sphere

<u>DOCUMENT A: GENERAL INSTRUCTIONS FOR OBSERVERS.</u> PAGE ONE

1. Arrange to spend a brief time talking to the teacher before entering the classroom. Explain <u>clearly</u> and <u>emphatically</u> that in no way is the study meant to evaluate a particular teacher, and that none of the information you collect or observations you make will be given to anyone outside the research team. Rather, the purpose of the study is to determine whether a particular mathematics education program produces changes in the way mathematics is routinely taught in northern classrooms. Thus it is important that the teacher teach as he or she normally would, and not attempt to teach a "model lesson". As well, tell the teacher that, even though your interest is in observing mathematics lessons, you do not wish the teacher to give any extra time or emphasis to mathematics in the daily schedule. Tell the teacher that he/she will be asked to examine your observation form after the lesson(s), and that his/her comments will be recorded and form part of the study data. Again, reassure the teacher that all information will be kept completely confidential, and that it will be read <u>only</u> by the person coding it for the purpose of combining it with observations from other mathematics classes.

2. Arrange to meet the teacher after class to have him/her examine your observation forms and record any comments, as well as assist you in filling out the other necessary forms (see "Observer Procedure in the Classroom", 7(i)).

3. If you have not already been informed, find out how many grades or comparable instructional groupings there are in the classroom. Ask the teacher to help you sketch a floor plan of the classroom with the positions of these different instructional groups marked. (If this is difficult because there is not a reasonably fixed seating arrangement, make a note of this fact and include it with the data you submit to the project team.)

4. Explain to the teacher that you would like to briefly take several students aside, one at a time, immediately after the mathematics lesson, to ask them a few questions. Show the teacher the Student Questionnaire (DOCUMENT D) to reassure him/her about the nature of the questions. If the time mentioned is not convenient for the teacher, arrange a mutually satisfactory time during your visit.

5. When you enter the classroom, sit as close as possible to whatever group is receiving mathematics instruction. If there are several grade levels in the room, it may be necessary to move a number of times while you are there.

6. Follow the steps described in DOCUMENT B ("Observer Procedure in the Classroom").

APPENDIX: INSTRUCTIONS FOR SELECTING STUDENTS FOR OBSERVATION AND/OR QUESTIONNAIRE ADMINISTRATION

DOCUMENT A
PAGE THREE

Before you can properly select students for these two purposes, it will be necessary for you to assign to each student in the classroom a unique number. There are several ways in which this can be done, none entirely satisfactory in practice. Depending on the particular situation in which you find yourself, you will have to use your judgement as to the best method of assigning these numbers. Here are two suggestions:

1) When you and the teacher draw up your floor plan of the classroom, number the seats in a logical order--e.g., each row in turn front to back. Assign each child the number you have given his/her seat.

   DISADVANTAGES:

   a) The room may not have a fixed seating plan.

   b) If there is a great deal of movement around the classroom, you may not remember which child goes with which desk. (If there is sufficient time, you may be able to overcome this handicap by making brief identifying notations on your plan--e.g., "red shirt".)

2) Arrange to get a list of students ahead of time from the teacher (the list may be, but need not be, in a particular order--e.g., alphabetical). Number the students in the order given on the list.

   DISADVANTAGES:

   a) The obvious great disadvantage is that you are now faced with the task of matching pupil with name and number. It would probably take an unreasonable length of time to have the teacher identify each child for you, and you would still be faced with the problem of <u>remembering</u> which child was which. (This could perhaps be overcome as in 1b) above.)

Whatever scheme you settle on, you should, before the class you are observing begins, have each child firmly identified with a number between 1 and whatever the total classroom population is. The next problem is to select the pupils you will observe during the class. (The observation procedure has you focus first on the teacher, then on two pupils in turn, then on the teacher again, then on two further pupils in turn, and so on.)

Attached to this document is a random number table, along with instructions on how to use it to select a list of two-digit random numbers. Once you know the total size of the classroom population, draw a list from this table of two-digit numbers. <u>For this purpose, consider the numbers from 1 to 9 as two-digit numbers and write them as "01", "02", and so on.</u> Draw <u>only</u> numbers between 01 and the class size (i.e., if the classroom contains 25 pupils, do <u>not</u> include any numbers over 25). Your list will almost certainly contain duplications; that is quite acceptable. Extend your list to approximately 50 numbers; if you are observing more than one class period taught by this teacher, add about 50 more numbers for each additional class period. (This is <u>not</u> necessary in, for example, the case where you are observing lessons taught to several classes, but <u>simultaneously</u>. You need roughly 5 numbers for each 4 minutes of observation time.)

When it is time to observe your first pupil, take the first number on your list. If that pupil is present, and is involved in mathematics, that is the pupil you will observe. If not, proceed to the second number; continue until you reach a number identified with a pupil who <u>is</u> present and doing mathematics. Write that pupil's number in the box <u>above</u> the first student column to be coded on the

Observation Form. Then make your observations of that student. Continue down the list until you reach another usable number; write it in the box above the second student column and make your observations of that student. Follow this procedure each time you are to observe a student. It may well be that the same student is observed more than once during the class; this is not a problem.

After the class, when you are to administer the Student Questionnaire, select the students to be questioned by continuing down your list. The number of students to be questioned will vary with the size of the class. Count the number of students who have been doing mathematics during this period, and determine the number to be questioned as follows:

Class size	No. of questionnaires
1- 5	1
6-10	2
11-15	3
16-20	4
etc.	

It may be that you exhaust the numbers on your list, either during observations or during questionnaire administration. If so, begin again at the top of the list. Remember to allow more numbers for your next observation to avoid a recurrence of this problem.

NOTE: When you are administering questionnaires, avoid duplications. If the same number comes up twice, do not question the student a second time; go on to the next number instead.

HOW TO USE THE TABLE OF RANDOM NUMBERS TO SELECT YOUR LIST OF TWO-DIGIT NUMBERS.

You may begin at any point in the table and proceed in any direction, either horizontal or vertical. Once you begin, however, please keep to the same direction and proceed sequentially. Select each two-digit number you come to that falls within the range of the number of students in the class you are observing.

EXAMPLE: You are about to observe a class of 25. You decide to begin on the eleventh line of the table (the one beginning "41 84 98 45 47") and to proceed horizontally left to right, taking rows down the table in turn.

You will reject the first seven numbers you come to as too large (over 25); your first acceptable number is 05. Your completed list--taking all numbers up to 25 in the order you reach them and no numbers over 25--will read:

05, 23, 06, 19, 15, 23, 24, 21, 18, 14, 09, 11, 08, 14, 01, 17, 13, 10, 15, 16,

06, 11, 02, 18, 16, 22, 25, 20, 20, 01, 15, 10, 24, 15, 24, 14, 12, 22, 17, 04,

21, 15, 14, 15, 19, 15, 20, 20, 14, 09

The first student you observe will be student 05, unless he/she is absent or doing something other than mathematics (in this case, you will observe student 23 first). Continue to observe students in order, including duplications, until the end of the class. For instance, assuming all students are present and doing mathematics, if you observe 20 students during the class you will have observed student number 23 on two different occasions; the same is true of students 15 and 14.

With a class of 25, you wish to question 5 students. Continue along your list, and you will find that the students you should speak to are those with numbers 06, 11, 02, 18, 16. If a duplicate had turned up in this group, you would skip the second (or third, etc.) occurrence of the number and select the next number from your list.

