

THE UNIVERSITY OF MANITOBA

A PARTIAL IMMERSION PROGRAM IN TEACHING
MATHEMATICS IN THE FRENCH LANGUAGE

by

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AN ABSTRACT

The purpose of this study was to investigate the effect of a first year partial immersion program consisting of French language study and regular school mathematics taught in French to grade four English speaking students, who had not taken French previously. The investigation was concerned with finding out if the students who were taught this course learned more French than students who were taught only a course in French language, and what effect that teaching such a program would have on the students' progress in mathematics.

It was found that the experimental students who took the partial immersion program scored significantly higher on French achievement tests than control students who took only French language. The T-test score was significant beyond .0005.

Four null hypotheses were tested to investigate the effects of the partial immersion program on progress in mathematics. The four hypotheses dealt with computation, concept development, problem solving, and total mathematics scores. The experimental class scored higher, beyond the .05 level of significance, than the control class on all tests except for computation, where the difference in scores was approaching the .05 level of significance.

It should be noted that this investigation lacked rigorous controls and the unexpected finding regarding mathematics achievement should be subjected to further research.

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CHAPTER I

INTRODUCTION

Many reasons have been given why English-speaking Canadians should learn to speak French. It is an official language of Canada. It has utilitarian value because the person who knows both national languages is going to have career opportunities which may be denied to the person who knows only one or the other. The French language enjoys world-wide use. Some persons claim that learning French encourages tolerance towards French-speaking people. Others justify it because of the personal satisfaction that learning another language may bring, or because it may increase awareness and appreciation of one's own first language. Recent studies indicated that knowing more than one language may provide the individual with a greater flexibility in thinking and attitude.

French has been taught as a second language in schools throughout English-speaking Canada for many years. The schools have not been effective in teaching French as a second language. The study of French has been reserved for the academically gifted student. French has been taught as a school subject and not as a communication skill.

Recent studies have revealed that starting elementary school French programs at an early age has not produced the improved results that were expected. There are many factors involved in learning a second language. Theory and research have considered such factors as age, methodology, motivation,

individual learning styles, attitudes, socioeconomic status, aptitude, intelligence, and the philosophies of teachers and administrators.

Immersion-style programs have become popular in recent years and studies have shown that this innovation has been an effective way of teaching French as a second language in Canadian schools. It is a modification of this kind of program that this study has examined.

I. THE PROBLEM

It was the purpose of this study to investigate the effectiveness of teaching an introductory French course through a program consisting of a French language course and a regular school subject taught in French. The investigation involved English-speaking, grade four elementary school students, who had not taken any French previously, and the subject chosen to be taught in French was grade four mathematics. More specifically, the study was designed to answer the following questions:

1. What is the effect on French language skills when grade four English-speaking students are taught French language and mathematics in French? Do they learn more French than students who take French language but who take mathematics in English?

2. What is the effect on mathematics skills when grade four English-speaking students are taught mathematics in French? Do they learn less mathematics than students who are taught mathematics in English?

II. DESIGN OF THE STUDY

The investigation took place in Riverview School in the Brandon School Division during the school year 1974-75. It involved two grade four classes which had not been taught French previously. One class was taught French language and arithmetic in French for one year and the other class was taught French language and arithmetic in English. In order to determine if there were any differences in mathematical achievement both classes were pretested in arithmetic at the beginning of the investigation using the Metropolitan Achievement Test in Mathematics, and post-tested at the conclusion of the investigation using an alternate form of the same test. An analysis of covariance was performed on the test results in order to adjust for any differences of ability between the two groups. Both classes were given a battery of achievement tests in French language skills at the conclusion of the investigation. A T-test was performed on the results of these tests to compare the scores of the two classes.

III. SIGNIFICANCE OF THE STUDY

There is growing public demand for accountability in education. In the past, French was included in high school curricula as one of the academic requirements at attend university. Strong emphasis was placed on passing the final written examination. This has now changed. French is no longer a requirement for admission to most universities. Consequently, fewer public school students

have chosen to take French as one of their options. The emphasis given to bilingualism by the federal government, however, has stirred the public's awareness of the value of learning French. The concern now is the teaching of French as a communication skill, not as an academic accomplishment. It is therefore important to find effective methods of teaching French in the public school. Since traditional techniques have been used primarily to teach the academic aspects of the French language, alternate methods and innovations which seek to provide the student with more opportunities of gaining a greater mastery of French language skills would be beneficial to the public school system.

IV. THE HYPOTHESES

In order to investigate the effects of teaching a program consisting of French language and mathematics taught in French to English-speaking students in their first year of French, the following null hypotheses were formulated and tested.

1. There is no significant difference in progress in computation skills between English-speaking students taking mathematics for one year in French and English-speaking students who follow the regular mathematics program in English.
2. There is no significant difference in progress in concept learning between English-speaking students taking mathematics for one year in French and English-speaking students who follow the regular mathematics program in English.
3. There is no significant difference in progress in mathematical problem solving between English-speaking students taking mathematics for one year in French and English-speaking students who follow

the regular mathematics program in English.

4. There is no significant difference in progress in overall achievement in mathematics between English-speaking students taking mathematics for one year in French and English-speaking students who follow the regular mathematics program in English.
5. There is no significant difference in achievement in French between students who take twenty minutes of core French per day for one year, and students who take a combination of twenty minutes of core French per school day and forty minutes of mathematics taught in French per school day for one year.

V. DELIMITATIONS

1. No attempt was made in this study to measure or determine the influence of student aptitude for learning a second language.
2. The study did not take into account any measures of intelligence quotient.
3. This study did not attempt to measure any possible side effects such as attitude changes or affective components.
4. There was no comparison of achievement between boys and girls.
5. There was no formal evaluation of teaching materials, although some informal observations were reported.
6. No attempt was made to evaluate the effectiveness of any particular foreign language teaching approach, such as the audio-lingual approach or the cognitive-code approach.

VI. LIMITATIONS

1. The selection of pupils for the experimental class and the control class was not controlled. Parents were allowed to choose whether or not their children would take the mathematics course in French. The parental decision determined the composition of the experimental and control classes. This limitation led to the formation of two groups having different ability.

2. An analysis of covariance was used to compare the pretest and the post-test marks obtained by the two groups in mathematics in order to compensate for the different ability levels of the two groups. In spite of this statistical attempt to minimize differences between the two groups, there is a lack of rigid experimental control, and the study must be regarded as an exploratory investigation.

3. There was no provision built into the program to allow for a Hawthorne effect on those pupils who formed the experimental class.

4. The study was restricted to one school in a working class district.

5. Teaching materials and evaluative materials have not been developed for this kind of program. This was evident particularly in the evaluation of French achievement.

6. It was not found possible to control for a number of factors related to the implementation of the program: the teacher of core French and mathematics in French was also the investigator; the teacher of mathematics in French and the teacher of mathematics in English were two different people;

the teaching of mathematics in French gave more emphasis to listening comprehension skills than to the development of speaking skills in French.

VII. DEFINITION OF TERMS

Core French. The term core French denotes a basic course in the French language. In the elementary school such a basic course is sometimes called a FLES program. FLES stands for "Foreign Language in the Elementary School."

Core programs are audio-lingual in approach, and are usually assigned from fifteen to twenty minutes per school day. They generally follow published courses, the most common in Canada being: En Avant, J'écoute, Je parle, Le Français Partout, Cours Élémentaire, Ici, On Parle Français, and Le Français International.¹

Core programs contain topics such as health, weather, time, numbers, age, family, clothing, school, and parts of the body. They usually deal in one way or another with survival language in such areas as eating and drinking, shopping, giving directions, introducing people, going to the railway station or the airport, at the post-office or the doctor's office, or the hospital. They include units on hobbies and interests such as television, camping and travelling.

1

J. A. Boyd, "Survey of Textual Material Used in Canadian Elementary and Secondary Schools During the School Year 1972-1973," Canadian Modern Language Review, 29: 20-21, May, 1973.

Extensive use is made of audio-visual aids such as pictures, posters, films, slides, flannel boards, puppets, records, and tapes. There is usually considerable emphasis on activities such as games, singing, and role-playing.

Immersion program. An immersion program refers to a program in which the language of instruction is the target language to be learned, in this case, French. In the literature, such a program is also called a home-school-language-switch program, and sometimes a bilingual program. These terms are used synonymously in this paper. In contrast to the core approach where the pupil may spend about twenty minutes a day learning the second language, the pupil in an immersion program may spend up to one hundred per cent of his instructional time learning the regular school subjects which are being taught in the second language. The immersion program thus greatly increases the time that a student is exposed to the second language. Much basic vocabulary which forms the syllabus of the core program is taught incidentally in the immersion program. In the immersion program the second language becomes the vehicle through which other subjects are taught. In the core program, the second language is taught as another subject on the curriculum.

Partial immersion program. A partial immersion program refers to a program in which a foreign language is used as the language of instruction for one or more subjects normally taught in the vernacular, but not for all such subjects. In the present study, the foreign language, French, is used in the teaching of mathematics, a subject normally taught in the vernacular, English.

Socioeconomic status. Socioeconomic status was based on the occupation claimed by the parent on the school student registration form. Annual salaries were estimated using the Annual Wage and Salary Survey - 1972 issued by the Department of Labour for the Province of Manitoba. The occupation categories used to describe this sample are similar to those used by Clare Burstall.² in French From Eight.

Centre d'Interêt. A centre d'interêt is a unit of work planned around a central theme which may be a topic such as the Metric System, Christmas, or Space Flight, or a song such as Cadet Rousselle or a short story or poem. It is important that the theme be interesting to the age group being taught. The length of time spent with a centre d'interêt varies from a few classes to several weeks. A centre d'interet includes teaching materials, activities, and resource suggestions.

VIII. SUMMARY

There appears to be a demand for effective French language training in the public schools of Manitoba. This study has examined a program of partial immersion in French as a way of teaching that language. In this chapter the

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Clare Burstall, French From Eight, (Slough U.K.: National Foundation for Education Research, 1968), p.2.

problem has been explained and the terms have been defined. The five null hypotheses that have been examined in this study have been given and the limitations and delimitations have been stated.

CHAPTER II

REVIEW OF THE LITERATURE

Elementary French programs in Manitoba usually consist of twenty minutes of core French per day. The intent of this investigation was to study the effectiveness of an alternate way of teaching French to English speaking children. In addition to the twenty minutes of core French each day, the children of one grade four class of English - speaking children were taught arithmetic for forty minutes a day in which French was the language of instruction. This chapter includes an examination of a number of topics relevant to the investigation: the effectiveness of teaching a foreign language to children of different ages, the effects of learning a foreign language on intellectual growth and on progress in subject areas, particularly mathematics, the selection of pupils for an elementary foreign language program, language learning theories, and the choice of approach to be used.

I. THE SUITABILITY OF TEACHING FRENCH IN THE ELEMENTARY SCHOOL

In an effort to improve French instruction, lay people and professional educators are looking to programs involving younger children. There is a common belief that younger children learn languages faster and more easily than adults. The authority most often quoted as support for this view has been the neurologist, Dr. Wilder Penfield,¹ who states: "...a child's brain has a

¹ Wilder Penfield and L. Roberts, Speech and Brain Mechanisms, (Princeton: Princeton University Press, 1959) pp. 236-240.

specialized capacity for learning languages - a capacity that decreases with the passage of years, " and "... for the purposes of learning languages, the human brain becomes progressively stiff and rigid after the age of nine." Penfield based many of his views on observations of patients who had undergone brain surgery. Thus, a child under ten who had lost the use of one hemisphere of his brain and had become aphasic could relearn language whereas those over ten who had suffered the same misfortune, he claims, did not have this capacity. Whether we can conclude from this that second languages are best taught at a very early age is still open to question. The first international conference on the teaching of second languages, according to Stern,² accepted Penfield's evidence with reservation: "Children do not, in short, learn foreign languages with miraculous ease in school settings. Nor is psychological evidence for an early start and for teaching languages before puberty nearly as obvious as is popularly believed."

