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THE UNIVERSITY OF ALBERTA

AVAILABILITY AND REQUIREMENTS FOR TEACHERS IN ALBERTA: 1971-1981

by

© DONALD MARCUS RICHARDS

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Availability and Requirements for Teachers in Alberta: 1971-1981" submitted by Donald Marcus Richards in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

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ABSTRACT

The projections of the demand for teachers in Alberta were developed through a social demand approach. By examining past trends and making alternate assumptions about birth rates, death rates, attendance rates, and pupil-teacher ratios, three sets of projections of the demand for teachers were produced.

The projection of the supply of teachers in Alberta was attempted in order to examine the available manpower in education in relation to the projected demand. The supply model was based on cohort survival and consideration of exit and entry. By examining past conditions and making alternate assumptions regarding the exit and entry variables, it was possible to produce three sets of projections of teacher supply.

The projections of the demand for teachers at various levels indicated the possibility of a slightly increasing demand for elementary school teachers, a slightly increasing demand for junior high school teachers, and a moderately increasing demand for high school teachers.

Similarily the projections of the demand for high school specialists indicated an increase in the demand for teachers in all specialties.

The projection of the total supply of teachers indicated a probable slightly increasing total supply. The projection of teacher supply by level indicated a possible slight decrease in the supply of

elementary school teachers, at least a steady supply of junior high school teachers, and a slightly increasing supply of high school teachers.

In terms of high school specialists, a steady or slightly decreasing supply was projected for teachers of mathematics and science, commercial and industrial arts. An increasing supply was projected for high school teachers of English and social studies, languages, fine arts, physical education, home economics, and trades and technical.

In terms of the total teaching force, an excessive supply of teachers probably will obtain until at least 1974-75. In the years 1975-76 to 1980-81 the possibility of a perfect balance or even slightly excessive demand exists.

The projections of the supply of and demand for teachers at various levels indicated no excessive supply of elementary school teachers. In fact, a possibility of an excessive demand of elementary school teachers was in evidence. A continuing excessive supply of both junior high school teachers and high school teachers appeared almost certain.

The supply and demand for various high school specialists was also examined. A definite, continuing, excessive supply of high school teachers of English and social studies, fine arts, physical education, and home economics was indicated. An excessive demand over the period 1971-72 through 1978-79 followed by a possible balance in 1979-80 and 1980-81 was indicated for commercial teachers.

ACKNOWLEDGEMENTS

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THE STUDY

A great deal of work has been done in the field of educational planning. Much of this work has dealt with the educational systems of developing countries, perhaps because the solutions of the educational problems in the developing countries were considered central to more rapid economic growth of those countries. Recently educators and economists have recognized that, although education contributes to economic growth, some of the economic resources must be utilized in developing and maintaining the educational system (1, p. 90-91). With this concept in mind, educational planning becomes nearly as important in developed as in developing countries. That is, in any country, developed or undeveloped, a description of the future of the educational system becomes a valuable part of the overall economic plan for that country (2, p. 138).

In order to predict the future of the educational system of an area, it is necessary to examine the past development of the educational system and predict the future on the basis of certain trends that appear. The forecasts that result from such studies are accurate only to the extent that the trends continue as predicted. If new trends appear then the forecasts tend to be in error. For this reason, the assumptions that are made in educational planning become very important.

Kaplan suggests that the problem of prediction may be simplified by distinguishing between presuppositions and assumptions (3, p. 86-89).

Further, he suggests that the assumptions should be tested for effect (3, p. 88). With this concept in mind, forecasts about the future of education can be composed of a series of predictions using alternate assumptions regarding the continuation of trends.

Even some of the more recent educational planning studies have avoided extensive use of alternate assumptions due to the lack of resources (5, p. xvi). However, with the use of computers and mathematical educational planning models, it becomes entirely possible to design an educational planning model such that alternate assumptions regarding the future trends in relevant variables may be tested for effect.

Admittedly, it would be very desirable to construct a computable model of the educational system for all of Canada, however, the resources required for such an undertaking are greater than those usually available for a single study. Even the development of a computable model of the Alberta school system was beyond the limited resources available for the present study; however a study of the demand for teachers in Alberta was considered both significant for educational planning and within available means.

Thus, the thrust of the study was the development of models, using alternate assumptions about trends in relevant variables, to predict the demand for teachers in Alberta.

THE PROBLEM

The problem of this study was composed of two main parts:

1. To develop an educational planning model to predict the demand for teachers through the school years 1971-72 through

1980-81.