DOCUMENT A
PAGE SEVEN

TABLE OF RANDOM NUMBERS

60 36 59 46 53	35 07 53 39 49	42 61 42 92 97	01 91 82 83 16	98 95 37 32 31
83 79 94 24 02	56 62 33 44 42	34 99 44 13 74	70 07 11 47 36	09 95 81 80 65
32 96 00 74 05	36 40 98 32 32	99 38 54 16 00	11 13 30 75 86	15 91 70 62 53
19 32 25 38 45	57 62 05 26 06	66 49 76 86 46	78 13 86 65 59	19 64 09 94 13
11 22 09 47 47	07 39 93 74 08	48 50 92 39 29	27 48 24 54 76	85 24 43 51 59
31 75 15 72 60	68 98 00 53 39	15 47 04 83 55	88 65 12 25 96	03 15 21 91 21
88 49 29 93 82	14 45 40 45 04	20 09 49 89 77	74 84 39 34 13	22 10 97 85 08
30 93 44 77 44	07 48 18 38 28	73 78 80 65 33	28 59 72 04 05	94 20 52 03 80
22 88 84 88 93	27 49 99 87 48	60 53 04 51 28	74 02 28 46 17	82 03 71 02 68
78 21 21 69 93	35 90 29 13 86	44 37 21 54 86	65 74 11 40 14	87 48 13 72 20
41 84 98 45 47	46 85 05 23 26	34 67 75 83 00	74 91 06 43 45	19 32 58 15 49
46 35 23 30 49	69 24 89 34 60	45 30 50 75 21	61 31 83 18 55	14 41 37 09 51
11 08 79 62 94	14 01 33 17 92	59 74 76 72 77	76 50 33 45 13	39 66 37 75 44
52 70 10 83 37	56 30 38 73 15	16 52 06 96 76	11 65 49 98 93	02 18 16 81 61
57 27 53 68 98	81 30 44 85 85	68 65 22 73 76	92 85 25 58 66	88 44 80 35 84
20 85 77 31 56	70 28 42 43 26	79 37 59 52 20	01 15 96 32 67	10 62 24 83 91
15 63 38 49 24	90 41 59 36 14	33 52 12 66 65	55 82 34 76 41	86 22 53 17 04
92 69 44 82 97	39 90 40 21 15	59 58 94 90 67	66 82 14 15 75	49 76 70 40 37
77 61 31 90 19	88 15 20 00 80	20 55 49 14 09	96 27 74 82 57	50 81 69 76 16
38 68 83 24 86	45 13 46 35 45	59 40 47 20 59	43 94 75 16 80	43 85 25 96 93
25 16 30 18 89	70 01 41 50 21	41 29 06 73 12	71 85 71 59 57	68 97 11 14 30
65 25 10 76 29	37 23 93 32 95	05 87 00 11 19	92 78 42 63 40	18 47 76 56 22
36 81 54 36 25	18 63 73 75 09	82 44 49 90 05	04 92 17 37 01	14 70 79 39 97
64 39 71 16 92	05 32 78 21 62	20 24 78 17 59	45 19 72 53 32	83 74 52 25 67
04 51 52 56 24	95 09 66 79 46	48 46 08 55 58	15 19 11 87 82	16 93 03 33 61
83 76 16 08 73	43 25 38 41 45	60 83 32 59 83	01 29 14 13 49	20 36 80 71 26
14 38 70 63 45	80 85 40 92 79	43 52 90 63 18	38 38 47 47 61	41 19 63 74 80
51 32 19 22 46	80 08 87 70 74	88 72 25 67 36	66 16 44 94 31	66 91 93 16 78
72 47 20 00 08	80 89 01 80 02	94 81 33 19 00	54 15 58 34 36	35 35 25 41 31
05 46 65 53 06	93 12 81 84 64	74 45 79 05 61	72 84 81 18 34	79 98 26 84 16
39 52 87 24 84	82 47 42 55 93	48 54 53 52 47	18 61 91 36 74	18 61 11 92 41
81 61 61 87 11	53 34 24 42 76	75 12 21 17 24	74 62 77 37 07	58 31 91 59 97
07 58 61 61 20	82 64 12 28 20	92 90 41 31 41	32 39 21 97 63	61 19 96 79 40
90 76 70 42 35	13 57 41 72 00	69 90 26 37 42	78 46 42 25 01	18 62 79 08 72
40 18 82 81 93	29 59 38 86 27	94 97 21 15 98	62 09 53 67 87	00 44 15 89 97
34 41 48 21 57	86 88 75 50 87	19 15 20 00 23	12 30 28 07 83	32 62 46 86 91
63 43 97 53 63	44 98 91 68 22	36 02 40 08 67	76 37 84 16 05	65 96 17 34 88
67 04 90 90 70	93 39 94 55 47	94 45 87 42 84	05 04 14 98 07	20 28 83 40 60
79 49 50 41 46	52 16 29 02 86	54 15 83 42 43	46 97 83 54 82	59 36 29 59 38
91 70 43 05 52	04 73 72 10 31	75 05 19 30 29	47 66 56 43 82	99 78 29 34 78
09 18 82 00 97	32 82 53 95 27	04 22 08 63 04	83 38 98 73 74	64 27 85 80 44
90 04 58 54 97	51 98 15 06 54	94 93 88 19 97	91 87 07 61 50	68 47 66 46 59
73 18 95 02 07	47 67 72 62 69	62 29 06 44 64	27 12 46 70 18	41 36 18 27 60
75 76 87 64 90	20 97 18 17 49	90 42 91 22 72	95 37 50 58 71	93 82 34 31 78
54 01 64 40 56	66 28 13 10 03	00 68 22 73 98	20 71 45 32 95	07 70 61 78 13

DOCUMENT B: OBSERVER PROCEDURE IN THE CLASSROOM. PAGE ONE

1. Begin by coding the first coding sheet, following the instructions given in DOCUMENT C ("Observation Form: Coding Information"). If this is the first lesson you are observing in the classroom, you will number this first sheet ool. For subsequent observations, numbering should follow sequentially from the previous observation. (For example, if your first observation requires 6 coding sheets, numbered 001 to 006, the first coding sheet of your second observation should be numbered 007.) Code the identifying information at the top of the sheet. Then note the starting time in the upper right-hand corner of the sheet and begin your observations. Coding should be done in the following order, working always from top to bottom of the sheet:

   i) the orange area under "Teacher" (column numbers 20-25);

   ii) the orange area under "Students", first left side, then right side (column numbers 20-28, then 29-37);

   iii) the yellow area under "Teacher" (column numbers 26-31);

   iv) the yellow area under "Students", first left side, then right side (column numbers 20-28, then 29-37);

   v) the green area under "Teacher" (column numbers 32-37);

   vi) the green area under "Students", first left side, then right side (column numbers 20-28, then 29-37).

2. When you have finished coding the first sheet, note the time in the appropriate space in the top right corner of the sheet. Spend the next five

minutes generally observing, with particular attention to information required to fill out DOCUMENT E ("Description of Learning Environment, Part One"). It would be helpful to keep running totals relevant to items 3 and 5 of that document.

3. When five minutes have passed, code another observation sheet, using the same procedure, and numbering the sheet in sequence to follow the previous sheet. Be sure to note the beginning and ending times.

4. Continue this sequence to the end of the mathematics period, alternating coding of the sheets with five-minute general observation periods.

5. At the end of the mathematics period, complete one copy of DOCUMENT E ("Description of Learning Environment, Part One").

6. If the teacher has given permission, interview the appropriate students. Instructions for selecting students are provided on the cover page of DOCUMENT D ("Student Questionnaire").

7. IF THIS IS <u>NOT</u> THE LAST CLASS CONDUCTED BY THIS TEACHER THAT YOU WILL BE OBSERVING: Note the number of the last observation form that you coded, and continue the sequence during the next class period.

8. IF THIS IS THE LAST CLASS CONDUCTED BY THIS TEACHER THAT YOU WILL BE OBSERVING: Hold your prearranged interview with the teacher. Have him/her examine your observation forms and make any comments he/she may wish to add. Fill out DOCUMENT F ("Description of Learning Environment, Part Two") and record the teacher's comments. Administer DOCUMENT G ("Interview Re Teacher Integration into Community, Form 1"). If this is the second visit to this teacher (i.e., after the instructional program has ended), administer as well DOCUMENT I ("Teacher Participation in Program") and DOCUMENT J ("Indices of Isolation").