There are a number of findings which suggest that the very opposite may be true. Burstall,³ in a recent report on the ten-year study of primary school French in Britain, describes a number of experiments which illustrate that the older student is a more efficient learner of a foreign language than

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H. H. Stern (ed.), Foreign Languages in Primary Education: The Teaching of Foreign or Second Languages to Younger Children, (Hamburg: UNESCO, 1963) p.17.

³Clare Burstall, Monika Jamieson, Susan Cohen and Margaret Hargreaves, Primary French in the Balance, (Windsor, U.K.: N.F.E.R. Publishing Co.Ltd., 1974) pp.120-123.

his younger counterpart. Thus, Thorndike⁴ and his associates, using subjects who ranged in age from nine to fifty-seven, found that younger learners learned more slowly than the older. Grinder⁵ and his associates found that English speaking grade four pupils performed consistently higher than pupils in grade three or grade two on proficiency tests in Japanese, which they were all learning for the first year using the same method. Asher and Price,⁶ comparing the listening comprehension in Russian of adults and children, found that the adults performed much better than the children and that the older children performed consistently better than the younger children. Olson and Samuels⁷ reported that with equal instruction in German, older pupils achieved a significantly more accurate standard of pronunciation than

4

E.L.Thorndike, E.O.Bregman, J.W.Tilton and E.Woodyard, Adult Learning, (New York: The Macmillan Co., 1928) cited in Burstall et al, op.cit., p.121.

5

R.E.Grinder, A.Otoma and W.Toyota, Comparisons Between 2nd, 3rd, and 4th Grade Children in the Audio-Lingual Learning of Japanese as a Second Language, (Honolulu: Psychological Research Center, University of Hawaii, 1961) cited in Burstall et al, op.cit., p.121.

6

J.J.Asher and B.S.Price, "The Learning Strategy of the Total Physical Response: Some Age Differences", Child Development, 38,4: 1219-1227, cited in Burstall et al, op.cit., p.121.

7

L.L.Olson and S.J.Samuels, "The Relationship Between Age and Accuracy of Foreign Language Pronunciation," paper presented to the American Educational Research Association, Chicago, 1972, cited in Burstall et al, idem.

did younger pupils. Justman and Nass,⁸ who studied the foreign language results of one hundred matched pairs of high school students, concluded that those who had studied foreign language in the elementary school showed no advantage over those who began their study later.

Oller and Nagato⁹ claim that if pupils taught foreign language in the elementary grades are integrated with pupils who are beginning their study of foreign language in junior high school, then the elementary trained pupils may not maintain their initial advantage over the pupils who had no previous training.

Burstall's¹⁰ findings in the British study of French in the primary school supports the view favouring teaching the older child. Previously, French had been introduced at age eleven, but in this study it was to be taught from age eight. One of the aims of the experiment was to determine if it was advantageous and educationally feasible to introduce French language teaching to younger students on a broad scale. In summarizing the results of the evaluation, Burstall states that although the eight-year olds retained a superiority in listening comprehension, they were no better in speaking skills

8

J. Justman and M. L. Nass, "The High School Achievement of Pupils Who Were and Were Not Introduced To A Foreign Language in Elementary School," Modern Language Journal, 40: 120-123, 1956.

9

John W. Oller, Jr., and Naoko Nagato, "The Long-Term Effect of FLES: An Experiment," Modern Language Journal, LVIII: 15-18, Jan.-Feb., 1974.

10

Burstall, et al, op. cit., (1974) pp. 188-243.

than those pupils who were taught from age eleven. By the end of the experiment those who had begun their study of French at age eleven were significantly superior to their peers who had begun studying French in the same schools at age eight on tests of reading and writing French. Burstall states unequivocally that no substantial gains in achievement are realized by introducing French at age eight. More recently, Burstall¹¹ restates his conclusions: "The most conservative interpretation which the available experimental evidence would appear to permit is that the achievement of skill in a foreign language is primarily a function of the amount of time spent studying that language, but is also affected by the age of the learner, older learners tending to be more efficient than younger ones."

Although there is considerable research which indicates that the young pupil is not as efficient in learning a second language as the older pupil, there are some researchers who claim certain advantages for the young learner. Thus, Anderssen¹² feels strongly that the best time to teach a second language is prior to age five, and Stern,¹³ on the basis of tests given to nearly three thousand university students, states that those students who begin their study of a foreign language in elementary school do better than those who

¹¹ Clare Burstall, "French in the Primary School: The British Experiment," Canadian Modern Language Review, 31: 388, May, 1975.

¹² Theodore Anderssen, "Bilingual Education and Early Childhood," (ERIC: Ed 074 866) April, 1973.

¹³ H.H. Stern, Languages and the Young School Child (London:Oxford University Press, 1969) p.63.

begin the study in secondary school. They in turn do better than those students who do not begin their study until they reach university. Asher¹⁴ found that sixty-eight per cent of Cuban children who came to the United States between the ages of one and six and who lived there for five years or more acquired near native pronunciation; forty-one per cent of Cuban children who had arrived between the ages of seven and twelve and who lived there for five years or more acquired near native pronunciation, and only seven per cent of Cuban immigrants arriving at age thirteen or more ever achieved native-like pronunciation. This may be because he does not have to overcome previously learned habits to the same extent as the older learner. This study does not indicate however that he learns any better or any faster. Stern¹⁵ feels that, "the comparison between an earlier and a later start leads at present to the conclusion that the early starters attain more fluency because of more oral practice."

Stern¹⁶ maintains also that young children who come from homes where there is a tolerant attitude towards languages will learn two languages with no

14

James J. Asher, "The Optimum Age to Learn a Foreign Language," Modern Language Journal, LIII, No. 5: 334-340, May, 1969.

15 H.H. Stern, "Languages for Younger Children: Recent Trends and New Directions," (Toronto: OISE, 1972) p. 23.

16 H.H. Stern (ed.), Foreign Languages in Primary Education: The Teaching of Foreign or Second Languages to Younger Children, (London: Oxford University Press, 1967).

apparent effort. Lavallée,¹⁷ working with English speaking children learning French in Geneva, found that pre-schoolers learned the second language rapidly, that children aged approximately six to eight were slow and often reluctant learners, and that children in the age group nine to twelve again showed rapid speech development. These findings are similar to those reported by Stern¹⁸ on a project to teach English to Swedish children. He found that the seven year old children were slower at comprehension and pronunciation than the eleven year olds. There were no pre-schoolers involved in the project. In Canadian bilingual programs,¹⁹ those involving kindergarten children tend to have better results than those which start at a later age. All this evidence suggests a pattern: effective language acquisition prior to age six; ineffective language learning from age seven to ten; effective learning from age ten to twelve. These ages correspond roughly to Piaget's stages of preoperational thought and concrete operational thought with an ambiguous

¹⁷ M. Lavallée, "Piagetian Stages and the Acquisition of a Second Language," cited by P.E. Engle, "The Use of Vernacular Languages in Education," Papers in Applied Linguistics. (Arlington: Center for Applied Linguistics, June, 1975) p.20.

¹⁸ Stern, op.cit., (1963) p.42.

¹⁹ H. Edwards and M. Casserly, "Evaluation of Second Language Programs in English Schools," (Ottawa: Ottawa R.C. Separate School Board, 1973) p.93.

R. Tucker, "An Alternate Days Approach to Bilingual Education," cited in J. Alatis (ed.) Bilingualism and Language Contact: Anthropological, Linguistic, Psychological, and Sociological Aspects, Report on the Twenty-first Annual Round Table Meeting, (Washington: Georgetown University, 1970) pp.281-299.

transitional stage between the two. Giles²⁰ hypothesized that language learning by the young child will be easy and effective because he will not be applying any analytical skills to either language. This corresponds to Piaget's notion of the preoperational thought stage. Language learning will again be effective after the child's analytical skills have been well developed. This corresponds to Piaget's stage of operational thought. Giles predicts further that the stage between these two levels, that is, from approximately age seven to age ten, will be the least effective time for learning a second language. If such a theory gains more support it may also help to explain why the audio-lingual method which does not provide explanation or analysis tends to be effective with young children, and why the cognitive-code method which does supply explanation and analysis tends to be effective with older learners.

As far as the present study was concerned, the research indicated possible advantages and disadvantages for all age groups learning a foreign language. This investigation involved grade four pupils who were in the nine to ten age group, and recent theory supports beginning a program at this age because the children's analytical skills should have been well enough developed to learn efficiently. It was not the purpose of this study, however, to demonstrate that this was the only age or the best age to begin an elementary French

program. There were other factors considered besides those found in this review of the literature before the decision was made to begin the program at the grade four level.

II. EFFECTS OF LEARNING A FOREIGN LANGUAGE ON INTELLECTUAL GROWTH AND ON PROGRESS IN SUBJECT AREAS

In addition to the age factor, there is also the concern that teaching young children a foreign language might impair their general intellectual growth or affect their progress in other subject areas. This question has taken on a new relevance with the rapid increase in the number of early immersion-style programs across Canada as reported by Swain.²¹ The research on this question is conflicting. This review will pay particular attention to research involving the effects of foreign language learning on the study of mathematics, that subject being particularly relevant to this investigation.

Research Outside Canada

Jenson²² argues that learning more than one referent for the same concept will create mental confusion and thus retard learning. Macnamara²³ found that English-speaking Irish children who had been taught arithmetic in

²¹M. Swain, "French Immersion Programs Across Canada: Research Findings," Canadian Modern Language Review, 31:117, Nov., 1974.

²²J. V. Jenson, "Effects of Childhood Bilingualism," Elementary English, 39:132-143, 1962.

²³John Macnamara, Bilingualism and Primary Education: A Study of Irish Experience, (Edinburgh: Edinburgh University Press, 1966) p. 136.

the Irish language for six years were about eleven months behind in their expected achievement in problem solving arithmetic. Macnamara²⁴ elsewhere notes that of twenty-two studies he reviewed in which arithmetic was investigated, the bilingual students tended to be inferior to monolinguals in problem arithmetic, (reasoning) but not in mechanical arithmetic (computation). He contends that this result is not found only in the initial stages of programs but that it has much greater permanence. Many of the studies reviewed by Macnamara involved students who took their instruction in a second or weaker language, and who were tested in this second language. It may be that the tests used were measuring proficiency in understanding the second language and not arithmetic reasoning per se.

Modiano's²⁵ Mexican study is frequently cited as evidence for teaching reading in the vernacular. Indian children were divided into two groups, one group receiving initial reading in the vernacular, then in Spanish, the other group receiving instruction only in Spanish. After three years the group which began reading in the vernacular scored higher than the Spanish only group on a reading comprehension test in Spanish.

24

John Macnamara, "The Effects of Instruction in a Weaker Language," Journal of Social Issues, 23, No.2: 122, 1969.

25

N. Modiano, "Reading Comprehension in the National Language: A Comparative Study of Bilingual and All Spanish Approaches to Reading Instruction in Selected Indian Schools in the Highlands of Chiapas, Mexico," Unpublished doctoral dissertation, New York University, 1966.

Liedtke and Nelson²⁶ compared two groups of grade one pupils matched for intelligence, socioeconomic status, age, sex, one being bilingual, the other monolingual. Both groups were given a series of Piagetian conservation tests. The bilingual students scored higher than their monolingual peers. According to the authors this indicates that they were functioning at a higher cognitive level.

Trevino²⁷ compared two groups of children, one taught bilingually in Spanish and English and the other taught exclusively in English. The California Achievement Tests were used to detect any differences of achievement in arithmetic fundamentals or arithmetic reasoning. She found that in grade one the children in the bilingual program scored significantly higher in arithmetic fundamentals but not as high in arithmetic reasoning as children taught exclusively in English. In grade three however, the children taught bilingually scored generally lower in arithmetic fundamentals and higher in arithmetic reasoning than the students taught exclusively in English. The results are similar for both English-speaking children and Spanish-speaking children.