2. To illustrate the utility of the projections of teacher demand through the use of a teacher supply model.

It should be noted that the main thrust of the study was the demand model, with the supply model added mainly as an illustration of the application of teacher demand data.

Sub-problems

A number of sub-problems were examined in the development of the models and in the ensuing projections.

Age-specific birth rates. There appear in the data trends in the age-specific birth rates. If it was possible to justify assumptions about the trends in these rates, the assumptions were tested for effect on the teacher demand.

Age-sex-specific death rates. If trends appeared in the death rate data, justifiable alternate assumptions about these trends were tested for effect in the teacher demand model.

Pupil-teacher ratios. Certain trends have appeared in the pupil-teacher ratios in recent years. These trends were subjected to further investigation and tested for effect in the teacher demand model.

Testing the Demand Model

Since a major portion of the input data in the demand model was obtained from two consecutive decennial census, the model was tested for accuracy. That is, although the final projections of teacher demand were to be based on 1961 and 1966 densus data, 1951 and 1956 census data were input and the resulting projections compared with the teacher demand that obtained in the school years 1961-62 through 1970-71.

Supply Model

The development of the supply model and the formulation of projections of teacher supply in Alberta were attempted mainly to determine under what conditions teacher supply would meet or exceed teacher demand.

SIGNIFICANCE OF THE STUDY

There are two different ways in which this study is of significance. First of all, the methodology used in this study may serve as a model for similar studies in other provinces in Canada as well as a basis for the development of other computable models in educational planning. Secondly, the predictions of the demand for teachers in Alberta serve as indications of the future conditions in the labour market for teachers in Alberta.

Essentially the same methodology that was used in this study could be used in other provinces in Canada since most of the same data are also available in the other provinces. Furthermore, a major part of the model used to predict the demand for teachers in this study may be used as a basis for a computable model of the entire Alberta educational system.

As to the predictions of demand for teachers, if the labour market is left with the task of providing teachers for a changing education system, there is a chance of over-supply or under-supply of teachers for that system. Thonstad states this very clearly when he says:

> One of the reasons for the frequent lack of equality of supply and demand for educated people (and for the fluctuations in the incomes of some categories) is the very long time lag between an observed scarcity of a given type of educated person and the point of time when an additional supply of this type has eventually completed the educational process. By that time, the skill may no longer be scarce. We may, in fact, observe a cobweb-like fluctuation in markets for educated people. One cannot, therefore, rely upon the 'free market mechanism' to operate satisfactorily (4, pp. 1-2).

It is also possible that if the length of time required to train teachers is increased, because of the increased time lag in the market the size of the fluctuations in the supply and demand of teachers could be accentuated.

Because the predictions of this study were based on available collected data and present trends, the first predictions--perhaps the predictions of the demand for teachers for the school years 1971-72 through 1975-76--should be relatively accurate predictions of the conditions that will exist in education in those years. However, trends will undoubtedly change and thus the later predictions will be somewhat less accurate.

To overcome the problem of the decreasing accuracy of the later part of the study, new trends could be accounted for as they occur. Furthermore, because much of the data that was used in this study will be compiled periodically, it will be possible to revise and extend the predictions periodically.

DEFINITIONS

Although a full discussion of each major term used in the study will be provided at an appropriate place, brief definitions of some of the more commonly used terms are set out below.

Alberta school system. All of those schools, public and separate, that serve, in whole or in part, to provide students with an education from grades one through twelve.

Demand for teachers. The number of teachers required by the Alberta school system, classified according to particular types.

Supply of teachers. The number of teachers available to teach in the Alberta school system, classified according to particular types.

Computer-based model. An algorithm based on selected characteristics of a real situation which, when provided with prior conditions and situational factors, predicts future conditions and situations.

PRESUPPOSITIONS

Although a number of alternate assumptions are proposed and tested for effect in the study, two of the presuppositions necessary for the study are set out below.

1. It was presupposed that regularities exist in the growth of a population that allow future predictions to be made with some degree of accuracy.

2. It was presupposed that major economic, political, or social changes of a precipitous nature cannot be predicted and therefore the effects of such changes on the supply and demand of teachers cannot be predicted.

3. It was assumed that legislation and regulations would not change such as to bring about major changes with respect to attendance or instructional patterns in Alberta schools.

LIMITATIONS

The data for this study were directly related to conditions or situations in Alberta. For this reason, the predictions will be applicable only to the Alberta school system.