NOTE: DOCUMENT E ("Description of Learning Environment, Part One") should be filled out after each observation period, with appropriate identifying information (including observation sheet numbers) filled out on the cover sheet. DOCUMENT F ("Description of Learning Environment, Part Two") is filled out only once for each teacher, after you have completed all observations of that teacher.

DOCUMENT C: OBSERVATION FORM: CODING INFORMATION. PAGE ONE

All numbers you enter should be right justified, with leading zeros where necessary. That is, the number should be written with enough digits to fill all spaces allotted on the computer card. Where the number does not have enough digits to fill all the spaces, add zeros in front of the number to fill the spaces.

For example, two spaces are allotted to "Number of students in area". If this number is 9, enter it as "09".

Note in particular that under the heading "Teacher", the category "No. engaged" is allotted two card spaces. Similarly, under the heading "Students", the categories "No. in math group" and "No. in math subgroup" are each allotted two card spaces. Please enter these as two-digit numbers.

IDENTIFYING INFORMATION:

Column

1 This number is for the keypuncher only. Ignore it.

2-5 Date. Columns 2 and 3 are for the day of the month, columns 4 and 5 for the month. Thus September 27 would be coded as 2709.

6-11 Teacher identification number. This will have been supplied to you.

12-13 Observer identification number. Enter the observer number you have been assigned.

14-15 Number of students in classroom or area. Enter as a two-digit number.

16 You may find that there are several grades or comparable instructional groupings in the classroom. Record the number here. If there is only one grade or comparable grouping, code 1.

17-19 Observation number. Your first observation sheet for any one teacher will be numbered 001. Numbering will continue sequentially over one or more lessons and one or more days. Do not begin again at 001 at the start of a new lesson.

DOCUMENT C
PAGE TWO

NOTE: Each time you begin a new coding sheet and enter the observation number, enter the time after "BEGIN" at the top right of the sheet. When you finish coding the sheet, enter the time after "END" at the top right of the sheet.

TEACHER INFORMATION:

Column

20 Teacher position. Code as follows:
- 1: seated at own desk
- 2: seated elsewhere in the room
- 3: standing and/or walking about the room
- 4: out of the room
- 5: other

21-22 Number engaged. Record here as a two-digit number the number of students to whom the teacher is directing attention or communication (e.g., "one" is recorded as "01"). If the teacher is engaged with a group or class as a whole, and is working on a question-and-answer basis with one student at a time, then the number engaged is the whole group, despite the fact that at the moment of observation the teacher may be focussing on only one student.

23 Proximity of teacher to student(s) with whom he/she is engaged. Code as follows:
- 1: touching
- 2: close enough to touch but not touching
- 3: beyond arms' reach but within 10 feet (approximately--if in doubt, code 3)
- 4: further than 10 feet away

In a question-and-answer interchange with the entire group during which individual students are selected to answer, code the proximity as 4 unless the entire group is within 10 feet.

24-25 Activities. Circle only one box on the observation form to indicate the activity in which the teacher is engaged at the moment of observation.

Code

01 Task direction--i.e., describing the mechanics of a task students will be required to undertake.

02 Lecturing--i.e., speaking continuously (but not dictating) to more than five students.

03 Dictating--i.e., giving orally material for students to write down.

04 Restoring discipline.

05 Reading--i.e., reading aloud to a group.

06 Discussing--i.e., discussing with more than five students or engaging in a question-answer session with more than five students.

07 Consulting--i.e., discussing something with or explaining something to five or fewer students.

08 Listening to student recitation.

09 Marking seatwork at student's seat.

10 Observing--i.e., observing students individually, in groups, or as a class.

11 Drawing--i.e., drawing diagrams or writing material on blackboard, overhead projector or other visual aid.

12 Working alone--i.e., on task other than that described in 11.

13 Doing maintenance--e.g., getting supplies, sharpening pencils, cleaning blackboard.

14 Other.

Columns 26 to 31 and 32 to 37 under "Teacher" are coded in exactly the same way as columns 20 to 25. The order of coding the sheet will have been explained to you before you begin your observations, so you will know at what point to code these columns.

STUDENT INFORMATION:

Column

20 Student position. Code as follows:
- 1: at own desk
- 2: sitting or lying on floor near own desk or with math group
- 3: elsewhere in room
- 4: out of room, elsewhere in school

21 Proximity to teacher. Code as follows (same codes as for teacher):
- 1: touching
- 2: close enough to touch but not touching
- 3: beyond arms' reach but within 10 feet (approximately--if in doubt code 3)
- 4: further than 10 feet away

22 Sex. Code as follows:
- 1: female
- 2: male

Column

23-24 Number in math group. Enter as a two-digit number the number of students in the mathematics group under observation.

25-26 Number in math subgroup. If the mathematics class or group is divided into subgroups, indicate the number of students in the subgroup of which the observed student is a part. If the mathematics group is not divided into subgroups, enter the same number here as you did for "Number in math group".

NOTE: You will have to use your judgement as to what constitutes a "mathematics group" and a "mathematics subgroup". In general terms, a "group" is a collection of students working on the same general assignment at roughly the same level. A "subgroup" is a subset of these students working on a specific task as part of the general task. For example, all Grade 2 students may be working on measurement by being divided into groups of two to carry out measurements of different objects in the room. Here the "group" would be the whole Grade 2 class, and the "subgroup" would be the two students carrying out a particular measuring task.

27-28 The activities listed are either explained under "Teacher Information" or are self-explanatory. Circle only one box to indicate the activity which the student is engaged in at the moment of observation.

Columns 29 to 37 under "Students" are coded in exactly the same way as columns 20 to 28. Again, adhere to the order of coding explained to you earlier.

CARD 1 [1] DATE (2 3 4 5) [ ] TEACHER ID (6 7 8 9 10 11) [ ] OBSERVER ID (12 13) [ ] BEGIN ________ END ________

NO. OF STUDENTS IN AREA (14 15) [ ] NO. OF INSTRUCTIONAL GROUPS (GRADES) IN AREA (16) [ ] OBSERVATION NO. (17 18 19) [ ]

	Teacher	COL	CODE	COL	CODE	COL	CODE
	Position	20		26		32	
		21		27		33	
	No. engaged	-22		-28		-34	
	Proximity	23		29		35	
	Task direction		01		01		01
	Lecturing		02		02		02
A	Dictating		03		03		03
C	Restoring discipline		04		04		04
T	Reading		05		05		05
I	Discussing		06		06		06
V	Consulting	24	07	30	07	36	07
I	Listening to st. recit.	-25	08	-31	08	-37	08
T	Marking seatwork		09		09		09
I	Observing		10		10		10
E	Drawing		11		11		11
S	Working alone		12		12		12
	Doing maintenance		13		13		13
	Other		14		14		14

		Students	COL	CODE	COL	CODE	COL	CODE	COL	CODE	COL	CODE	COL	CODE
		STUDENT NUMBER		[ ]		[ ]		[ ]		[ ]		[ ]		[ ]
		CARD	1	[illegible]			1	3			1	4		
		Position	20		29		20		29		20		29	
		Proximity	21		30		21		30		21		30	
		Sex	22		31		22		31		22		31	
			23		32		23		32		23		32	
		No. in math group	-24		-33		-24		-33		-24		-33	
			25		34		25		34		25		34	
		No. in math subgroup	-26		-35		-26		-35		-26		-35	
A		Unengaged		01		01		01		01		01		01
C		Reading		02		02		02		02		02		02
T		Seatwork (pen(cil) & paper)		03		03		03		03		03		03
I		Construction		04		04		04		04		04		04
V		Playing game		05		05		05		05		05		05
I		In transit		06		06		06		06		06		06
T		At blackboard		07		07		07		07		07		07
I		Maintenance		08		08		08		08		08		08
E		Bookhunting		09		09		09		09		09		09
S		Other	27	10	36	10	27	10	36	10	27	10	36	10
WATCHING		Teacher	-28	11	-37	11	-28	11	-37	11	-28	11	-37	11
AND/OR		AV device		12		12		12		12		12		12
LISTENING		Student(s)		13		13		13		13		13		13
TO		Teacher & Student(s)		14		14		14		14		14		14
		Other		15		15		15		15		15		15
		Teacher 1-1		16		16		16		16		16		16
SPEAKING		Teacher not 1-1		17		17		17		17		17		17
TO		Student 1-1		18		18		18		18		18		18
		Student(s) not 1-1		19		19		19		19		19		19
		Other		20		20		20		20		20		20

DOCUMENT C1: OBSERVATION FORM

DOCUMENT D: STUDENT QUESTIONNAIRE PAGE ONE

Determine from your list of random numbers which students you should question (follow the procedure for selection outlined in DOCUMENT A). The interviews should take place immediately after the mathematics class, if possible. If the teacher has advised you that this is not possible, you will have arranged a mutually satisfactory time.