26

W. W. Liedtke and L. D. Nelson, Bilingualism and Conservation, (Washington: U.S. Dept. of Health, Education and Welfare, Office of Education, 1968) ERIC: ED 030 110, AL 001 965.

27

B. A. G. Trevino, An Analysis of the Effectiveness of A Bilingual Program in the Teaching of Mathematics in Primary Grades, (Austin: University of Texas, unpublished doctoral dissertation, 1968).

Burstall²⁸ states that in the British study there is no evidence of retardation in general ability or in subject matter mastery. This was not a bilingual project, however, and generally involved only about twenty minutes a day of teaching French as a subject, so that one would expect little effect on subjects taught in English.

Malherbe²⁹ compared large numbers of children in South Africa having similar intelligence. One group attended monolingual Africans schools, another group attended monolingual English schools, and the third group attended bilingual Africaans-English schools. The group which attended the bilingual schools scored higher than the other groups on tests of language attainment, geography, and arithmetic by the end of the sixth grade. This had not been true in the lower grades. He also found: "... that not only the bright children but also the children with below normal intelligence do better school work all round in the bilingual school than in the unilingual school." Bruck, Rabinovitch and Gates³⁰ have found similar results working with children in Montreal who have language disabilities.

²⁸ Burstall et al, op.cit., 1974, p.242.

²⁹ E.G. Malherbe, The Bilingual School. A Study of Bilingualism in South Africa, (London: Longmans, Green and Co.Ltd., 1946.)

E.G. Malherbe, "Session 1, Commentaries," in L.G. Kelly (ed.) Description and Measurement of Bilingualism, (Toronto: University of Toronto Press, 1969) p.48.

³⁰ M. Bruck, M.S. Rabinovitch, M. Oates, "The Effects of French Immersion Programs on Children with Language Disabilities - a Preliminary Report," Working Papers on Bilingualism No.5 (Toronto: OISE, Jan., 1975) pp.47-78.

31

John and Horner claim that in the Coral Way Elementary School in Miami, children in bilingual classes progress as well in all areas of the curriculum as do children in regular unilingual schools. Gaarder³² claims that these students do better than regular students. He cites test results from the Stanford Achievement Tests given in 1966 when students from this school scored at the ninety-third percentile in arithmetic reasoning and at the sixtieth percentile in arithmetic computation. He adds that these pupils were not a select group. Tucker,³³ reporting on the alternate days program in the Philippines agrees to some extent with these findings. He compared three groups, one following the vernacular Pilipino course, one studying in English and the third alternating daily from Pilipino to English. The second and third groups scored as well as the pilipino class on vernacular tests of science and social studies. The group taught in English performed better than the others on tests of English reading, science, social studies, and mathematics.

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Vera John and Vivian Horner, Early Childhood Bilingual Education, (New York: MLA-ACTFL, 1971) p. 176.

32

B.A. Gaarder, "Organization of the Bilingual School," Journal of Social Issues, XXIII No. 2: 115, 1969.

33

R. Tucker, "An Alternate Days Approach to Bilingual Education," in J. Alatis (ed.) Bilingualism and Language Contact: Anthropological, Linguistic, Psychological, and Sociological Aspects, (Washington: Georgetown University, 1970) pp. 281-299.

Research in Canada

Chiasson³⁴ administered a number of tests to two groups of Acadian children in Nova Scotia: one bilingual, English and French, and the other English-speaking. Differences in intelligence scores favoured the bilingual group, but although they performed slightly better on certain arithmetic sub-tests, they performed generally more poorly on achievement tests in arithmetic and English. It should be noted however, that the bilingual students spoke French as their mother tongue and that there is no description of how well they spoke, read or understood English. This is important since all tests were given in English with the exception of the Pintner Non-Verbal I.Q. Test.

In 1967, Peal and Lambert³⁵ compared two groups of children, one bilingual and the other unilingual. The groups were otherwise very carefully matched for factors such as socioeconomic status, age and sex. A variety of tests were given to both groups. The bilingual group performed significantly better on nearly all of the verbal and non-verbal sub-tests.

Evaluations of bilingual programs carried out in Canada since 1970 have occasionally found an initial subject matter lag, but this has always disappeared in a year or so, and no evaluation to date has revealed any evidence of intellectu-

³⁴ R.J. Chiasson, Bilingualism in the Schools of Nova Scotia, (Quebec: Les Editions Ferland, 1962).

³⁵ E. Peal and W.E. Lambert, "The Relation of Bilingualism to Intelligence", in J. Michel (ed.) Foreign Language Teaching: An Anthology, (New York: Macmillan Co., 1967), pp. 143-191.

al retardation. Barik and his associates evaluated the Ottawa public school immersion classes in kindergarten, grade one and grade two. They administered the Otis-Lennon Mental Ability Test, the Metropolitan Readiness Test and the Stanford Early School Achievement Test to kindergarten children in both the immersion classes and the regular English classes, and found no significant differences between the two groups. On the Metropolitan Achievement Test however, there were statistically significant differences favouring the regular classes on tests involving word knowledge, word discrimination, and reading. This is not surprising because the pupils in the French immersion classes had received no formal training in English at this time. On the test of arithmetic concepts and skills there were no statistical differences between the two groups. In grade two the same tests were used. The Otis-Lennon Mental Ability Test showed no difference between the groups and surprisingly, there were no statistically significant differences on any of the subtest scores on the Metropolitan Achievement Test. Since English was taught to the French immersion class for a portion of the time in grade two, the examiners speculate that this may have helped these children to catch up to their peers.

Evaluations of the second language programs of the Ottawa Roman Catholic Separate School Board were reported by Edwards and Casserly.³⁷ Using a wide variety of tests, they found the immersion group lagging slightly behind the comparison group in most tests of English skills at the grade two level. Tests given to the grade three's however, showed no such differences. There were no statistical differences between the two groups on tests of mathematics. It should be pointed out that the comparison group was also taking French, but for only about seventy-five minutes per day in comparison to about two hundred and seventy-five minutes a day for the immersion group. Intelligence tests indicated an advantage for the immersion group but the authors point out that this may have been caused by the student selection procedure: parents volunteered their children for the immersion classes. Thus, the fact that they scored higher on this test may have had nothing to do with the course they were taking.

In a more recent report on the Ottawa Roman Catholic Separate School

37

H.P. Edwards and M.C. Casserly, "Research and Evaluation of the French Program 1970-71: Annual Report," (Ottawa: The Ottawa Roman Catholic Separate School Board, 1971).

H.P. Edwards and M.C. Casserly, "Evaluation of Second Language Programs in English Speaking Schools," (Ottawa: Annual Report 1972-73 to the Ottawa Roman Catholic Separate School Board, 1973).

Board programs, Game³⁸ and associates report that in grade one the immersion group scored significantly higher in arithmetic skills than the other group which took sixty minutes of French per day. Although the two groups were comparable on English oral tests, the immersion grade ones lagged behind the others on tests of word knowledge, word discrimination and reading sub-tests of the Metropolitan Achievement Tests. Evaluations of the grade two and grade three classes showed less of a difference between the two groups but the sixty minute group still demonstrated a detectable advantage in grammar and reading skills. Both groups compared favourably with former grade three classes.

An evaluation of the French immersion kindergarten and grade one program at Allenby Public School in Toronto was made by Barik, Swain and McTavish.³⁹ They found no significant differences between children in immersion classes and those in regular classes on tests of English, mathematics, or intelligence.

Swain⁴⁰ and his associates evaluated the Elgin County program. This program is different from the immersion programs described above in that it

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A. Game, H. Edwards, and F. Smyth, "Second Language Programs in the Ottawa Roman Catholic School Board," Canadian Modern Language Review, 31:252-256, Jan., 1975.

³⁹H. C. Barik, M. Swain and K. McTavish, "Evaluation of 1972-73 French Immersion Kindergarten and Grade One at Allenby Public School in Toronto," (Toronto: Bilingual Education Project, Modern Language Center, OISE) Oct., 1973.

⁴⁰M. Swain, H. C. Barik, E. Nwanunobi, "Evaluation of Elgin County Board of Education Partial Immersion Program for Grades 1, 2, and 3." (Toronto: Bilingual Education Project, Modern Language Center, OISE) Oct., 1973.

is a half-time French immersion program. The subjects taught in French are French language arts, mathematics and music. English language and reading, science, social studies, art, physical education, health, and religion are taught in English.

Grade one results show no significant differences in mental ability between this group and the control group which took from twenty to forty minutes of French per day. There is also no difference between the groups on tests of English language or mathematics. In grade two there is no significant difference between the two groups on either the concepts and problem solving subtest or the computation subtest of the arithmetic test but on the tests of word knowledge, word discrimination, reading and spelling, the regular class scored higher than the partial immersion class. In grade three there is no statistical difference between the two groups on tests of arithmetic or mental ability. The regular class still scored higher in English skills, especially on the subtest of Punctuation and Capitalization but not on the reading subtest.

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The St. Lambert Study is a recent and often quoted experiment in bilingual education. In this longitudinal study the experimental group was composed of English speaking children learning French by the immersion method. There were two carefully selected control groups, one English speaking and the other French speaking. At the end of grade one, results showed the immersion

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W.E. Lambert and G.R. Tucker, Bilingual Education of Children: The St. Lambert Experiment, (Rowley, Mass.: Newbury House, 1972).

children poorer than the English control group in reading skills. By the end of the second grade however, after they had received some training in English language, they had caught up with the English control group in reading and were able to keep up to the English control group from that point on.

More recently, Lambert,⁴² after observing the program for seven years, declared satisfaction that there had been no native language or subject matter deficit. As to their cognitive development, he claims that the experimental children are at the same level as the controls on standard tests of intelligence and that they are significantly higher on tests of cognitive flexibility.

It is interesting to note the current research being done by Bain⁴³ at the University of Alberta. He contends that the child exposed to a continuous bilingual experience has a cognitive flexibility unmatched by the unilingual child. If his research demonstrates that the bilingual child does have a cognitive advantage, then educators may be pressed to introduce more bilingual programs.

As far as the present study was concerned, the research supported the view that an immersion program or a partial immersion program would not have a negative effect on the academic growth of the students involved. The research,

42

W.E. Lambert, "A Canadian Experiment in the Development of Bilingual Competence," Canadian Modern Language Review, 31: 108-116, Nov., 1974.

43

Bruce Bain, "Bilingualism and Cognition: Toward A General Theory," (Edmonton: University of Alberta, 1975).

especially the recent Canadian evaluations, also provided support for the view that teaching mathematics in French to English-speaking pupils would not result in any retardation in learning that subject. However, because of the concern expressed by parents that there might be a retardation in mathematics learning, the question appeared in need of re-examination.

III. SELECTION OF PUPILS FOR AN ELEMENTARY FRENCH PROGRAM

The research is very inconclusive about the question of aptitude for learning a foreign language. Stern⁴⁴ makes this point in his review of the 1963 Hamburg conference. He says that although some early studies indicated that there is such an aptitude, psychologists were at that time quite uncertain. Burstall⁴⁵ states: "It is clear that a pupil's potential level of achievement in French cannot reliably be predicted from his performance on a general attainment battery." The data on which this statement was based referred only to the oral stage of learning French. By 1969, Stern⁴⁶ seems less cautious in his view of measuring aptitude. He states: "I have found it possible to develop tests of language aptitude that can be given as early as age nine or ten and predict the amount of success the child will have with the learning of a second language."

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Stern, op. cit., (1963), p.25.

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Clare Burstall, "French From Eight;" A National Experiment, (Slough, Bucks: N.F.E.R., 1968) p.26.

46

Stern, op. cit., (1969), p.65.