Where complete data were unavailable, best estimates based on incomplete data were used and produced minor inaccuracies in the predictions. Where data were so incomplete that estimates were subject to major inaccuracies, the effect of alternate assumptions was tested.

Classifications of teachers according to types were based on the existing teaching force. No attempt was made to account for any new classifications of teachers which may develop in the future.

DELIMITATIONS

The study was delimited to the demand for teachers created by the public and separate schools in Alberta since private schools in Alberta have no defined attendance area and are thus not confined to a geographic region.

The study was delimited to a prediction of the demand for teachers in Alberta for each of the school years 1971-72 through 1980-81.

OVERVIEW

The thesis is composed of eight chapters. Chapter I consists of a general introduction to a major problem of the study. Chapter 2 and Chapter 3 review the relevant literature and research on educational planning. Chapter 2 deals with the general models of educational planning including manpower planning, social demand, and rate of return. Chapter 3 deals with particular kinds of social demand planning including enrolment projections and demographic projections.

The next two chapters are concerned with the research design and the data of this study. Chapter 4 outlines the details of the research design. Chapter 5 contains summaries and tabulations of the data used in this study. It should be noted that some of the data, summarized in Chapter 5, are dealt with in detail in the Appendix.

The last three chapters present the results and conclusions of the study. Chapter 6 is composed of the results of the tests of the the teacher demand model as well as the projections of teacher demand. Chapter 7 is an attempt to illustrate the possible teacher supply and to compare the supply to demand. The last chapter, Chapter 8, contains the summary, implications, and conclusions.

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Chapter 2

EDUCATIONAL PLANNING

An acceptance of the fact that education, as a part of the entire social and economic system, must compete with other goods and services for scarce resources leads to the asking of several questions about education. Questions such as (1) "How much education should be provided?"; (2) "Which persons should be educated?"; (3) "How should education be conducted?"; and (4) "When should education be provided?". Educational planning is essentially the process by which attempts are made to answer questions such as those above.

It should also be pointed out that educational planning is accomplished while maintaining a relatively long future orientation. That is, the educational planner attempts to answer the question of how much, for whom, how, and when for a period in the future rather than in the present. This future orientation can be understood by consideration of the rather long process time in education and the resulting lead-time necessary to accomplish a change in the product.

Educational planners have used a variety of methods to accomplish their purposes. Blaug has classified the methods of educational planning and has pointed out some of the resulting problems. He states:

> Consider the curious predicament of an educational planner who consults the fast-growing literature on the economics of education for guidance in making policy decisions. On the one hand, he is told to gear the expansion of the educational system to the quantitative forecasts of the demand for highly qualified manpower. On

the other hand, he is urged to project what is called "the social demand" for education, that is, the private consumers' demand, and to provide facilities accordingly. Finally, he is furnished with calculations of the rate of return on investment in education and advised to supply just enough schooling to equalize the yield of investment in human capital with the yield of investment in physical capital (2, p. 262).

The purpose of this chapter is to explain the various general approaches to educational planning and to point out the strengths and limitations of each.

MANPOWER PLANNING

Manpower planning is the process of determining the future distribution and utilization of labour by economic sector, region, and industry. The forecasts are based generally upon a statement of goals for the economy for the period specified, an analysis of the resources necessary for the achievement of these goals, and an awareness of the implications of the analysis of resources for manpower needs.

The Technique

Although any specific manpower study may differ slightly from the general model, the steps in manpower planning as set out by O'Donoghue are

1. A projection of the level of output in the target years.
2. A projection of the level of output per worker in the target years.
3. A projection. . .of the total number of workers in the target years.
4. A break-down of the total number of workers into component occupational groups.
5. A projection of the educational level appropriate to each occupation (7, p. 58).

As the procedure for manpower planning indicates, the approach is based on a selected level of future development with human resources considered among other resources as the way of accomplishing the future goal. This approach and the underlying assumptions are responsible for some of the limitations of the manpower approach.

Disadvantages of Manpower Planning

In order to determine the manpower requirement of an economic system, general goals must be established. These goals are usually summarized into a specific level of Gross National Product. However, specific goals of each industry are seldom set and if they are set, they may be set with little or no consideration given to consumer demand. A rigid adherence to manpower planning would result in an economic system in which individual choice of goods or services would become subservient to economic goals. Even if the goals could be agreed upon in realistic terms, the assumptions of manpower planning produces some limitations.