Interview each of the students in turn where your questions and the student's answers will not be heard by other students. Begin the interview something like this:

"I am trying to find out what students like you think about arithmetic. Would you help me by answering a few questions?"

Ask the student the questions on the following pages, and record his/her answers.

Date ____________________
Day Month

Teacher ID ____________________ Observer ID ____________________

Observation Nos.* ________________ Student No.* ________________

Student's Grade Level ________________

*In the space for Observation Nos., record the range of numbers of the observation sheets coded during this period--e.g., "001-005". In the space for Student No., record the random number assigned to this student.

DOCUMENT D
PAGE TWO

1. Do you like arithmetic?

   Why? or Why not?

2. If you were at home and had nothing else to do, would you ever do some arithmetic like you are learning now, just for fun?

3. Do you ever need to use arithmetic outside school?

   (If "yes") When, for example?

4. (If the answer to (3) is "yes") What other places can you think of where you might need to use arithmetic?

   (If the answer to (3) is "no") Can you think of any places where you might need to use your arithmetic?

DOCUMENT D,
PAGE THREE

5. Do your mom and dad or any other grown-ups you know use arithmetic much?

(If "yes") Can you think of times you have seen them using it?

6. Do your parents think arithmetic is something you need to learn?

Do you think that they like arithmetic?

7. What do you like <u>best</u> about your arithmetic lessons?

8. What do you like <u>least</u> about your arithmetic lessons?

Thank you for helping me.

DOCUMENT E: DESCRIPTION OF LEARNING ENVIRONMENT, PART 1 PAGE ONE

___ of ___

Date ______________________________
Day Month

Teacher ID ______________________________

Observer ID ______________________________

This form refers to mathematics class(es) observed under observation numbers ___ to ___.

The observer should fill out Part 1 (five items) while still in the classroom area, after observing each mathematics class. If there is an apparent difference on any of the points between mathematics class and any other instructional period, fill out the form only as it applies to the mathematics class.

1. STUDENTS' MOBILITY: How much freedom do the students appear to have to move around the room (or area) and/or school? (Check one response.)

A. Students must ask permission to leave their desks or work tables. ___

B. Students are not required to ask permission to leave their desks or work tables and move around the room; there are no other facilities in the school to which they might wish to go. ___

C. Students are not required to ask permission to leave their desks or work tables, but usually are not allowed to move in and out of the room or area to use the library, resource centre or similar facility except in special circumstances or in class groups. ___

D. Students are not required to ask permission to leave their desks or work tables, but must ask permission to move in and out of the classroom or area to use the library, resource centre or similar facility. Permission is usually given readily. ___

E. Students do not need permission of the teacher to leave the classroom but freely move in and out of the r-om or area to use the library, resource centre or similar facility. ___

2. LEARNING ENVIRONMENT: Where do learning activities take place during the school day? (Check one response.)

A. Learning activities take place almost entirely at the student's own desk or table. ____

B. Learning activities take place in a number of different places (centres) within the classroom area. ____

C. Learning activities take place in a number of different places (centres) throughout the school. ____

D. Learning activities take place both inside and outside the school-- i.e., the community and its institutions are incorporated into the learning environment. ____

3. TEACHER FOCUS: What size of student group is most often addressed by the teacher at one time? Answer on the basis of what you see as the <u>main</u> teacher focus during the mathematics lesson. (Check <u>one</u> response.)

A. The teacher directs attention to more than one class or grade or other instructional grouping. ____

B. The teacher directs attention to the mathematics class as a whole. ____

C. The teacher directs attention to subgroups of the class. ____

D. The teacher directs attention to individual students. ____

E. The teacher constantly varies his/her focus. ____

4. APPEAL TO STUDENT INTEREST: How does the teacher appear to relate his/her teaching to the interests of the students in the mathematics class? Estimate the percentage of time spent on each of the following categories.

A. The teacher lectures and/or orders the students to do exercises without any particular appeal to student interest in mathematics. ____

B. The teacher attempts to create or augment interest, but interest that is extrinsic to mathematics (for example, use of a film, competition or prize). ____

C. The teacher attempts to create or augment interest which is intrinsic to mathematics (for example, use of numerical puzzles, use of questions or statements that pose apparent paradoxes and encouragement of discussion directed at resolving those paradoxes). ____

D. The teacher appeals to existing interests of individual students and attempts to relate them to mathematics (for example, the teacher uses a Grade Six student's interest in electricity as an aid in learning addition of fractions by having her make circuit calculations). ____

5. INDIVIDUAL ATTENTION: What proportion of class time does the teacher spend dealing with individual students? (Check <u>one</u> response.)

A. Less than 10%. ____

B. 10% to 25%. ____

C. More than 25%, less than 75%. ____

D. 75% or more. ____

DOCUMENT F: DESCRIPTION OF LEARNING ENVIRONMENT, PART 2. PAGE ONE

Date ______________________________
Day Month

Teacher ID ______________________________

Observer ID ______________________________

This form refers to mathematics class(es) observed under observation numbers ___ to ___.

The observer should fill out Part 2 (14 items) after all classes have been observed for any one teacher, and during the post-observation interview with that teacher.

6. TEACHER ROLE: What role does the teacher usually play in the student's contact with the mathematics he/she is learning? (Check one response.)

A. The teacher chooses topics for study and provides instruction through a sequence of highly-structured lessons, including a lecture and close supervision of student learning activities. ___

B. The teacher chooses topics for study and organizes instructional activities which are generally not highly structured. ___

C. The students choose topics for study within broad guidelines and the teacher organizes instructional activities which are generally highly structured. ___

D. The students choose topics for study within broad guidelines and the teacher organizes instructional activities which are generally not highly structured. ___

E. The teacher provides guidance as a resource person to whom students come when in need of assistance. ___

7. DETERMINING INSTRUCTIONAL OBJECTIVES: Who sets most of the instructional objectives of the mathematics program? (Check one response.)

A. Instructional objectives are set by the school board and/or central administrative staff. ____

B. Instructional objectives are set by the principal and/or vice-principal. ____

C. Instructional objectives are determined by the teacher(s). ____

D. Instructional objectives are set by the parents. ____

E. Instructional objectives are set by the students. ____

8. CONTENT ORGANIZATION: How is course content organized as part of the program? (Check one response.)

A. Content is organized along traditional subject matter lines (e.g., mathematics, science, social studies). ____

B. Content is combined into two or more groupings of subjects (e.g., environmental studies, communication arts). ____

C. Content is integrated; there is no attempt to organize content into subjects or groupings. ____

9. DEVELOPMENT OF MATERIALS: How much personal involvement do teachers and/or students have in the development of materials for the classroom? (Check one response.)