Fox⁴⁷ notes that students chosen for the first grade seven immersion class in Elmgrove School in 1969 were selected largely on the basis of high academic achievement in all subjects studied, including French, but that two years later, the main criterion for entrance to the program was willingness on the part of the students to participate. The position taken by a report of the FLES committee of the American Association of Teachers of French⁴⁸ in 1963 may still be valid. This report suggested giving all students a trial run at the foreign language program before weeding anyone out. Perhaps even more important than aptitude is the question of attitude. Thus, a feature found consistently in successful immersion programs is strong parental support.

As far as the present study was concerned, parental support for the program was considered essential. Recent research shows this to be an important aspect of successful programs. Parents of all children in grade three were given the opportunity to enroll their children in the grade four partial immersion program with the understanding that any child could be withdrawn from the program if his academic progress seemed jeopardized.

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M. R. Fox, "So Called French Immersion Programmes," (Montreal: The Protestant School Board of Greater Montreal, 1973) pp.27-31.

48

FLES Committee of the American Association of Teachers of French, The Correlation of a Long Language Sequence Beginning in the Elementary School, (New York: AATF, 1963).

IV. SECOND LANGUAGE TEACHING METHODOLOGY

Language Learning Theories

There are two basic theories of language learning: the audio-lingual theory and the cognitive-code theory. The audio-lingual theory is supported by the behaviorist psychologists, notably Skinner,⁴⁹ who hold that language learning is habit formation. It is a mechanical operation in which the brain responds to external stimuli and the language is learned if positive reinforcement follows immediately. In the classroom this theory has produced a method emphasizing mimicry-memorization of carefully selected dialogues and followed up by pattern practices to reinforce the new language structures. Brooks⁵⁰ gives a description of the method in practice in his book, Language and Language Learning. He advocates a situation in which the pupil is drilled to give automatic responses to the stimulus questions. He discourages the teacher from using the vernacular during the foreign language lesson. Grammar is considered unnecessary, and audio-lingual experience precedes reading and writing in what is deemed to be the natural order of introduction. This method was accepted enthusiastically by many foreign language teachers who were frustrated by the grammar-translation approach which was used prior to that time.

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B. F. Skinner, Verbal Behavior, (New York: Methuen, 1957).

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Nelson Brooks, Language and Language Learning, (New York: Harcourt, Brace and World, Inc. 1964).

The cognitive-code theory can be considered a reaction against the audio-lingual theory. It reflects the opposition of certain psychologists, like Ausubel and Chomsky,⁵¹ to the stimulus reinforcement theory. The cognitive-code theory holds that language is a rule-governed, creative system. It is mentalistic rather than mechanistic, as is the case with the audio-lingual theory. The mind is an active agent in language acquisition. Language is infinitely varied so it is impossible to learn all the sentences and expressions necessary to function efficiently in normal language situations. Language is unique and creative. Chomsky's theory is often called the generative-transformational theory. The mind has the innate capacity to generate understandings of situations, an ability called "competence," and the capacity to produce appropriate linguistic transformations to respond to new situations. This expressive ability is called "performance." In the classroom this means no rote-learning, and the use of deductive explanations to help the learner acquire understanding of what is being learned. Although there are certain similarities between this method and the grammar-translation method, the differences in practice are twofold: first, the grammar translation method emphasizes the rules of grammar in a rigid and prescriptive sense. The cognitive-code method offers rules as explanations to make new structures meaningful, and there is no need to memorize

⁵¹ David Ausubel, Educational Psychology: A Cognitive View, (New York: Holt, Rinehart and Winston, 1968).

Noam Chomsky, "Review of Skinner's Verbal Behavior," Language, 35, 1959.

rules for later regurgitation. Second, the grammar translation method provides the bright students with the opportunity mainly to read and write in the foreign language whereas the cognitive-code proponents claim that their method is not restrictive in its application to only the bright students, and that there is much more emphasis on oral and written practice during the performance stage of learning.

Research comparing the audio-lingual method and the cognitive-code method.

There has been little research comparing the two methods. In 1947 Delattre⁵² reported his observations of the audio-lingual method in the classroom. He claimed that the new method was easy for the teacher and for the students. Not only were the results superior in oral skills but also in written work. Chastain⁵³ reported two subsequent studies, one by Agard and Dunkel,⁵⁴ and the other by Hamilton and Haden,⁵⁵ neither of which found superiority in students taught by this method. In 1964, Scherer and Wertheimer⁵⁶ compared

⁵²P. Delattre, "A Technique of Aural-Oral Approach Report on a University of Oklahoma Experiment in Teaching French," French Review, 20: 238-250, Jan., 1947.

⁵³Kenneth Chastain, The Development of Modern Language Skills: Theory to Practice, (Philadelphia: The Center for Curriculum Development, 1971), Pp. 124-144.

⁵⁴F. B. Agard and H. B. Dunkel, An Investigation of Second Language Teaching, (Boston: Ginn, 1948) cited in Chastain, K., Ibid., p. 127.

⁵⁵D. L. Hamilton and E. T. Haden, "Three Years of Experimentation at the University of Texas," Modern Language Journal, 34:85-102, Feb., 1950 cited in Chastain, K. idem.

⁵⁶G. A. C. Scherer and M. Wertheimer, A Psycholinguistic Experiment in Foreign Language Teaching. (New York: McGraw-Hill, 1964) cited in Chastain K. idem.

two groups of German students, one taught by the audio-lingual method and the other by the traditional method. They found that after one year the audio-lingual group was superior in listening and speaking skills and that the other group was superior in reading and writing skills. After the second year they found that these differences tended to disappear. It should be noted that during the second year the classes were mixed and this may help to explain why the differences between the groups disappeared.

In 1969, Chastain and Woerdehoff⁵⁷ reported the results of an investigation comparing the audio-lingual habit theory and the cognitive-code learning theory as applied to first year college classes in Spanish. After one year the audio-lingual students scored higher on a test of repeating sentences after a native speaker, and the cognitive students scored higher in reading, listening and writing. At about the same time, a project was carried out in Pennsylvania to compare the audio-lingual versus traditional teaching procedures in High School French and German classes. Chastain⁵⁸ reported that one conclusion of the project was that students taught by traditional strategies were equal or superior in all measures to those taught by audio-lingual procedures.

57

K.D. Chastain and F.J. Woerdehoff, "A Methodological Study Comparing the Audio-Lingual Habit Theory and the Cognitive-Code Learning Theory," Modern Language Journal, 52: 268-279, May, 1968.

58

Chastain, op. cit., (1971), p. 129.

Another large scale project was carried out in Sweden comparing audio-lingual teaching strategies with the cognitive-code method. Levin,⁵⁹ in reporting on the project in 1972 cautiously suggests that the students taught by the cognitive-code method may have a slight advantage over the others and that this advantage increases with the age of the learner. Burstall⁶⁰ notes that ". . . no single method is equally appropriate for all pupils. High achieving pupils tend to reject the audio-visual approach . . ."

Recently, Dulay and Burt⁶¹ have been carrying on research to clarify the role played by the brain in the cognitive learning sequence. In one of their studies they claim that the habit formation theory would predict that children learning a foreign language would suffer from interference errors attributable to their overlearned first language. They found that Chinese and Spanish speaking children learning English as a second language commit roughly the same errors and learn in roughly the same sequence. Dulay and Burt claim that this demonstrates that the errors are not attributable to habits formed in their native languages but to a common cognitive process innate to all humans which

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Lennart Levin, Comparative Studies in Foreign Language Teaching, (Stockholm: Almqvist and Wiksell, 1972).

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Burstall et al, op. cit., (1974) p. 244.

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Heidi Dulay and Marina Burt, "A New Perspective on the Creative Construction Process in Child Second Language Acquisition," Working Papers on Bilingualism, No.4, pp.71-98, Oct., 1974, and

Elaine Tarone, "A Discussion of the Dulay and Burt Studies," Ibid., pp. 57-70.

helps us to organize linguistic input. They admit that as yet these universal, innate mechanisms cannot be explained.

There is no reason why the audio-lingual theory and the cognitive-code theory should be mutually exclusive, and there is a growing number of supporters such as John Carroll and Hector Hammerly⁶² who favour an eclectic approach to methodology in foreign language teaching. Carroll finds many aspects of the two theories complementary and Hammerly notes that some things may be best taught in one way and that other things may be best taught in the other way.

The materials available for teaching core French in the elementary school are generally audio-lingual in approach. Because this investigation involved nine and ten year olds, using an audio-lingual approach was considered appropriate in view of the research findings. This approach was not used exclusively, however, and when an explanation was demanded, or when it appeared that an explanation might serve a useful function, then it was provided.

The choice of approach

Although widely used, the conventional core programs that expose students to about twenty minutes of French a day have not produced the results hoped for by teachers and parents; these programs appear to promise more than they

⁶² John B. Carroll, "Current Issues in Psycholinguistics and Second Language Teaching," TESOL Quarterly, 5, 2:101-114, June, 1971.

Hector Hammerly, "The Deductive/Inductive Controversy," Modern Language Journal, LIX: 15-18, Jan.-Feb., 1975.

achieve. Stern⁶³ reports a growing feeling that this kind of program is obsolete. Burstall's⁶⁴ conclusions testify to the ineffectiveness of this method when applied to eight year old British children. Stanutz⁶⁵ claims that twenty minutes a day of French instruction does not permit the setting of objectives that are acceptable to anyone, and leads to serious control problems. Disillusionment with this kind of program led to the establishment of the Toronto French School and to the St. Lambert program. Parental pressure was very influential in establishing these two immersion-style schools. Parental pressure also led the Ottawa Separate School Board to drop the regular twenty minute French program but retain an hour long program and the immersion program. Similarly, the Ottawa Board of Education dropped its twenty minute program in 1973 in favour of a forty-minute core program and an immersion program, both starting at kindergarten.

Oliva⁶⁶ expresses another kind of concern about the twenty-minute conventional course. He says:

This author has been concerned with the attrition rate in some schools that follow a longer sequence. Something happens to

⁶³Stern, op.cit., (1972) pp.10-11.

⁶⁴Burstall, op.cit., (1974) pp. 241-246.

⁶⁵S.Stanutz, "The Teaching of French as a Second Language in Ottawa." Canadian Modern Language Review, 31: 148, Nov., 1974.

⁶⁶Peter F. Oliva, The Teaching of Foreign Languages, (Princeton: Prentice-Hall Inc., 1969) p. 27.

youngsters along the way which causes them to drop out of language instruction as soon as they can. Or, if they remain in foreign languages, they switch to a different foreign language instead of sticking with the longer sequence in which they could gain a mastery.

It seems that the children who take the standard core program initially enjoy the new experience but after a period of time they get bored with it, putting more and more pressure on the teacher to be increasingly more exciting and entertaining. No teacher is gifted with an unlimited reserve of talent and energy to cope with such a situation.

Lambert and Tucker⁶⁷ found a marked difference between students who took the standard twenty minute course and those in the immersion program. The immersion children not only demonstrated superiority of competence in French, but they made it clear that they enjoyed the program and wanted to stay in it. The twenty minute students felt that they had already had enough French and were not enthusiastic about taking further instruction.

Part of the failure of the standard core program may be due to teaching about French rather than teaching in French. Paulson⁶⁸ claims: "Children in primary schools do not seem to learn a language well if it is taught only as a subject matter with second language techniques, especially if those techniques are classic audio-lingual. Unless a child understands and can use a language to

⁶⁷Lambert and Tucker, op.cit., (1972) chapter 9.

⁶⁸P. B. Paulson, "Implications of Language Learning Theory for Language Planning: Concerns in Bilingual Education," Papers in Applied Linguistics, Bilingual Education Series 1, (Arlington: Center for Applied Linguistics, 1974), p. 26.

communicate, he will not gain any proficiency in that language." Penfield⁶⁹ states: "Language is not a subject to be studied, nor an object to be grasped. It is a means to other ends, a vehicle and a way of life."