Blaug states the assumptions of manpower planning as follows:

1. Students acquire education for non-economic reasons.
2. Students choose major subjects in ignorance of, or with no regard for, career prospects.
3. All education is 'specialized education' and specialization starts at entry.
4. All input coefficients in the education system are fixed; complete indivisibility and specificity of teachers, plant, and equipment.
5. The demand curves for separate skills shift discretely.
6. Zero elasticities of substitution between skilled men and zero elasticities of transferability between jobs.
7. Zero elasticity of demand for all separate skills (1, p. 180).

Obviously, the above assumptions are not an accurate description of the educational system and the labour market. Students do exhibit some intelligence in the selection of their education. The education system is somewhat flexible, and the labour market allows for substitutability to some degree. It should be pointed out that, although these assumptions are not true, their opposites are not true either.

Further limitations of manpower planning arise from attempts to apply the process. That is, after having established the goals and accepted the assumptions, the manpower requirements are still to be estimated. This can be accomplished by one or more of several ways--extrapolating past demands, adopting the labour output of more advanced countries, adopting the labour output of more advanced sectors, or asking employers. Obviously, even a combination of the four methods leaves much to be desired because the changes in technology may produce occupations not yet heard of and thus not predictable through manpower planning.

Advantages of Manpower Planning

Even with consideration of the limitations of manpower planning, the process can produce worthwhile results. Given a manpower plan for the total economy or a particular sector, an estimate of the validity of the growth objectives may be obtained.

For example, if an underdeveloped country has available to it natural resources and capital then its economic growth will be constrained by human resources. Establishing a manpower plan may provide an estimate of the degree to which resources must be channelled into education in order to achieve a specific level of economic growth. If manpower planning is applied to a labour intensive sector of the economy, the indication of the labour needed may prevent a vast over-supply or under-supply of qualified people.

Conclusion

The strengths and limitations of manpower planning are such as to make it useful in educational planning but it should not be the only method used to guide change in the educational system.

SOCIAL DEMAND

The social demand approach to educational planning is perhaps the least discussed and most commonly used technique for educational planning. The aim of this technique is to predict the amount and kind of education that will be required by the exercise of choice by individuals.

The Technique

Although there have been many general modifications in the general technique as it has been applied, the following constitutes a general procedure:

1. estimate the number of persons who have a right to education (5, p. 9).
2. estimate the levels of education that will be demanded--based on past trends.
3. estimate the amount of specialized education that will be demanded--based on past trends.
4. relate step 1 to steps 2 and 3 to obtain an estimate of the demands on the educational system.

Obviously, the social demand approach to educational planning is based on individual choice as long as the aggregate demand does not change over time.

Limitations of Social Demand

The main disadvantage of the social demand approach results from the use of past aggregate demand to predict the future demand.

As Parnes suggests, both the past choices regarding education and the future choices regarding education, by individuals are affected by a host of costs to the student (d, p. 25). Included in these costs are such things as tuition fees, availability of scholarships, foregone income, and future job placement. Furthermore, each of these factors may change from time to time and thus influence the individual demand. The fluctuations in individual demand may produce fluctuations in aggregate demand.

It should also be mentioned that, with the exception of planning for universal literacy, social demand has little to do with economic targets. No consideration is ever given to growth in G.N.P. in setting objectives through the social demand approach. For this reason perhaps, social demand is often looked upon with disfavor by economists.

Strengths of Social Demand

The social demand approach to educational planning has the advantage of accuracy when applied to compulsory or basic education. If legislation or the realities of the labour market force students to obtain a certain level of basic education, then the demand on the educational system depends only upon the number of clients. Since the relationship between demand for education and the number of persons is presupposed in the social demand approach, it is entirely appropriate at this level.

Conclusion

The social demand approach is an appropriate predictor of the demand for basic education but is not appropriate when applied to specialized advanced education.

RATE OF RETURN

The rate of return approach to educational planning appears to be the most acceptable sophisticated approach to planning for specialized education in free market economies. This approach uses estimates of increased earning power as well as costs of education in an investment model.

The Technique

There are really two basic techniques involved with the rate of return approach. Which technique is used depends upon whether the rate of return is calculated in terms of public or private investment.

According to Blaug the rate of return to public investment may be calculated as follows:

> Here we start with a cross-tabulation of the labour force by age, education, and earnings before and after tax. From these we construct age-earning profiles by years of schooling, that is, we use cross section data to project lifetime earnings associated with additional education. It is convenient to treat the costs of education as merely negative earnings, with the result that we can proceed immediately to calculate the present value of the net earning differentials associated with extra education at different discount rates (2, p. 267).