A. There is little involvement of teachers and/or students in developing material--i.e., most materials in use are ready-to-use "packages" (sets of mathematics texts, computer-assisted instruction, etc.). ____

B. There is some involvement of teachers and/or students in developing materials--i.e., most materials in use are things chosen by teachers and/or students from a variety of sources in a ready-to-use form (books not in series, abacus, collection of mathematical puzzles, etc.). ____

C. There is a great deal of involvement of teachers and/or students in developing materials--i.e., most materials in use have been developed or adapted by teachers and/or students specifically for situations which arose in this classroom (collections of objects for use in working out arithmetic problems, student-made puzzles, etc.). ____

10. SELECTION OF MATERIALS: How much involvement do students have in selecting materials with which to work? (Check one response.)

A. The student is assigned materials prescribed for all members of his/her class (the same materials for all students in the same class). ____

B. The student is assigned materials prescribed for all members of his subgroup of the class (the same materials for all students in the same subgroup, different materials for different subgroups). ____

C. The student is assigned materials prescribed for him/her individually. ____

D. The student chooses from alternatives suggested by the teacher. ____

E. The student chooses from all the materials available and may bring in materials from outside the classroom. ____

11. FLEXIBILITY OF ENVIRONMENT: Who makes the decisions about the arrangement and the setting of the learning area? (Check one response.)

A. The arrangement of furniture and equipment in the learning area is decided upon by the administrative staff. ____

B. The arrangement of furniture and equipment in the learning area is decided upon and changed by the teacher(s). ____

C. The arrangement of furniture and equipment in the learning area is decided upon and changed by the students. ____

D. The arrangement of furniture and equipment in the learning area is decided upon and changed by agreement between students and teacher(s). ____

12. STUDENT PACING: At what pace is the student expected to work? (Check one response.)

A. The student is expected to work at a pace set for all members of the class. ____

B. The student is expected to work at a pace set for the members of his subgroup of the class. ____

C. The student works at a pace prescribed for him individually. ____

D. The student sets his own pace. ____

13. INDEPENDENT STUDY TIME: How much time for independent study in mathematics is routinely available? (This is time in which students work by themselves on projects of their choice, within the wide-range objectives of the mathematics course--e.g., during a unit on elementary functions and patterns a student might use his independent study time to play number games.) (Check <u>one</u> response.)

A. More than one hour per week is allocated for independent study time. ____

B. About 30 to 60 minutes per week is allocated for independent study time. ____

C. Some time is allocated for independent study, but less than 30 minutes per week. ____

D. No time is allocated for independent study, but students who finish their regular class work ahead of the class may use the extra time for this purpose. ____

E. Independent study time is not available. ____

14. STUDENT INTERACTION: How much opportunity does the student have to interact, through discussion, with his peers? (Check one response.)

A. Interaction with peers through discussion is not encouraged; each student is expected to work independently without exchanging ideas with his peers. ____

B. Interaction with peers through discussion is permitted after assignments have been completed. ____

C. Interaction with peers through discussion is encouraged by the teacher and a regular part of the learning. ____

15. PEER GROUP ASSISTANCE: To what extent do students work with other students on mathematics work? (Check one response.)

A. Students independently seek assistance in their mathematics work from other students; this is accepted and encouraged as a valid way of seeking solutions or of exploration. ____

B. There is student-to-student assistance on a teacher-initiated basis (e.g., the teacher assigns a good mathematics student to help a poorer student). ____

C. Assistance comes almost entirely from the teacher. ____

16. OTHER ADULT INVOLVEMENT: To what extent are adults other than teachers involved in the mathematics program?

A. All teaching is done by the regular classroom teacher and/or mathematics specialists. ____

B. Although most of the teaching is done by the classroom teacher and/or mathematics specialists, occasionally there are parents, volunteers or other visitors who have special knowledge of a topic, or who help in a practical way in the classroom. ____

C. Although much of the teaching is done by the classroom teacher and/or mathematics specialists, there are regularly involved parents, volunteers and frequent visitors whose involvement is considered an important part of the learning experience. ____

17. COOPERATIVE TEACHING: To what extent do teachers teach their mathematics program together and share information about students?

A. There are no other teachers teaching mathematics in this school. ____

B. Teachers teach independently of one another and share little or no information about students. ____

C. Teachers teach together but do not share information about students. ____

D. Teachers teach independently but do share information about students. ____

E. Teachers teach together and share information about students. ____

18. USE OF LEARNING AIDS: Who selects and uses the learning aids employed in the classroom? (Check one response.)

A. The teacher takes responsibility for selecting and using learning aids. ____

B. The teacher takes responsibility for selecting learning aids; the students use them. ____

C. The students take responsibility for selecting and using learning aids. ____

19. EVALUATION PROCEDURES: What types of tests and/or other evaluation instruments are used in evaluation of student progress in mathematics? (Check the one response which describes the most important evaluation instrument(s) used.)

A. Evaluation is based on work samples and reported anecdotally. ____

B. Evaluation instruments used were developed in this classroom. ____

C. Evaluation instruments were developed within this school (for example, by other teachers or in previous years). ____

D. Evaluation instruments used were developed by school board consultants or similar personnel for use throughout the county or region. ____

E. Standardized instruments are used. ____

DOCUMENT G: INTERVIEW RE TEACHER INTEGRATION INTO COMMUNITY, FORM 1. PAGE ONE

Explain to the teacher that the questions you are about to ask are about his/her relationships with people in the community and/or area, and about his/her feelings about working and living in the north.

The teacher may be uneasy and inclined to be defensive unless the purpose of the interview is clearly explained. Emphasize that you are not in any way assessing or rating the teacher. Explain that you are interested only in exploring common difficulties of adjustment to working and living in the north, and that the project of which this interview forms a part is aimed at least partially at finding ways to make that adjustment easier. Emphasize that the teacher's anonymity is guaranteed, that only an identifying code number will be associated with his/her responses, and that the code will be available only to a handful of researchers.

If a relevant question occurs to you as a result of something the teacher says, don't feel limited to the questions listed here. This is intended as a framework for the interview rather than a definitive list of questions.

Teacher ID____________________________

Observer ID___________________________

1. I'd like to ask you about your social relationships with members of the community which your school serves.

a) Do you have regular social contacts with people whose home is in the community? How regularly? What sorts of contact are these (exchanging home visits, attending church, involvement in sports activities, etc.)?

b) What proportion of your social contacts would you estimate are with itinerants (teachers from outside the community, oil company geologists, members of the armed forces, etc.)? What sorts of contacts are these (see examples above)?

c) Are there members of the community with whom you would maintain contact if you should leave the community?

d) Do you feel accepted as a member of the community? How do you think you are regarded by most members of the community?

2. Now I'd like to ask you about your involvement, if any, in community organizations and activities.

a) Have you in the past year been involved with a community organization or participated in any community events? If so, in what role? If so, by preference or because you felt it was expected of you? If not, why not?

3. The next few questions are about your feelings for the north.

a) How would you describe your feelings about the north?

b) (If teacher is not originally from the north) If you had to make the decision to come here again, would you still choose to come?

c) Would you consider making your permanent home in the north?

d) (If the answer to c) is "no") Would you consider returning to the north for another period? Under what conditions?

DOCUMENT G
PAGE FIVE

4. Do you have any general comments to make about your experience in the north, and in this community in particular?

DOCUMENT H: INTERVIEW RE TEACHER INTEGRATION INTO COMMUNITY, FORM 2. PAGE ONE

Carefully explain to the community member you are interviewing that you are not assessing the teacher as an individual. Emphasize that you are interested only in studying difficulties of adjustment to working and living in the north, with a view to helping make this adjustment easier. Emphasize also that his/her responses will be kept totally confidential, that there is no possibility that the teacher or anyone familiar with the teacher will ever see the questionnaire with the name of the teacher or of the person you are interviewing associated with it. The information on the questionnaire will be coded, and combined with information from similar questionnaires to give an overall picture of the difficulties of teachers in making the adjustment to northern life.