Macnamara⁷⁰ recommends a setting: ". . . in which true acts of communication can take place; one in which the teacher and learner have something to say to each other." Language comes as a by-product when subject material is taught in the foreign language, and also exposes the child to the foreign language over longer periods of time without borrowing that time from the other subjects. Macnamara⁷¹ again advises that "Age or neurology aren't really the questions at all - the point is that children learn languages quickly in the streets because of situation and motivation. They learn poorly in the classroom because the teacher can't compete with the Nursery or Street, but maybe he should try . . ."

The more informal and natural approach also receives the support of Carroll,⁷² who writes, "Although formal and technical learning may have some

⁶⁹Lambert and Tucker, op.cit., (1972) chapter 9.

⁷⁰John Macnamara, "The Objectives of Bilingual Education in Canada from an English-speaking Perspective," in Swain, M.(ed.) Bilingual Schooling: Some Experiences in Canada and the United States. (Toronto: OISE, 1972), p.37.

⁷¹John Macnamara, "Nurseries, Streets and Classrooms: Some Comparisons and Deductions," Modern Language Journal, LVII: 250-254, Sept.-Oct., 1973.

⁷²John Carroll, Language and Thought, (New Jersey: Prentice Hall Inc., 1964), p.43.

place in second language learning, it is probable that a faster, more appropriate kind of learning can be attained by shifting the balance in favour of informal learning." The first Hamburg conference⁷³ recognized the value of this approach; ". . . teaching other subjects in a second language is very valuable," The second Hamburg conference⁷⁴ seemed even more certain of the value of this approach and pointed out that such an approach gave the language a "functional significance" which is important to a child's motivation. By 1972, Stern⁷⁵ strongly advocated implementation of bilingual education projects, pointing out that this method allows children to participate in "true acts of communication."

Evaluations of bilingual projects appear to support the convictions of its advocates. Thus, in the St. Lambert program, Lambert⁷⁶ reports that by grade four the immersion children score at the same level as the French speaking control group on a test of vocabulary, although they lack the spontaneity of expression of the French speaking children. Barik⁷⁷ reports that tests given to children in the Ottawa Public School show that children who have spent three years in the twenty-minute French program do not do as well as the children enrolled in the half day French immersion kindergarten. Both Edwards and

⁷³Stern, op.cit., (1963), p.63.

⁷⁴Stern, op.cit., (1969), p.52.

⁷⁵Stern, op.cit., (1972), p.34.

⁷⁶Lambert, op.cit., (1972), p.204.

⁷⁷Barik, McTavish, and Swain, op.cit., (1973), p.18.

Casserly,⁷⁸ and Game, Edwards and Smyth⁷⁹ report that children involved in the immersion program of the Ottawa Roman Catholic School Board far surpass in all French skills those taking less intensive courses. Children involved in the Elgin County partial immersion program do not score as high as comparably aged children in full immersion programs but they do perform significantly better than children in the twenty minute program by the end of the third grade according to Swain, Barik, and Nwanunobi.⁸⁰ Sweet,⁸¹ commenting on the immersion program at Allenby Public School in Toronto, states: ". . . the children's ability to understand and speak French seems phenomenal in comparison with the achievements of the children in the twenty-minutes-per-day program."

V. CONCLUSIONS

Both the audio-lingual method and the cognitive-code method of language instruction have advantages. Some people may learn better using one method and some may prefer the other. Optimum learning may result when a combination of the two methods is possible. Thus, a skill may be introduced in a deductive

⁷⁸Edwards and Casserly, op.cit., (1973), p.93.

⁷⁹Game, Edwards and Smyth, op.cit., (1975), p.256.

⁸⁰Swain, Barik and Nwanunobi, op.cit., (1973), p.21.

⁸¹R.J.Sweet, "the Pilot Immersion Program at Allenby Public School, Toronto," Canadian Modern Language Review, 31: 166, Nov., 1974.

way but practiced using an audio-lingual technique such as a pattern drill. Young learners tend to perform well using the audio-lingual method whereas older learners appear to perform better using the cognitive-code method. Bright students tend to prefer the cognitive-code method.

The degree of proficiency desired in speaking a foreign language determines to a large extent the amount of time to be spent learning it. Generally speaking, the younger a child begins to learn a second language the more native-like will be his proficiency in using that language. Older children however appear to be more efficient learners, and children between the ages of six and eight may be the least efficient learners of foreign languages. Learning a second language using any method does not appear to have any detrimental effect on an individual's intellectual growth. The Canadian research indicates that taking a regular school subject like mathematics in a second language does not appear to have adverse effect upon progress in that subject.

Certain tests may be able to predict a child's degree of success in learning a second language, although social, economic and political factors may also be considered.

The approach to foreign language teaching appears to be changing. The twenty-minute per day program does not seem to be generally successful. An approach in which other subjects are taught in the foreign language seems to be more effective.

The present study involved two classes of grade four children. Most of the children were nine or ten years old. The research suggests that students

aged six to nine may be inefficient learners of a second language so that choosing to begin this second language program at the grade four level when most pupils are in their tenth year conforms with research findings.

Admission to the program was on a voluntary basis with the expectation that only pupils and parents who were seriously interested in a second language program would apply for admission. Pupil and parent support has often been given as an important factor in designing a successful foreign language program, especially by Canadian researchers.

The study involved teaching a basic twenty-minute French program to two grade four classes and teaching mathematics in French to one of the classes. The research supports the concept of teaching regular school subjects in the second language, and mathematics was chosen for this investigation because the research reported in Canada since 1970 has found that English-speaking pupils taking mathematics in French perform as well as those who take their instruction in English.

CHAPTER III

RESEARCH PROCEDURES

Introduction

The research into bilingual education suggests a number of trends in second language teaching: 1) generally, second language teaching is being started at a younger age than formerly; 2) there is a growing feeling that teaching a second language for twenty minutes a day is not effective; 3) teaching regular school subjects in a second language appears to be an effective way to teach that language. These trends have had a strong influence on the design of the Riverview School program.

Description of the program

The Riverview elementary French program began in the fourth grade. Students in the program took twenty minutes a day of French as a second language using an approved course, and forty minutes of mathematics a day in which French was the language of instruction.

Beginning a French program at grade four may seem rather modest in comparison to the programs described above, but at the time of this study there was not sufficient public support to start the program earlier. Starting the program at this grade also had the advantage of not teaching French to the six to nine age group, a group which the research suggested may be inefficient at learning a second language. Another factor recognized by starting the program at grade four was the availability of French speaking teachers.

If the program continued into succeeding grades more French speaking teachers would be needed, and there were few such teachers available in Brandon. Introducing French at an earlier grade would have created a need for even more French speaking teachers, and expanding the number of subjects taught in French would have had the same result. Care had to be exercised too, not to alienate English speaking teachers who may have feared that the program would eventually involve replacement of large numbers of monolingual English speaking teachers for bilingual French-English teachers.

The twenty-minute core French course was the program authorized by the Department of Education of Manitoba.¹ Course material included Le Français Partout: Cours Préliminaire,² and Petit Monde.³ Grammatical elements found in this course included the present indicative tense, the imperative, the articles le, la, les, un, une, des; voici and voilà; question forms; colour adjectives; prepositions such as dans, sur, sous, devant, derrière and weather expressions.⁴ The topics in the course included greetings the classroom, the weather, numbers, Christmas, colours, prepositions, days of the week, parts of the body, clothing, fruit, and vegetables.⁵ The course

¹Department of Education, Teacher's Guide: French, Kindergarten to Grade VI, 1972 Supplement, (Winnipeg: Province of Manitoba, 1972).

²A. F. W. Hodgins (ed.) Le Français Partout: Cours Préliminaire, (Toronto: Holt, Rinehart and Winston, 1967).

³E. D. Cooper, Petit Monde Kit, (Toronto: Holt, Rinehart and Winston, 1973).

⁴Department of Education, Teacher's Guide: French for Elementary Grades. (Winnipeg: Province of Manitoba, 1966), p. 25.

⁵Department of Education, Ibid., p. 27.

was supplemented by other materials such as the "centres d'interêt" available from the Modern Language Center, Ontario Institute for Studies in Education.

The arithmetic course offered in the French language was the one authorized by the Department of Education of Manitoba. The text was called La Mathématique à l'Élémentaire.⁶ It was very similar to the English text: Elementary School Mathematics.⁷ The grade four mathematics course included:

- a) development of a better understanding of the base ten numeration system;
- b) strengthening the four fundamental operations with numbers;
- c) development of a better understanding of measurement and its application in specific problems;
- d) expressing problems in equation form;
- e) operations with larger numbers;
- f) simple geometric operations.⁸

In the school year 1974-75 the students who took the program which included twenty minutes a day of French language and forty minutes a day of mathematics in French formed the experimental group for the purpose of the investigation. A second class of grade four students in the same school formed the control group. The control group took the same twenty minute course in French as the experimental group but took forty minutes a day of

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Eicholz, O'Daffer, and Fleenor, La Mathématique à l'Élémentaire 4, (Montreal: Editions du Renouveau Pédagogique Inc., 1972).

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Eicholz, O'Daffer, Elementary School Mathematics, Book 4, (Don Mills: Addison-Wesley (Canada) Ltd., 1969).

⁸ Department of Education, Mathematics 1-6, Province of Manitoba, 1967, and Mathématiques, Niveau Intermédiaire: 4,5,6., (Winnipeg: Prov. of Man., 1973).

mathematics using English as the language of instruction. One teacher, the investigator, taught both groups the twenty minute French program and also the mathematics in French to the experimental group. The purpose of the investigation was to compare the achievement both in French and in mathematics between the two groups.

Preliminary steps to introducing the program

Approval to initiate this program was received from the Department of Education for the Province of Manitoba on November 29, 1973. The final consultation with the superintendents of the Brandon School Division No. 40 was on January 9, 1974. At that meeting administrative details were concluded and the superintendents agreed to support the program. A program description was mailed to each of the School Board members of the Brandon School Division prior to their regular meeting of February 11, 1974. They approved the introduction of the program at that meeting. The French teachers from the junior and senior high schools of Brandon endorsed the program at a meeting on February 12, 1974. A questionnaire sent to all the parents of children attending Riverview School was returned to the school on February 13, 1974. Of the 270 questionnaires distributed, 137 were returned. Of these, 103 were in favour of French being taught at Riverview School, twenty-six expressed no strong feelings either for or against the teaching of French at Riverview School, and eight were not in favour of the idea. A meeting was held with the parents of the grade three pupils on February 18, 1974 to explain the program in detail.

The parents were asked to preregister their children according to the following choices: a) the sixty-minute program in which arithmetic would be taught in the French language; b) the twenty-minute program of basic core French; c) enrollement in either course, leaving placement to the discretion of the principal and teachers of Riverview School, and d) no French program. Pre-registration forms returned to the school on March 1, 1974 showed the following distribution: a) sixty-minute program; twenty-one pupils; b) twenty-minute program: ten pupils; d) no French program: two pupils.

Twenty-six children took the sixty minute program. Of these, twenty-one had been preregistered by their parents and five were chosen at random from the group whose parents had stated that their children could be placed in either the sixty-minute program or the twenty-minute program. All twenty-six completed the program even though a transportation problem arose because several families moved to other parts of the city during the school year. Thirty-three children in all took the alternate program consisting of twenty minutes of core French per day. Of these, twenty-four took the course throughout the entire year.

Description of the sample

All students from the experimental class and the control class attended the same school and were all enrolled in grade four. One student was eleven years old, the rest were all aged nine or ten. All students spoke English as their home language. Most students had an Anglo-Saxon background. Most

students came from middle class homes as the following table illustrates. Some children came from single unit homes, some came from a multiple unit housing complex and a few came from low-rental houses. The socioeconomic

TABLE 3.01
OCCUPATIONS OF STUDENTS' PARENTS

Occupation Description	Experimental	Control
Professional : High Income	0	0
Professional : Low Income	9	4
Skilled Workers & Self Employed	9	11
Semi-skilled workers	8	4
Unskilled workers	0	3
No employment	0	2

level of the experimental class is slightly higher than that of the control class. All students who took mathematics in French were grouped together as one class, and those who took mathematics in English formed the other class. All grade four students who transferred into the school during the year 1974-75 chose to take mathematics in English, and consequently were placed with the class taking mathematics in English.