The approach used to calculate the returns to individuals, which is usually used in determining the demand for higher specialized education is as follows:

1. Estimate the total cost to the individual including foregone earnings and direct costs such as tuition fees, books, etc. (6, p. 487).
2. Estimate the returns to education through age-income profiles of earnings (6, p. 487).
3. Relate the costs and benefits through internal rate of return or present value analysis.

The rate of return approaches treat education as investment. The analysis proceeds from the cost of the education to the returns from education. In general, the only implicit cost that is taken into consideration is the foregone income; no implicit benefits are usually considered directly.

Limitations of Rate of Return

Attempts to apply the rate of return approach have been criticized for various reasons. Weisbrod claims that returns such as prestige, power, satisfaction, and other psychic returns have not been considered (9, p. 17). Clark suggests that the average aggregate cost is not representative of individual cost (4, p. 16). Bowman identifies the problems associated with cross-sectional data and spill-over effects (3, p. 652). Regardless of the problems encountered in applying the rate of return technique the concept itself is invalid to some extent.

It is assumed in the rate of return approach that a high rate of return indicates a high demand. With negotiated salary scales, the high rate of return may indicate a high degree of success by labour negotiators rather than demand. Also, a certain circularity exists. High level manpower often argues for high pay on the basis of a fair return for their time and money invested in training. Naturally, when this rate of return is measured it is found to be high.

It should also be mentioned that the exclusive use of rate of return planning methods would lead to students and governments reacting to rates of return and thus create cobweb markets of manpower.

Strengths of Rate of Return

Regardless of all of the disadvantages of the rate of return approach, it is useful for governments to have some indication of the return on money invested in education. This information, combined with other information can be used in political decision-making.

Conclusion

The rate of return approach suffers from conceptual and practical problems such that it may not provide accurate indications of demand. For this reason if only one approach to education planning could be used, the rate of return approach is probably the least desirable.

SUMMARY AND CONCLUSIONS

Three general approaches to educational planning have been identified; these approaches are manpower planning, social demand, and rate of return.

All three planning models have limitations and strengths. The manpower planning approach is difficult to use to obtain valid estimates of manpower demand. The social demand approach does not take into account economic goals. The rate of return approach does not account for some costs and some benefits and may not be a valid indicator of demand. Manpower planning has the advantage of focussing on economic goals while social demand is a good predictor of the demand for basic education. Rate of return indicates the degree to which education is an investment.

Because each of the approaches has serious limitations the technique to be used depends upon the level of education to be planned and the nature of the decisions to be made by the planners.

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Chapter 3

RELATED RESEARCH

This study is unique in its approach to the analysis of the supply and demand of teachers in Alberta; there exist no major studies in Alberta whose approaches are directly related to that of this study. While studies which involve enrolment projections are relevant to the prediction of the demand for teachers, few available studies are of direct relevance to the prediction of the supply of teachers in Alberta.

ENROLMENT PROJECTIONS

Many different kinds of enrolment projections have been used in educational planning. Rather than attempt to provide a full review of the research, the vast number of prior studies are subsumed under two broad categories. The relevant studies, then, are classified as either flow models or demographic models of enrolment projection.

FLOW MODELS OF ENROLMENT PROJECTION

The main characteristic of the flow models of enrolment projection is their basis in the movement of students through a school system. The projections tend to proceed through an analysis of the flow of student cohorts through the various levels. Rates of promotion, repetition, and retention are considered in calculating future enrolments.

Flow models have been used by Thonstad in a study of the

Norwegian education system (15), by Brown and Savage in a study of an American university (2), by Correa in a study of the Dutch education system (4), by Moser and Redfern (10), Armatage and Smith (1), and Stone (14) in studies of the British education system. Admittedly, there are some variations among the studies mentioned above, however, all of the flow model studies suffer from some of the same limitations.

There appear to be two main limitations of the flow models of enrolment projection. First of all, the model does not account for changing transition ratios such as retention ratios, promotion ratios, and repetition ratios. The second problem is that the flow model is based on the movement of students through a school system and is thus an attempt to simulate the processes of that system. Any major changes in the processes which affect the flow patterns of students through the system will invalidate the projections.

To overcome the problem of the process-specific model, demographic projections of student populations have been used.