Teacher ID ______________________________

Observer ID ______________________________

1. How would you say [the teacher] is regarded by members of the community? (Record comments as accurately as possible. Is the teacher referred to strictly in the role of teacher--i.e., in terms which might apply to any teacher? Or is the teacher referred to as an individual--for example, a reference to a particular interest of the teacher, such as "John likes to drop down to the Legion and shoot a little pool"?)

2. Does it seem to you that [the teacher] likes the north?
(If applicable) Do you think living is such as isolated community bothers him/her?

3. Does [the teacher] have many social contacts in the community? What sorts of contacts are these (exchanging home visits, attending church, involvement in sports activities, etc.)?

4. Does [the teacher] participate in community activities?
(If "yes") Do you feel he/she participates because he/she wants to, or because he/she feels it is expected?

5. Do you have any general comments you would like to make about how [the teacher] has adjusted to living in the north in general and in your community in particular?

DOCUMENT I-1: TEACHER PARTICIPATION INVENTORY, GROUP 1. PAGE ONE

Explain to the teacher that it is necessary to know the extent to which he/she participated in the program in order to be able to evaluate the program's effectiveness. Assure the teacher that anonymity will be preserved, and that there is no assessment involved.

Teacher ID______________________________

Observer ID_____________________________

DOCUMENT I-1
PAGE TWO

1. How many of the weekly assignments in the mathematics course did you complete and have marked?

____

2. Did you receive a university credit for the mathematics course?

____

3. How many of the weekly assignments in the mathematics education course did you complete and have marked?

____

4. Did you receive a university credit for the mathematics education course?

____

DOCUMENT I-2: TEACHER PARTICIPATION INVENTORY, GROUP 2. PAGE ONE

Explain to the teacher that it is necessary to know the extent to which he/she participated in the program in order to be able to evaluate the program's effectiveness. Assure the teacher that anonymity will be preserved, and that there is no assessment involved.

Teacher ID ______________________________

Observer ID ______________________________

DOCUMENT I-2
PAGE TWO

1. Did you attend the orientation week at the beginning of the program?

____

2. How many of the weekly assignments in the mathematics course did you complete and have marked?

____

3. How many of the weekly assignments in the mathematics education course did you complete and have marked?

____

4. Of the occasions available for telephoning, what percentage would you estimate you used? (Check one response.)

100%	______
90% to 99%	______
75% to 89%	______
50% to 74%	______
25% to 49%	______
1% to 24%	______
0	______

5. Did you attend the final session with your instructor?

______

6. Did you receive a university credit for the course in <u>mathematics</u>?

____

7. Did you receive a university credit for the course in <u>mathematics education</u>?

____

DOCUMENT I-3: TEACHER PARTICIPATION INVENTORY, GROUP 3 AND GROUP 4. PAGE ONE

Explain to the teacher that it is necessary to know the extent to which he/she participated in the program in order to be able to evaluate the program's effectiveness. Assure the teacher that anonymity will be preserved, and that there is no assessment involved.

Teacher ID ______________________________

Observer ID ____________________________

1. How many of the weekly assignments in the mathematics course did you complete and have marked?

____

2. How many of the weekly assignments in the mathematics education course did you complete and have marked?

____

3. What percentage of the video presentations and related discussions would you estimate you attended? (Check one response.)

100%	_____
90% to 99%	_____
75% to 89%	_____
50% to 74%	_____
25% to 49%	_____
1% to 24%	_____
0	_____

4. Did you receive a university credit for the course in mathematics?

____

5. Did you receive a university credit for the course in mathematics education?

____

DOCUMENT I-4: TEACHER PARTICIPATION INVENTORY, CONTROL GROUP. PAGE ONE

Explain to the teacher that the information you are requesting is part of a study of the effects of different types of training and study in methods of teaching mathematics. Assure the teacher that anonymity will be preserved, and that there is no assessment involved.

Teacher ID________________________

Observer ID_______________________

DOCUMENT I-4
PAGE TWO

1. During the past eight months, have you received any special training in either mathematics or methods of teaching mathematics?

____

If "yes", please describe this training.

2. During the past eight months, have you undertaken a study program designed by yourself in mathematics or methods of teaching mathematics (study beyond the reading you would normally do to keep up with developments in this field)?

____

If "yes", please describe the program.

DOCUMENT J: INDICES OF ISOLATION. PAGE ONE

Explain to the teacher that his/her answers to these questions will enable us to assess the degree of isolation of the school and the community (if any) in which it is located. If the teacher is uncertain of the exact answer to a particular question, he/she should give his/her best estimate.

For some of the questions (travel, mail delivery, etc.) answers may vary with the season. For these questions, two answer spaces are provided. In the first, give the answer applicable to summer; in the second, the answer applicable to winter.

Teacher ID____________________________

Observer ID___________________________

DOCUMENT J
PAGE TWO

1. How many students attend the school in which you teach? ______

2. How many full-time teachers (including yourself) teach at your school? ______

3. How large an area (in square miles) does your school serve? ______

4. What is the <u>total</u> population of your school area? ______

5. If your school is located in or near a community, what is the population of that community? ______

6. If your school is <u>not</u> located in or near a community, <u>or</u> if your community has a population less than 1,000, what is the distance in miles to the nearest community with a population of 1,000 or more? ______

7. What is the distance in miles to the nearest community with a population of 20,000 or more? ______

	SUMMER	WINTER
8. Is a daily newspaper regularly available to you?	______	______
(If "yes") How many days after publication is it available to you? (If available on day of publication, write 0.)	______	______

9. How may radio stations do you <u>usually</u> receive? ______

10. Do you have regular access to a television set? ______

(If "yes") How many channels do you <u>usually</u> receive? ______

DOCUMENT J
PAGE THREE

11. Which of the following are commonly used means of access to your school area? (Check all applicable answers.)

	SUMMER	WINTER
road vehicle	____	____
train	____	____
plane	____	____
boat	____	____
______________ other (specify at left)	____	____

12. How often is there regularly scheduled transportation in and out of your area? (Check one response.)

more than once a day	____	____
once a day	____	____
1 to 6 times a week	____	____
1 to 3 times a month	____	____
less than once a month	____	____

13. How often do you travel to communities outside your school area for reasons unrelated to teaching? (Check one response.)

1 or more times a week	____	____
1 to 3 times a month	____	____
less than once a month	____	____

14. What is the distance in miles between your school and the nearest post office? ____

DOCUMENT J
PAGE FOUR

15. How frequent is mail delivery to this post office from distant communities? (Check one response.)

	SUMMER	WINTER
5 or more times a week	____	____
1 to 4 times a week	____	____
1 to 3 times a month	____	____
less than once a month	____	____

16. How frequent is mail delivery to your school from this post office? (Check one response.)

	SUMMER	WINTER
5 or more times a week	____	____
1 to 4 times a week	____	____
1 to 3 times a month	____	____
less than once a month	____	____

17. Do you have access to a telephone? ____

(If "yes") How often do you use the telephone to place calls outside your school area or to receive calls from outside your school area? (Check one response.)

more than once a day ____

once a day ____

1 to 6 times a week ____

1 to 3 times a month ____

less than once a month ____

DOCUMENT J
PAGE FIVE

18. Can you think of any other factors which might help us define the degree of isolation of your school area?

DOCUMENT K: BACKGROUND INFORMATION. PAGE ONE

SECTION I: PERSONAL INFORMATION

1. Date of birth: ______________________
   Day Month Year

2. Sex (check): male ________ female ________

3. Members of my family living with me are (check):

   none ____
   father ____
   mother ____
   brothers and sisters ____ How many? ____
   husband or wife ____
   children ____ How many? ____
   other (specify below) ____ How many? ____

   ____

   ____

4. My first language is ______________________.

   Other languages spoken ______________________
   read ______________________
   written ______________________

DOCUMENT K
PAGE TWO

SECTION II: EDUCATIONAL BACKGROUND

5. ANSWER THIS QUESTION IF YOUR LAST YEAR OF SECONDARY EDUCATION WAS IN ONTARIO, OR IF YOU HAVE NO SECONDARY EDUCATION.

The highest level of secondary education I successfully completed was (check one):

no secondary education ____

Grade Nine ____

Grade Ten ____

Grade Eleven ____

Grade Twelve ____

Grade Thirteen ____

6. ANSWER THIS QUESTION IF YOUR LAST YEAR OF SECONDARY EDUCATION WAS OUTSIDE ONTARIO.

My last year of secondary education was in:

Province (if in Canada)________________________

Country (if other than Canada)__________________

The highest level of secondary education I successfully completed

was____.