Classroom procedures

In teaching the twenty minute course to both the experimental class and the control class, the suggestions in the teacher's guide accompanying Le Francais Partout: Cours Préliminaire were followed carefully. A new course called Petit Monde, also published by Holt, Rinehart and Winston was used extensively and again the suggestions to the teacher were followed closely. A number of other programs were used at different times during the year including Voix et Images de France and several "centres d'interêt" developed by the Bilingual Education Project, the Modern Language Center, Ontario Institute for Studies in Education. Both classes were taught similar lessons each day.

In teaching the mathematics in French it was decided to withhold the textbooks until the students knew the numbers one to a hundred. Many pupils knew the numbers one to ten before the course began. A variety of techniques were used to teach the numbers: counting orally, counting things in the classroom, for example: 1 livre, 2 livres, etc., playing cards, dice, and flash cards. Addition and subtraction facts up to ten were then reviewed orally, with flash cards, and by using prepared lists of basic addition and subtraction facts. The operation names were taught at the same time: two plus two equals . . . would be said: "deux et deux font . . ."; six subtract three . . . would be said: "six moins trois font . . ." As the children's confidence with numbers increased, multiplication and division operations were reviewed using similar

techniques as those used to review addition and subtraction. Daily dictation tests on number knowledge and basic facts were introduced.

A number of games were devised to motivate the children to count in French, for example: "Combien de" In this game a number of students would be asked to calculate the number of windows in the school or the number of cars to pass a certain corner within a given time span, etc. After one month of this review of basic operations using French, the pupils were given the French mathematics text books. To begin with, only calculation exercises were done from the text. The instructions for these exercises were usually very simple: "Trouve les sommes" or "Trouve les différences", etc. The word "trouver" had been introduced by a game of the same name in which a certain pupil would be asked to find an object hidden somewhere in the classroom.

Daily tests of number knowledge continued and by October 21, 1974 all the pupils knew the numbers from one to twenty-five. On this day a visiting music supervisor was startled to hear the children counting time in French. As a reward for good attention and performance, Bingo and Bingo-like games involving mathematical computations were played periodically. By November 12, 1974 several students were able to recite the numbers from one to a million in French.

New concepts were taught in much the same way as in English. Often, a new word in French closely resembled the English word, for example;

périmètre, diamètre, tangente, or the concept was easily illustrated with diagrams, pictures blocks, models, or by pantomime. Sometimes, vocabulary items were introduced one day before being used in a problem the following day. Mathematical problems from the text which involved a lot of unfamiliar vocabulary were either left out or simplified. Many problems were teacher-constructed using a simplified vocabulary but involving the same kinds of mathematical operations as the text problems.

The overhead projector was found to be a useful teaching aid in this respect because it allowed the teacher to prepare problems and illustrations in advance. It was seldom necessary to revert to an explanation in English. Problem solving lessons presented a unique opportunity to teach new words and expressions in an incidental, natural way.

Data Collection

For the purpose of the investigation the program was evaluated during the school year 1974-75. The children in both the experimental class and the control class were given the Metropolitan Mathematics Test, Elementary Level, Form F, in September of 1974, and the Form G of the same test in June, 1975. This test is written in English. It has subtests on computation, concepts, and problem solving. It has been noted that the OISE sponsored evaluators based their observations on the Metropolitan Mathematics Tests. Also, a team of Department of Education Field Officers based in Brandon had used the Metropolitan Mathematics Test the previous year to obtain means for grade

four mathematics on a school level, a division level, and a regional level. These statistics were available and presented an additional source as comparative data.

For an evaluation of French language acquisition no pretest was considered necessary since none of the children spoke French. Three tests were chosen to assess the development of French skills at the year's end. The first one was the French Comprehension Test/Level 1 by Henri C. Barik of the Ontario Institute for Studies in Education, published in the Spring of 1975. The test was designed specifically for use in the beginning grades of French immersion programs but has been used with less intensive programs. The second test used was designed by the National Foundation for Educational Research in England and Wales for evaluation of the listening comprehension skills of students taking part in the ten year study of French from age eight. This test was not designed for children in immersion classes and consequently was easier than the one described above. As it was an unpublished test, permission was requested for its use in this investigation. This permission was then granted by the National Foundation for Educational Research. The third test used was a test of oral proficiency constructed by the investigator. It consisted of ten questions posed to each of the pupils in a tape recorded interview session. The recorded student answers were then evaluated on a common scale by three teachers of French. The final mark was an average of the three examiners' marks taken to the nearest whole number. A copy of the oral proficiency test is included in appendix A.

Treatment of Data

Test results from the Metropolitan Mathematics Test were recorded as four separate scores: computation subtest, concepts subtest, problem solving subtest and total score. The same procedure was followed for both the pretest and the post test. Students who had not written the pretest in September 1974 were allowed to write the post test in June, 1975 but their marks were not recorded. All raw score marks were converted to standard scores using the conversion tables supplied by the test publisher.

Separate scores were recorded for each of the three French tests: the OISE French Comprehension Test, the NFER Listening Comprehension Test, and the teacher constructed oral response test. All three of these tests were given to the students during the third week of June, 1975. A composite mark in French was then calculated for each student by adding together the three test marks.

At the conclusion of the investigation each student had four pretest scores and four post test scores in mathematics, and one achievement score in French.

Type of analysis performed

To test the hypotheses of no significant differences in progress in computation skills, concept learning, problem solving, and overall mathematical achievement between English speaking students taking mathematics for one year in French, and English speaking students taking mathematics in English, an analysis of covariance was performed on the four null hypotheses

using the post test marks as the criterion and the pretest marks as the covariate. The ST46 program of the Statistics On Line for Health Sciences, University of Manitoba was used to test these four null hypotheses. This program provides a chi square test of homogeneity of variance, tests of significance on equality of slope and intercept, and a multiple T-test based on adjusted means.

To test the hypothesis that there is no significant difference in achievement in French between students who took twenty minutes of core French per school day and students who took a combination of twenty minutes of core French per school day, and forty minutes of mathematics taught in French per school day, a T-test was performed using the ST13 program of the Statistics On Line for Health Sciences, University of Manitoba.

CHAPTER IV

RESULTS OF THE ANALYSIS

The purpose of this chapter is to report the results of the study described in the preceding chapter. Each of the five null hypotheses presented in chapter one is re-stated and examined statistically. Hypotheses one to four serve to investigate the relationship between the progress in mathematics of the class taking mathematics in French and the class taking mathematics in English. The fifth hypothesis serves to investigate the relationship of achievement in French language skills between the two classes.

Hypotheses 1	There is no significant difference in progress in computation skills between English speaking students taking mathematics for one year in French and English speaking students taking mathematics in English.
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Table 4.01 shows that the improvement in mean score by the experimental class is greater than the improvement in mean score by the control class. The difference in improvement is shown also by comparing the grade equivalency scores in table 4.01.

TABLE 4.01
COMPARISON OF MEANS AND GRADE EQUIVALENCIES FOR
COMPUTATION SKILLS

TEST	MEAN	S. D.	G. E.	IMPROVEMENT in G. E.
EXPERIMENTAL CLASS				
PRETEST	75.080	10.259	4.7	
POST TEST	82.640	9.966	5.6	0.9
CONTROL CLASS				
PRETEST	70.348	9.523	4.3	
POST TEST	75.261	9.616	4.7	0.4

Table 4.02 presents the results of covariant analysis for scores on computation. On the test of homogeneity of variance, chi square equals 0.029, which is not significant. The F ratio for the test of equality of slope is 0.067 for 1 and 44 degrees of freedom, which is not significant. The F ratio for the test of equality of intercept is 4.017 for 1 and 45 degrees of freedom, which is significant. The multiple T-test score is -2.004 which is not significant approaching .05.

TABLE 4.02
COVARIANCE ANALYSIS OF COMPUTATION SCORES

Chi Square	Equality of slope F(1,44)	Equality of inter- cept F(1,45)	T-test
0.029	0.067	4.017	-2.004 (N.S.)

On the basis of these results the first hypothesis is accepted. There is not a significant difference in computation test scores between the students who took mathematics in French and those who took mathematics in English, although a difference approaching .05 favours the experimental class.

Hypothesis 2 There is no significant difference in progress in concept learning between English speaking students taking mathematics for one year in French and English speaking students taking mathematics in English.

Table 4.03 shows that the improvement in mean score by the experimental class is greater than the improvement in mean score by the control class. The difference in improvement is shown also by comparing the grade equivalency scores in table 4.03.

TABLE 4.03
COMPARISON OF MEANS AND GRADE EQUIVALENCIES FOR
CONCEPT LEARNING

TEST	MEAN	S.D.	G.E.	IMPROVEMENT IN G.E.
EXPERIMENTAL CLASS				
PRETEST	75.840	7.771	4.9	
POST TEST	81.320	7.750	5.6	.7
CONTROL CLASS				
PRETEST	70.909	10.899	4.2	
POST TEST	74.435	9.014	4.7	.5

Table 4.04 presents the results of covariant analysis for scores on concept learning. On the test of homogeneity of variance, chi square equals 0.514 which is not significant. The F ratio for the test of equality of slope is 0.453 for 1 and 44 degrees of freedom, which is not significant. The F ratio for the test of equality of intercept is 4.087 for 1 and 45 degrees of freedom, which is significant. The multiple T-test score is -2.022 which

is significant at the .05 level.

TABLE 4.04
COVARIANCE ANALYSIS OF CONCEPT SCORES

Chi square	Equality of Slope F(1,44)	Equality of Inter- cept F(1.45)	T-test
0.514	0.453	4.087	-2.022 *

* significant at .05 level

On the basis of these results the second hypothesis is rejected. There is a significant difference in test results between the students who took mathematics in French and those who took mathematics in English. The difference favours the experimental class.

Hypothesis 3 There is no significant difference in progress in mathematical problem solving between English speaking students taking mathematics for one year in French and English speaking students taking mathematics in English.

Table 4.05 shows that the improvement in mean score by the experimental class is greater than the improvement in mean score by the control class. The difference in improvement is shown also by comparing the grade equivalency scores in table 4.05.

TABLE 4.05
COMPARISON OF MEANS AND GRADE EQUIVALENCIES FOR
PROBLEM SOLVING

TEST	MEAN	S.D.	G.E.	IMPROVEMENT in G.E.
EXPERIMENTAL CLASS				
PRETEST	81.000	8.689	5.4	
POST TEST	88.280	10.257	6.4	1.0
CONTROL CLASS				
PRETEST	74.478	11.200	4.4.	
POST TEST	76.696	10.020	4.7	.3

Table 4.06 presents the results of covariant analysis for scores on concept learning. On the test of homogeneity of variance, chi square equals 0.012, which is not significant. The f ratio for the test of equality of slope is 1.902 for 1 and 44 degrees of freedom, which is not significant. The F ratio for the test of equality of intercept is 9.243 for 1 and 45 degrees of freedom, which is significant at the .01 level. The multiple T-test score is -3.040, which is significant at the .01 level.

TABLE 4.06
COVARIANCE ANALYSIS OF PROBLEM SOLVING SCORES

Chi Square	Equality of Slope F(1, 44)	Equality of inter- cept F(1,45)	T-test
0.012	1.902	9.243	-3.040 **

** significant at .01 level

On the basis of these results the third hypothesis is rejected. There is a significant difference in test results between the students who took mathematics in French and those who took mathematics in English. The difference favours the experimental class.

Hypothesis 4 There is no significant difference in progress in overall achievement in mathematics between English-speaking students taking mathematics for one year in French and English-speaking students taking mathematics in English.

Table 4.07 shows that the improvement in mean score by the experimental class is greater than the improvement in mean score by the control class. The difference in improvement is shown also by comparing the grade equivalency scores in table 4.07.