DEMOGRAPHIC MODELS OF ENROLMENT PROJECTION

The main characteristic of the demographic models of enrolment projection is that the numbers of various ages of school students is predicted from a projection of the entire population. That is, the structure of the entire population is predicted from available data. Then, using attendance ratios, the structure of the school-aged population is projected. The demographic models of enrolment projection tend to vary largely according to the kinds of data that are available to the planners.

Demographic enrolment projections have been used by UNESCO in Columbia, the Philippines, and the Sudan (16). Also, UNESCO has reported on studies, using this technique, which were completed in the United States and France (16). The Economic Council of Canada has also done a demographic enrolment projection using census data (6).

It is interesting to note that the demographic enrolment projection model can be applied to regional or sub-national areas such as was the case in the Economic Council's study (6) and in Hanson's study (8).

Thus, where data are available, the demographic projection of enrolment would appear to be an advantageous technique to use in predicting the demand for teachers in an area. This still leaves the problem of selecting from among the several available demographic projection techniques in order to predict the structure of the population of an area.

DEMOGRAPHIC PROJECTIONS

The many demographic projections which have been done in the past can be included under six basic categories: stages of development models, capacity of area models, mathematical growth models, components of change models, cohort-survival models, and parity progression models (16).

Each of the particular models of demographic projection has certain advantages and disadvantages. The model that appears to be most advantageous for use in this study is the cohort-survival model. This model provides reasonably accurate predictions from available census and vital statistics data and can be applied to a sub-national region (11, p. 6).

Schmid et al describe the cohort-survival technique as follows:

> The cohort-survival method, on the other hand, has been found to be very effective in estimating future populations precisely. This procedure assumes the availability of reliable, detailed, historical data concerning age- and sex-specific base population, age- and sex-specific mortality trends, age-specific fertility trends, and age- and sex-specific net migration trends. Increasingly, data in this detail are becoming available for small geographic and political subdivisions in both the United States and other industrialized areas of the world.
>
> Within the cohort-survival framework, the three components of population change--fertility, mortality, and net migration--are projected independently according to pre-established, detailed assumptions. On the basis of historical trends, high and low projections are derived for each of the three components (13, p. 1).

The prediction for the demand for teachers in Alberta was based on the prediction of school enrolments calculated with a cohort-survival demographic projection model.

THE ALBERTA TEACHING FORCE

Studies of teachers in Alberta have concentrated on characteristics of the teaching force as it exists in any given year. Little research has been done on changes in the teaching force over time. However, some of the data compiled by the Alberta Teachers' Association (3, 12), The University of Alberta's Faculty of Education (7), the Alberta Department of Education (5), and the Alberta Advisory Committee on Educational Studies (9) will be useful in isolating certain trends in the supply of teachers. The model to be used in predicting the future supply of teachers arises out of an examination of the exit and entry patterns of the teaching force rather than out of any of the previous studies.

CONCLUSIONS

The literature suggests that school enrolments may be predicted from a larger demographic projection and that sufficient data are available to make use of the cohort-survival model of demographic projection. Furthermore, it has been suggested that the cohort-survival model may be applied to a sub-national region. Thus accurate data may be obtained from which the demand for teachers may be calculated.

As to the problem of teacher supply, the limited nature of previous research provides little insight. For this reason, it appears as though the teacher supply projection of this proposed study will be of a more exploratory nature.

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Chapter 4

RESEARCH DESIGN

Although some computer-based models have been used in educational planning, the models tend to have little generalizability across educational systems. This can be explained in part by the differences among educational systems, however many differences occur because of the nature of data available to the model-builder. Since two separate computer-based models were used in this study this chapter is composed of two somewhat different sections.

One of the advantages of a computer-based model is that it allows alternate assumptions regarding various factors to be tested for effect. For this reason, this chapter is an attempt to outline, briefly, the design of each of the computer-based models as well as to describe the means that were used to arrive at the alternate assumptions of each of the variables.

TEACHERS REQUIRED

The projection of the number of teachers required was based on social demand. For this reason, the model was largely a population projection model.

The Model for Teacher Demand

As outlined in Figure 1, the model was designed to read in the first population matrix as well as age-specific birth rates and age and sex-specific death rates. From these data, the model calculated a natural population matrix for the end of a five-year period. That is, it calculated the population that would have obtained if net migration had been zero. At this point, the true population matrix was read in and compared to the natural population matrix. The differences between the two were used to calculate the age and sex-specific migration rates. It is at this point that the projections of populations began.