The Ontario equivalent of this level is__________________________.

DOCUMENT K
PAGE THREE

7. ANSWER THIS QUESTION IF YOUR LAST YEAR OF SECONDARY EDUCATION WHICH INCLUDED MATHEMATICS WAS IN ONTARIO, OR IF YOU HAVE NO SECONDARY EDUCATION IN MATHEMATICS.

The highest level of secondary education in mathematics I successfully completed was (check one):

no secondary education in mathematics ____

Grade Nine mathematics ____

Grade Ten mathematics ____

Grade Eleven mathematics ____

Grade Twelve mathematics ____

Grade Thirteen mathematics ____

8. ANSWER THIS QUESTION IF YOUR LAST YEAR OF SECONDARY EDUCATION WHICH INCLUDED MATHEMATICS WAS OUTSIDE ONTARIO.

My last year of secondary education in mathematics was in:

Province (if in Canada) ______________________________

Country (if other than Canada) ______________________

The highest level of secondary education in mathematics I successfully

completed was ____.

The Ontario equivalent of this level is ______________________________.

DOCUMENT K
PAGE FOUR

9. I have the following university education (please indicate all degrees held):

no university education ____

some university education, degree incomplete ____

major field(s) of study, if any ______________________

general bachelor's degree (specify B.A., B.Sc., etc.) ____

major field(s) of study, if any ______________________

honours bachelor's degree (specify B.A., B.Sc., etc.) ____

major field(s) of study ______________________

master's degree (specify M.A., M.Sc., etc.) ____

major field(s) of study ______________________

doctorate (specify Ph.D., Ed.D., etc.) ____

major field(s) of study ______________________

other degree, diploma, etc. (specify) ____

major field(s) of study, if any ______________________

10. I have the following number of full-year university courses in mathematics (count semester courses as one-half course each):

none ____

½ to 5 ____

5½ to 10 ____

10½ to 15 ____

15½ to 20 ____

more than 20 ____

11. My teacher training was taken at (name(s) of institution(s)): ____________

____

____

I hold the following diplomas, certificates, degrees, etc. in education:

____

____

____

____

____

DOCUMENT K
PAGE SIX

12. ANSWER THIS QUESTION IF YOU HAVE ATTENDED ANY POSTSECONDARY EDUCATIONAL INSTITUTION OTHER THAN A UNIVERSITY OR A TEACHER TRAINING INSTITUTION.

Name of institution ______________________________

Number of years completed ______________________________

Major field(s) of study, if any ______________________________

Diploma, certificate, etc. earned ______________________________

Number of full-year mathematics courses ______________________________

Name of institution ______________________________

Number of years completed ______________________________

Major field(s) of study, if any ______________________________

Diploma, certificate, etc. earned ______________________________

Number of full-year mathematics courses ______________________________

SECTION III: TEACHING EXPERIENCE

13. As of August 1977, I have completed ______ years of teaching.

14. I have taught at the following grade levels (check):

Kindergarten ____________	Grade Five ____________
Grade One ____________	Grade Six ____________
Grade Two ____________	Grade Seven ____________
Grade Three ____________	Grade Eight ____________
Grade Four ____________	Secondary ____________

Other (specify) ______________________________

15. During the 1977-1978 school year, I will be teaching at the following grade level(s) (check):

Kindergarten ____________	Grade Five ____________
Grade One ____________	Grade Six ____________
Grade Two ____________	Grade Seven ____________
Grade Three ____________	Grade Eight ____________
Grade Four ____________	Secondary ____________

Other (specify) ______________________________

DOCUMENT L: SELF-CONCEPT INVENTORY. PAGE ONE

This booklet contains a number of statements to help you describe yourself as you see yourself and as you think about yourself in relation to other people. There are no right or wrong answers. Your honest personal opinion is the best answer.

Your responses to the statements in this inventory will be kept completely confidential, and will not be used to assess you or rate you in any way. They will be read only by the person who transfers them to computer cards to be stored under a code number for combination with responses from other teachers. In particular, none of this information will be given to your instructors or employers. It is, however, of great importance to the researchers, who are attempting to assess the effects of life in the north on the self-concept of teachers, and to find ways to ease the common difficulties of adjustment to this way of life. Therefore, please answer all questions as honestly as you can, according to the directions on the following page.

Thank you for your assistance.

Teacher ID ______________________

DOCUMENT L
PAGE TWO

Please read each of the statements on the following pages carefully, and respond to it as if you were describing yourself to yourself.

For each statement, select one of the four responses listed below:

Circle 1 if the statement is completely false.

Circle 2 if the statement is mostly false.

Circle 3 if the statement is mostly true.

Circle 4 if the statement is completely true.

This scale will be repeated on each page for your convenience.

There are several statements included in the inventory that deal with your feelings and attitudes toward your ethnic group. These statements are indicated by an asterisk (*). If you are a member of a minority ethnic group (i.e., other than white Anglo-Saxon), please respond to these questions in the context of your actual situation. If, on the other hand, you are a majority group member, we ask you to respond to the questions in a hypothetical situation. Please try to imagine yourself as you are, but living in a situation in which white Anglo-Saxons are the minority among a quite different cultural group. These instructions apply to all those questions, and only those questions, marked with an asterisk.

Do not spend too much time on any one statement.

Do not omit any statement.

DOCUMENT L
PAGE THREE

1: completely false	2: mostly false	3: mostly true	4: completely true

1.	I do not like some people.	1	2	3	4
2.	I have never gossiped.	1	2	3	4
3.	I feel much more contented with the old familiar surroundings.	1	2	3	4
*4.	I take pride in my ethnic origin.	1	2	3	4
5.	I believe I am in the world to build rather than to destroy.	1	2	3	4
*6.	I like to associate with persons of my own ethnic group while outside of school.	1	2	3	4
7.	I must have an inspiring leader in order to do my best work.	1	2	3	4
8.	Most of the time I do things without thinking about them first.	1	2	3	4
9.	I would like to explore the crater of an active volcano.	1	2	3	4
10.	I would like to learn one kind of job and then stick to it.	1	2	3	4
11.	I think I am an important person to my friends and family.	1	2	3	4
12.	In unexpected situations I am often at a loss as to what to do.	1	2	3	4
13.	I become so attached to my friends that I can hardly get along without them.	1	2	3	4

1: completely false 2: mostly false 3: mostly true 4: completely true

14.	I would like to seek out undersea caves.	1 2 3 4
15.	Good rules of etiquette are very important.	1 2 3 4
16.	I often share my feelings with students.	1 2 3 4
17.	I like to think about what it would be like to be a movie star.	1 2 3 4
18.	Usually I try to understand the other person's point of view.	1 2 3 4
19.	People should have personal heroes.	1 2 3 4
20.	Movies which glorify gangsters undermine the morals of children.	1 2 3 4
21.	I have some weaknesses but they don't bother me.	1 2 3 4
22.	I would like to do stunt flying in an air circus.	1 2 3 4
23.	I like to ride with daredevil drivers.	1 2 3 4
24.	It means a great deal to me to be different.	1 2 3 4
25.	I like my looks just the way they are.	1 2 3 4
26.	I would like to settle down for the rest of my life in one place.	1 2 3 4