TABLE 4.07
COMPARISON OF MEANS AND GRADE EQUIVALENCIES FOR
OVERALL ACHIEVEMENT IN MATHEMATICS

TEST	MEAN	S.D.	G.E.	IMPROVEMENT in G.E.
EXPERIMENTAL CLASS				
PRETEST	81.720	8.008	4.9	
POST TEST	88.200	7.853	5.7	0.8
CONTROL CLASS				
PRETEST	75.957	8.132	4.3	
POST TEST	79.783	8.224	4.7	0.4

Table 4.08 presents the results of covariant analysis for scores on overall achievement in mathematics. On the test of homogeneity of variance, chi square equals 0.048, which is not significant. The F. ratio for the test of equality of slope is 0.000 for 1 and 44 degrees of freedom, which is not significant. The F ratio for 1 and 45 degrees of freedom on equality of intercept is 6.078 which is significant. The multiple T-test score is -2.466, which is significant at the .02 level.

TABLE 4.08
COVARIANCE ANALYSIS OF TOTAL MATHEMATICS SCORES

Chi Square	Equality of Slope F(1,44)	Equality of inter- cept F(1,45)	T-test
0.048	0.000	6.078	-2.466 *

* significant at .02 level

On the basis of these results the fourth hypothesis is rejected. There is a significant difference in test results between the students who took mathematics in French and those who took mathematics in English. The difference favours the experimental class.

The following table compares the post test means of the experimental and control classes with the Division-wide means obtained the previous year on the same test. The means are reported to the nearest decimal point. The Division scores were obtained during the Spring term of 1974 and the scores for the other two groups were obtained in June of 1975. The scores were obtained from the same Metropolitan Achievement Test in Mathematics. The scores obtained by the Experimental class on the sub-tests are consistently higher than the Division mean scores, whereas the scores obtained by the Control class are consistently lower than the Division mean scores. The difference between the scores obtained on the problem solving sub-test is

greater than for the other sub tests.

TABLE 4.09
COMPARISON OF MEANS FOR EXPERIMENTAL, CONTROL, AND
DIVISION-WIDE CLASSES IN MATHEMATICS

TEST	EXPERIMENTAL CLASS	CONTROL CLASS	DIVISION-WIDE
Computation	83	75	80
Concepts	81	74	78
Problem Solving	88	77	79
Total	88	80	84

Hypothesis 5

There is no significant difference in achievement in French between students who take twenty minutes of core French per school day for one year and students who take a combination of twenty minutes of core French per school day and forty minutes of mathematics taught in French per school day for one year.

Table 4.10 presents the results of statistical analysis on French achievement scores. The T-test score of 8.120 is significant beyond .0005. The chi square score of 36.522 is very significant, and the U test score of probability is 0.000000. Because the students in the experimental class scored significantly higher on the French achievement tests, hypothesis 5

is rejected.

TABLE 4.10
ANALYSIS OF FRENCH ACHIEVEMENT SCORES

MEAN (Experimental)	S.D.	MEAN (Control)	S.D.	T-test score
62.160	11.393	38.739	8.170	8.120 **

** significant beyond .0005 level

Table 4.11 compares the mean scores of the experimental and control classes on the French Comprehension Test/Level 1 with the mean scores of pupils in other programs. The information on the first three groups in this table is taken from the Teacher's Manual of the French Comprehension Test.¹ If the criterion of time spent studying French is used, the control class cannot be compared closely with the pupils in any other group. The best comparison is between the control class and the grade one core French program group which has taken French for 30 minutes a day in kindergarten and 40 minutes a day in grade one. The control pupils achieve nearly as well as this group.

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Henri C. Barik, French Comprehension Test/Level 1, Teacher's Manual, (Toronto: Ontario Institute for Studies in Education, 1975).

TABLE 4.11
 MEAN SCORES IN FRENCH ACHIEVEMENT
 BY PUPILS IN DIFFERENT PROGRAMS

GROUP	N	SCORE (out of 45)
1. Total French Immersion Program		
Grade 1	268	30.82
Grade 2	209	37.19
2. Partial Immersion Program (no French in Kindergarten, half-day French grades 1-4)		
Grade 1	21	11.05
Grade 2	23	19.74
Grade 3	17	21.77
Grade 4	18	31.89
3. Core French Program.		
Grade 1 (30 mins.French in Kindergarten; 40 mins.French in Grade 1)	59	10.58
Grade 2 (30 mins.French in Kindergarten; 40 mins.French in Grades 1 & 2)	97	13.98
Grade 3 (20 mins.French in Kindergarten; grades 1,2, & 3)	54	15.65
4. Experimental Class (20 mins.core French French; 40 mins.math.in French for one year Grade 4		
	26	14.96
Control Class (20 mins.core French per day for one year) Grade 4	23	9.65

Using the same criterion of time spent studying French, the experimental class has spent about the same amount of time studying French as the grade one core French group and considerably less time than the grade two core French group. The experimental class scores higher than either of these groups. The experimental class also scores higher than the grade one half-day immersion group.

CHAPTER V

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

1. SUMMARY

Purpose of the study

The basic purpose of this investigation was to study the effectiveness of an introductory grade four French program involving the teaching of core French and arithmetic taught in French as compared to the conventional program which involves only the teaching of core French. An examination of the research revealed that the conventional core program has not been effective but that immersion-style programs which have involved the teaching of other subjects in French have been successful. Consequently, the main purpose of this study was to investigate the effectiveness of a partial immersion program involving the teaching of one subject in French which is normally taught in English as an alternative to the conventional core French program.

Design of the study

Two classes of grade four students from the same school were used for the study. One class was taught core French and arithmetic in French for one year and the other class was taught core French and arithmetic in English. Both classes were pretested in arithmetic at the beginning of the investigation using the Metropolitan Achievement Test in Mathematics, and post-tested at the conclusion of the investigation using an alternative form of the same test. Neither class had taken French previously. Both classes were given a battery of achieve-

ment tests in French language skills at the conclusion of the investigation.

An analysis of covariance was performed on four null hypotheses dealing with achievement in mathematics, and a T-test was done to compare the French achievement scores of the two classes at the end of the year's investigation.

Major Findings

In this section the null hypotheses will be restated and the pertinent conclusions summarized below.

Hypothesis 1 - There is no significant difference in progress in computation skills between English-speaking students taking mathematics for one year in French and English-speaking students taking mathematics in English.

Test of hypotheses 1. No significant differences were found for the two groups on computation scores. Null hypothesis one was therefore accepted.

Discussion. Although the difference in scores between the two groups is not significant, there is a tendency for the experimental pupils to show higher achievement than the control pupils. The experimental pupils who took arithmetic in French performed better than the control pupils who took arithmetic in English.

Hypothesis 2 - There is no significant different in progress in concept learning between English-speaking students taking mathematics for one year in French and English-speaking students taking mathematics in English.

Test of hypothesis 2. The analysis of covariance showed a difference between the two groups significant at the .05 level. The null hypothesis was therefore rejected.

Discussion. The experimental class which took arithmetic in French

showed higher achievement in concept learning during the year than the control class which took arithmetic in English.

Hypothesis 3 - There is no significant difference in progress in mathematical problem solving between the English-speaking students taking mathematics for one year in French and the English-speaking students taking mathematics in English.

Test of Hypothesis 3. The analysis of covariance showed a significant difference at the .01 level. The null hypothesis was therefore rejected.

Discussion. The experimental class which took arithmetic in French did significantly better in problem solving than the control class which took arithmetic in English.

Hypothesis 4 - There is no significant difference in progress in overall achievement in mathematics between English-speaking students taking mathematics for one year in French and English-speaking students taking mathematics in English.

Test of Hypothesis 4. The analysis of covariance showed a significant difference between the two groups at the .02 level. The null hypothesis was therefore rejected.

Discussion. The results indicated that the experimental class which took arithmetic in French did significantly better on overall improvement in the mathematics skills than the control class which took arithmetic in English.

Hypothesis 5 - There is no significant difference in achievement in French between students who take twenty minutes of core French per school day for one year and students who take a combination of twenty minutes of core

French per school day and forty minutes of mathematics taught in French per school day for one year.

Test of Hypothesis 5. The T-test indicated a significant difference between the two groups beyond the .0005 level. Because of this significant difference between the two groups, null hypothesis 5 was rejected.

Discussion. The results show that the students who took twenty minutes of core French and forty minutes of arithmetic in French each day scored significantly higher on tests of French achievement than students who took only twenty minutes of core French per day.

II. CONCLUSIONS AND IMPLICATIONS

The statistical analysis of the data revealed that the pupils who took grade four mathematics in French showed greater improvement in mathematics skills than a grade four class in the same school which took grade four mathematics in English. The analysis revealed also that those who took a combination of mathematics in French and core French learned more French than did those who took mathematics in English and core French.

Computation Skills

In computation skills there was no significant difference between the two groups although the experimental class tended to score somewhat higher. This tendency may have been due to the length of time spent at the beginning of the year reviewing basic computation in addition, subtraction, multiplication, and division. More than a month was spent doing fundamental exercises in the four basic skills, with the purpose of teaching French numbers. There is little doubt however, that as the students were learning the French numbers they were also being exposed to a thorough review and reinforcement of basic number functions.

Concept Learning

In concept learning where the pupils who took mathematics in French performed better on the Metropolitan Arithmetic Test than those who took mathematics in English, the pupils taught in French may have done better because of a more careful teaching approach. Many new words and new concepts received

special attention in the French class. Because it was anticipated that the experimental pupils would have difficulty learning in the foreign language, great care was taken in introducing new words and new concepts.

Problem solving

In problem solving the experimental pupils also did significantly better than the control pupils. This may have been caused by the special attention given to problem solving by the teacher. It was soon evident that many problems in the text book involved too much unfamiliar vocabulary to be useful. Consequently, the problems were revised in order to make them simpler from the point of view of vocabulary, or, new problems were constructed by the teacher involving the same mathematical functions but using a simpler vocabulary. Problem solving sessions using the overhead projector became a popular classroom activity and the teacher regarded these sessions as being a unique opportunity to introduce new vocabulary items. An attempt was made to make the problems entertaining and relevant to the lives and activities of the pupils. A sample of an overhead transparency is included in the appendix.

Student Ability Factor

The pupils in the experimental class were better mathematics students initially than the pupils in the control class. Table 4.01 shows that the experimental class scored at a grade equivalency of 4.7 in computation skills on the pretest, while the control class scored at 4.3. For concept learning, table 4.03 shows that the experimental class began at 4.9 and the control class began at 4.2. For problem solving, table 4.05 shows that the experimental class began

at 5.4. and the control class began at 4.4. For total achievement in mathematics, the experimental class scored at the 4.9 grade level and the control class scored at the 4.3 grade level. The control class post test scores did not even reach the level of the experimental pretest scores except on the sub-test for computation skills. There is no doubt that the teacher of French mathematics had the advantage of working with better mathematics students.

If grade equivalency scores are used to show improvement in mathematics skills, the pupils of the experimental class showed greater improvement than the pupils of the control class on all sub-tests. The expected improvement in grade equivalency scores from September of one year to June of the following year is 0.9, each decimal point representing one month's progress in achievement. Table 4.01 shows that the experimental class has an improvement of 0.9 on computation skills and the control class an improvement of 0.4. For concept learning, table 4.03 shows the experimental class with an improvement of 0.7 and the control class with 0.5. For problem solving, table 4.05 shows the experimental class with an improvement of 1.0 and the control class with 0.3. For overall achievement in mathematics table 4.07 shows that the experimental class has an improvement score of 0.8 and the control class 0.4. Thus, the experimental class achieved more or less as expected whereas the control class achieved consistently more poorly than expected.

The fact that the control class did not achieve as well as expected may have been caused by several factors. The most obvious of these is that the

pupils of the control class were not as bright as those in an average class and an improvement of 0.9 was an unrealistic expectation. Another possible reason why the control class did not do well is that some of the pupils in this class may have been disappointed at not being selected for the experimental class and expressed their disappointment by making little effort to improve their mathematics skills - a reverse Hawthorne effect.