The technique of achieving the population projections was designed in such a way as to allow the maximum input of various parameters. Thus in each year, a new set of birth rates and death rates were used. These new rates as well as the age and sex-specific migration rates were used to calculate a new population matrix. This matrix was then used to predict the number of students of various ages.

A calculation was built into the model which disaggregated the five-year age groupings of the population matrix to yield a matrix of one-year groupings of schoolage persons. This matrix was the major predictor of the number and types of teachers required.

A set of parameters, basically pupil-teacher ratios, relating the number of different types of teachers to the student population matrix were input into the model. This set of parameters was used to calculate the projected number of teachers required.

It should be noted that the above model was designed to allow a large number of the parameters to be changed. This is to facilitate

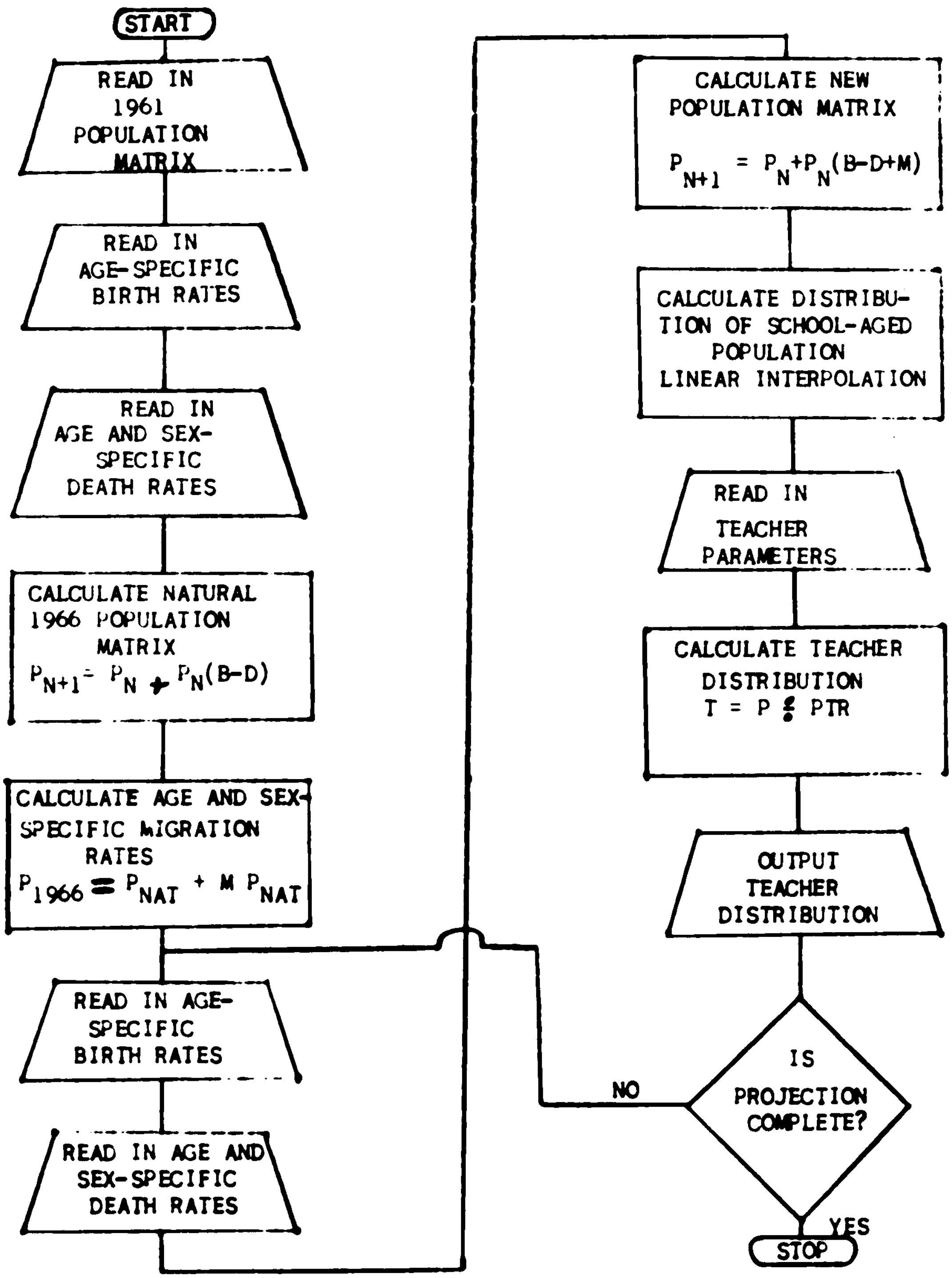

FIGURE 1

GROSS FLOW CHART OF THE TEACHER DEMAND MODEL

the testing of the effect of various trends that might appear in the parameters.