1: completely false	2: mostly false	3: mostly true	4: completely true

*27.	I prefer the food of other ethnic groups to that of my own group.	1 2 3 4
28.	I always encourage students to try something new and to join in new activities.	1 2 3 4
29.	When shopping I would much rather look at things without help from a salesman.	1 2 3 4
30.	No matter what game I play, I always play to win.	1 2 3 4
31.	I would like to work as a flying-trapeze artist.	1 2 3 4
32.	I would like to go on the first rocket-ship expedition to the moon.	1 2 3 4
*33.	I feel embarrassed by wearing my native costume in public.	1 2 3 4
34.	With my students I always try to practise what I preach.	1 2 3 4
35.	I always hated to have my parents tell me what to do.	1 2 3 4
36.	I would like to cross the Sahara Desert in a caravan.	1 2 3 4
37.	I like to imagine myself to be the hero of success stories.	1 2 3 4
38.	I usually try to avoid rough or dangerous games.	1 2 3 4
39.	I don't much care for people who try to impress you.	1 2 3 4

DOCUMENT L
PAGE SIX

1: completely false 2: mostly false 3: mostly true 4: completely true

40.	I like to watch movies showing violent murders.	1 2 3 4
41.	When I play a game I never think of cheating.	1 2 3 4
42.	In order to be happy I always have to feel free to come and go as I like.	1 2 3 4
43.	I like to have as much fun as possible even in a serious situation.	1 2 3 4
44.	All works of art should convey a serious message.	1 2 3 4
45.	I hate to be expected to do a job that I know little about.	1 2 3 4
46.	Radical politicians should be deported from the country.	1 2 3 4
47.	I would attempt to tidy up a hotel room before checking out.	1 2 3 4
48.	Often I feel I ought to get along better with other people.	1 2 3 4
49.	I do not come up to the expectations of my family.	1 2 3 4
50.	I always let my students know what I expect of them.	1 2 3 4
51.	I always make sure that I am adequately prepared for class.	1 2 3 4
52.	The surest way to a peaceful world is to improve people's morals.	1 2 3 4

DOCUMENT L
PAGE SEVEN

1: completely false 2: mostly false 3: mostly true 4: completely true

*53.	People should be married according to the traditions of their culture.	1	2	3	4
54.	I often prepare for examinations by last-minute cramming.	1	2	3	4
55.	It is amusing to see some people get into a predicament.	1	2	3	4
56.	Good manners are about the most important thing a parent can teach a child.	1	2	3	4
57.	I am often sleepy in a school or training class.	1	2	3	4
58.	Sometimes I have thoughts too bad to talk about.	1	2	3	4
59.	I usually try to get someone to help me with tough assignments.	1	2	3	4
60.	Sometimes I feel uneasy when I look down from high places.	1	2	3	4
61.	I would like to go on an expedition to the South Pole.	1	2	3	4
62.	I would like to run river rapids in a motorboat.	1	2	3	4
*63.	I use my native language while speaking with my own people.	1	2	3	4
64.	I almost always ask the advice of an older and more experienced person before making important personal decisions.	1	2	3	4
*65.	I would like to go to movies set in my own culture.	1	2	3	4

1: completely false 2: mostly false 3: mostly true 4: completely true

66.	I work best when competition is keenest.	1	2	3	4
67.	People waste too much time trying to plan everything ahead of time.	1	2	3	4
68.	I like the company of people who are always cracking jokes.	1	2	3	4
69.	I learn the name of each student as soon as possible, and use that name often.	1	2	3	4
70.	I always keep my distance from strange dogs.	1	2	3	4
71.	I would like to ride out a storm in a small boat.	1	2	3	4
72.	I always permit students to challenge my opinions.	1	2	3	4
73.	I often find myself opposing customs that are old-fashioned.	1	2	3	4
74.	When I visit a new city I like to go on a guided tour.	1	2	3	4
75.	A good boss ought to spend a great deal of time checking up on his/her subordinates.	1	2	3	4
76.	Most people have standards of conduct that are too low.	1	2	3	4
77.	I often discuss my personal problems with others.	1	2	3	4
78.	I can take care of myself in any situation.	1	2	3	4

DOCUMENT L
PAGE NINE

1:	completely false	2:	mostly false	3:	mostly true	4:	completely true

79.	I like to wear clothes of the same type that others wear.	1	2	3	4
80.	I am always honest in my dealings with people.	1	2	3	4
81.	Sometimes I get satisfaction out of breaking the rules.	1	2	3	4
*82.	I prefer to associate with students of my own ethnic group while in school.	1	2	3	4
83.	I never laugh at a dirty joke.	1	2	3	4
84.	I dislike following a set schedule.	1	2	3	4
85.	I would like to see a snobbish rich man suddenly go broke.	1	2	3	4
*86.	I do not like to read literature and fiction written by authors of my own ethnic group.	1	2	3	4
87.	I would try to avoid giving my name as witness to an accident.	1	2	3	4
88.	I never become angry.	1	2	3	4
89.	I am often flat broke.	1	2	3	4
*90.	I do not like to attend social and cultural events involving people of my own ethnic group.	1	2	3	4
91.	I usually get help when I have to make an important decision.	1	2	3	4

DOCUMENT L
PAGE TEN

1: completely false	2: mostly false	3: mostly true	4: completely true

92.	I take every opportunity to establish a high degree of individual communication with my students.	1	2	3	4
*93.	I like to identify with leaders from my own ethnic background.	1	2	3	4
94.	I have no trouble in expressing my feelings to those around me.	1	2	3	4
*95.	I feel that my ethnic group is not as good as other ethnic groups.	1	2	3	4
96.	On social occasions I know exactly how to handle every situation.	1	2	3	4
*97.	I like to study the history of my own people.	1	2	3	4
98.	Many of my friends are unconventional in the way they live.	1	2	3	4
99.	People should act as they please without worrying about the opinions of others.	1	2	3	4
100.	I consider myself to be a dedicated worker.	1	2	3	4
101.	I sometimes carry a good luck charm.	1	2	3	4
102.	I often discuss my personal problems with a close friend.	1	2	3	4
103.	I usually act on the principle that tomorrow will take care of itself.	1	2	3	4

DOCUMENT L
PAGE ELEVEN

1: completely false	2: mostly false	3: mostly true	4: completely true

104.	I always avoid dark alleys when walking alone at night.	1	2	3	4
105.	I feel that people do not trust me.	1	2	3	4
106.	Strict home discipline would prevent much of the crime in our society.	1	2	3	4
107.	I like being the way I am.	1	2	3	4
108.	It is best if a person just tries to be himself and not pretend.	1	2	3	4
109.	I like to watch circus clowns.	1	2	3	4
110.	Life has a lot to offer me.	1	2	3	4
0111.	I like to attend church and religious festivals supported by my own ethnic group.	1	2	3	4
112.	I would like to live with or near my parents as long as possible.	1	2	3	4
113.	I am a strong believer in luck.	1	2	3	4
114.	Many times I enjoy being by myself.	1	2	3	4
115.	I like to make up exciting plots with myself as a character.	1	2	3	4
116.	I usually find myself going along with the crowd since I don't want to be left out of things.	1	2	3	4

1: completely false	2: mostly false	3: mostly true	4: completely true

117.	Children should be firmly disciplined when they disobey their parents.	1	2	3	4
*118.	I do not like to listen to music produced by people of my own ethnic group.	1	2	3	4
119.	I let my students know that I am aware of and interested in them.	1	2	3	4
120.	I seldom know ahead of time how I will spend the evening.	1	2	3	4
121.	I sometimes forget to mail a letter at the time I intend to.	1	2	3	4
122.	I like to imagine what I would do if I won the grand prize in a big contest.	1	2	3	4
123.	I respect people who have a lot of power.	1	2	3	4
124.	Bad news is easier to bear if you have a friend with you.	1	2	3	4