That the experimental class did not show a greater improvement score may have been a function of the test used. Several of the experimental pupils recorded nearly perfect scores on the pretest, leaving almost no room for improvement on the post test. This may have been avoided by using a test of greater difficulty but this would have penalized the poorer pupils. Also, grade equivalency scores are not always accurate at the extremes of the scale.

Teacher Factor and Hawthorne Effect

The teacher who taught mathematics in French and core French to both grade four classes had taught French for a number of years in high school but had never taught in an elementary school. The teacher who taught the mathematics in English was an experienced elementary school teacher. The teacher of mathematics in French did a lot of improvising with the mathematics course because it was being taught in French. This improvisation may have contributed to the better results made by the experimental class.

Although both classes took core French there was no control for the Hawthorne effect which may have been a factor in causing the superior perfor-

mance of the experimental class in mathematics. Parental attitude also may have been a factor.

Class Organization

The experimental children formed one grade four class and the control class children formed the other grade four class. Students who transferred into the school were placed with the control class because they chose to take mathematics in English. This caused the control class to become considerably larger than the experimental class. These new students often needed special attention by their teacher until they adjusted to the new school, peers, books, and routine. This placed an additional workload on the control class teacher which was not appreciated. The control class pupils tended to be less interested in school work generally than the experimental class pupils, and the control class teacher felt that this was another disadvantage to her. These factors may have contributed to the inferior performance by the control class. It would seem that a better grouping procedure would have been to divide the pupils into two classes heterogeneously and then re-group them for a special subject like mathematics in French.

Follow Up

During the school year 1975-76 French is offered at the grade four and grade five level at Riverview School. At the grade four level the French option consists of forty minutes of mathematics each day and a twenty-minute core

French class every second day of a six-day cycle. There is no core-only class. In grade five the French program for the first month consisted of forty minutes of mathematics per school day and thirty minutes of science taught in French every second day of a six-day cycle. The composition of the grade five class had changed to such an extent that only about half of these pupils had been enrolled in the previous year's partial immersion program. To the disappointment of these pupils, it was decided to abandon the teaching of science in French and concentrate on the teaching of mathematics. This class was re-scheduled to take daily mathematics in French and two half-hour periods of core French per six-day cycle. A student from the interprovincial second-language monitor program has been helpful in assisting new pupils to catch up to their peers in both grades four and five. It is planned to offer French at grades four, five, and six next year. Student evaluation in both mathematics and French is continuing. The heterogeneous grouping of students with re-grouping for mathematics appears to be working very satisfactorily.

Implications

This study has investigated the effectiveness of teaching a partial immersion French program on an optional basis as an alternative to a core French program. It was an introductory course in French taught to English speaking pupils in grade four. Test results indicated that the experimental class which took the partial immersion program did significantly better in

both mathematics and French than the control class which took mathematics in English and a core French program. However, since there was a lack of controls in this investigation it has not been possible to imply that English speaking pupils who are taught mathematics in French will do better than English speaking pupils who are taught the same program in English. The only implication resulting from this investigation is that grade four pupils who take an introductory course in French consisting of forty minutes of mathematics and twenty minutes of French language per school day will likely learn more French than pupils who take only an introductory program in French consisting of twenty minutes of French language per school day and, it is unlikely that such pupils will show a significant retardation in development of mathematical skills.

In spite of its experimental shortcomings, this investigation offers support to the idea that a partial immersion program in French is a viable and promising alternative to the twenty-minute core French program for average or above average English-speaking Manitoba students whose parents favour French instruction in the school.

III. SUGGESTIONS FOR FURTHER RESEARCH

This investigation indicated that grade four pupils in a class which took a combination of core French and mathematics in French learned more French than grade four pupils in a class which took core French and mathematics in

English. This was not a surprising result because the former class was exposed to French for one hour each school day while the latter class was exposed to only twenty minutes per school day. Many researchers have pointed out that the amount of time spent in learning and practicing a second language is an important factor in increasing proficiency in the language studied. This approach to teaching French was effective at teaching listening comprehension, but not very effective at teaching the speaking skills. This observation exposes a number of questions unanswered by the research. What is the relationship between listening skills and speaking skills? Should listening be taught prior to practice in speaking? If so, at what point should the speaking skills be taught? In what proportion? Are children more disposed at a certain age to attempt to speak a new language?

It is surprising to find that the pupils taught mathematics in French progressed more quickly than pupils taught mathematics in English. More research should be carried out to determine the validity of this finding. It may be that the use of French per se in teaching mathematics was not the factor which caused the superior performance. Rather, it may have been that the techniques required to teach mathematics in French were the causes of the superior performance.

The reasons for introducing this program at the grade four level are given in length in chapter three. Circumstances may be appropriate in another school to begin a similar program at an earlier or later grade. It might be

useful to compare the results of such a project with the results of this investigation.

The problem of controls is one of the most difficult in an experiment of this kind. Control for the Hawthorne effect might be achieved by offering an alternate mathematics program such as Project Mathematics to the control class. In a school where there are only sufficient pupils for two grade four classes, the control class may be composed of less capable students. To avoid this situation, the control class might be from a neighbouring or comparable school where a program such as Project Mathematics might be introduced on an optional basis. It would be preferable to use persons other than the researchers to implement the programs to avoid the possibility of research bias.

Finally, there is a need for research into the suitability of materials for partial immersion programs, and into the preparation of teachers.

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APPENDIX A

GRADE IV ORAL RESPONSE TEST

Ten questions were given to each student in the experimental class and the control class. The ten questions are given below. The questions or statements in parentheses which follow each of the questions were used for assistance so that students might earn partial marks for a question they did not at first understand. The marking criterion is provided below.

1. QUESTION: Bonjour, ca va? (Comment vas-tu?)

EXPECTED ANSWER: Bonjour, ca va, or, Je vais bien, merci.

2. QUESTION: Comment t'appelles-tu? (Je m'appelle monsieur . . .)

EXPECTED ANSWER: Je m'appelle . . .

3. QUESTION: Quel âge as-tu? (Tu as six ans?)

EXPECTED ANSWER: J'ai neuf (dix) ans.

4. QUESTION: Quelle heure est-il? (Il est midi?)

EXPECTED ANSWER: Il est dix heures et demie.

5. QUESTION: Quelle est la date aujourd'hui? (La date de Noël est le 25 décembre.)

EXPECTED ANSWER: (C'est) le 23 juin.

6. QUESTION: Quel est ton numéro de téléphone? (Tu as un téléphone, n'est-ce pas?)

EXPECTED ANSWER: sept-deux-sept . . .

7. QUESTION: Comment vas-tu à l'école? (Moi, je vais à l'école en voiture.)

EXPECTED ANSWER: (Je vais à l'école) à pied, or, à bicyclette.

8. QUESTION: Quelle couleur sont les feuilles sur les arbres? (Le ciel est bleu.)

EXPECTED ANSWER: (Les feuilles, or Elles sont) vertes, or, brunes, or, jaunes.

9. QUESTION: Comment s'appellent ces gens qui habitent le pôle nord? (Par exemple, la famille d'Apoutsiak.)

EXPECTED ANSWER: (Ils s'appellent) les esquimaux, or, la famille du père Noel.

10. QUESTION: Comment s'appelle un animal qui chasse les lapins et les lièvres? (dans la chanson: "Cadet Roussele.")

EXPECTED ANSWER: (Cet animal, or Il s'appelle) un chien.

Marking Criterion

Three marks - For an answer indicating comprehension of the question spoken in French that can be understood.

Two marks - As above but after the question has been repeated.

One mark - As above but after the assisting question or statement has been given, and the question repeated for the second time.

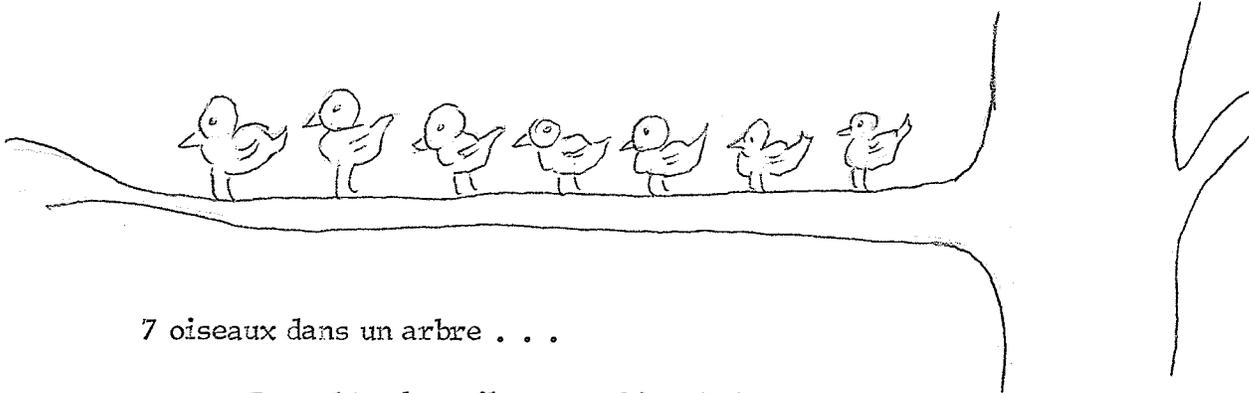
No marks - For no answer, or an answer given in English, or an incomprehensible answer.

Marking Procedure

Each of the three markers were instructed to listen to the tape recorded answers, and using the above criterion, assign each student a mark for each question. Each student then had three total marks. These were averaged to obtain his final oral response test mark.

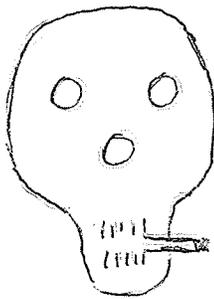
APPENDIX B

Example of a transparency designed to assist the teaching of
Problem Solving in French



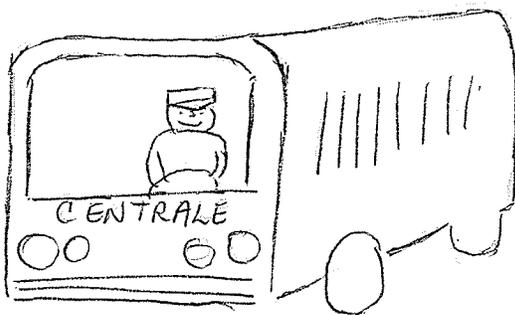
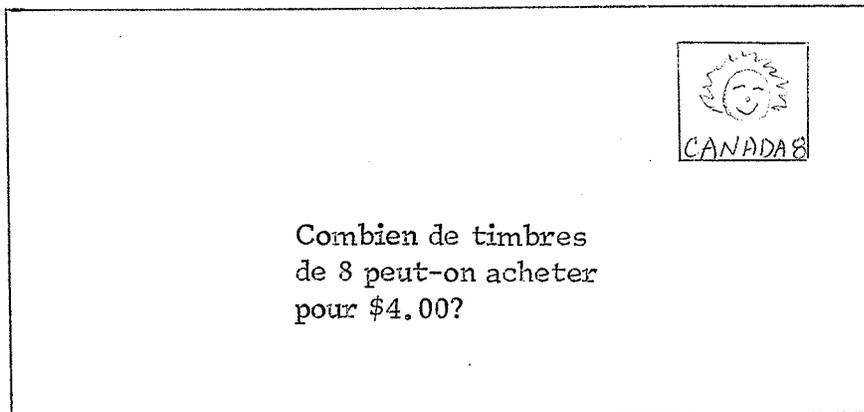
7 oiseaux dans un arbre . . .

Dans 15 arbres il y a combien d'oiseaux?



Jean Le Cancer fume 32 cigarettes
par jour.

Combien en fume-t-il dans une semaine?



Il y a 48 filles dans un autobus.

Combien de filles y a-t-il dans 5 autobus?