Trends in Input Parameters

Since the computer-based model was little more than a set of mathematical rules to interact among various input data, the nature of the input data took on a great deal of importance. Thus trends that exist in various input data were analyzed and tested for effect on the demand for teachers.

Age-specific birth rates. Much of the recent literature on school enrolments has contained speculation as to the effect on changing birth rates. It appears that there can be no doubt that changing birth rates can have some effect on school enrolments. The problem of dealing adequately with this phenomenon is to find out what changes are occurring in the birth rates and what effect these changes will have if the various trends continue.

The age-specific birth rates for Alberta were compiled from the Annual Reports of the Department of Public Health and Vital Statistics Division for the years 1951 through 1967 (3). These birth rates were analyzed for trends. Alternate assumptions were then made regarding continuation of the trends in the future.

The use of the alternate assumptions of trends in the future allowed several series of age-specific birth rates to be constructed, input into the computer model, and analyzed for their effects on the requirements for teachers.

Age and sex-specific death rates. It is unlikely that changes in the general mortality rate would have any great effect on school enrolments. However, any significant changes in infant mortality rates could have some impact on future school enrolments.

The age and sex-specific mortality rates for Alberta were compiled from the Annual Report of the Department of Public Health and Division of Vital Statistics for the years 1951 through 1967 (3). Where significant trends in these rates appeared, alternate assumptions were made and tested for effect.

Teacher pupil parameters. The use of the social demand approach to the determination of the number of teachers required presupposes that the number of teachers is related to the number of students. In some of the past studies, a gross pupil-teacher ratio has been used. However, as teachers become more highly specialized, the gross pupil-teacher ratio becomes less satisfactory as a predictor. Thus there was a need for a set of more suitable parameters.

The Economic Council of Canada has attempted to relate the number of teachers to the number of pupils and account for teacher specialization by using separate pupil-teacher ratios for elementary and secondary schools (1, p. 134). Furthermore, the Alberta Teachers' Association has reported data such that details are presented regarding the total number of teachers employed at three levels of the school system--elementary, junior high, and high school (4, p. 20). These data combined with detailed enrolments by ages for each level, as reported by the Department of Education (2, p. 199) facilitated the compilation of a pupil-teacher ratio for each of elementary, junior high school, and high school. Thus the problem of specialization of the teaching function by level was overcome in part. However, the problem of subject specialization, particularly in the high school, still existed.

The A.T.A. attempted to classify teachers according to a set of specializations but their classifications were not particularly useful since over eighty-five per cent of the teachers were classified in the category "Not Applicable" (4, p. 34).

Assuming that teachers have some competence in areas peripheral to their specialty and assuming that schools have some flexibility in selection of subjects to be offered, a classification system of nine broad categories of specialty included all high school teachers. The categories were mathematics and science, English and social studies, languages, fine arts, physical education, commercial, industrial arts, home economics, and trades and technical. The data to compile the number of teachers in each of these categories were available from the Department of Education. Also, the demand for special education instructors for each level was projected.

Thus, from available data, thirteen pupil-teacher ratios were used to relate the number of teachers to the number of pupils.

TEACHERS AVAILABLE

The prediction of the number of the various types of teachers available in Alberta was based on predicted entry to and exit from the present teaching force. Thus, the model was based on an analysis of trends in entry to and exit from the teaching force. This model provided an illustration of the utility of the teacher demand model by showing the way in which particular policies may create a mismatch between supply and demand.

The Model for Teacher Supply

As outlined in Figure 2, the prediction of the supply of teachers in Alberta was based on cohort survival of the present teaching force. Projections were completed essentially by updating the age-specialty matrix of the teaching force to account for Alberta trained teachers, immigrant teachers, emigrant teachers, retirement, and teachers leaving the teaching force for other reasons.

The teacher supply model was designed to allow a considerable number of parameters to be input into the model and used in the projections. For each year of the projections, a new matrix of the number of Alberta trained teachers and a new matrix of immigrant teachers were used. Also, a matrix of extraordinary exit from the teaching force were used in some years of the projections. Thus, variations in entry to or exit from the teaching force were taken into account.

Trends in input variables. The rationale for allowing variations in the input data is to test the effect on the teacher supply

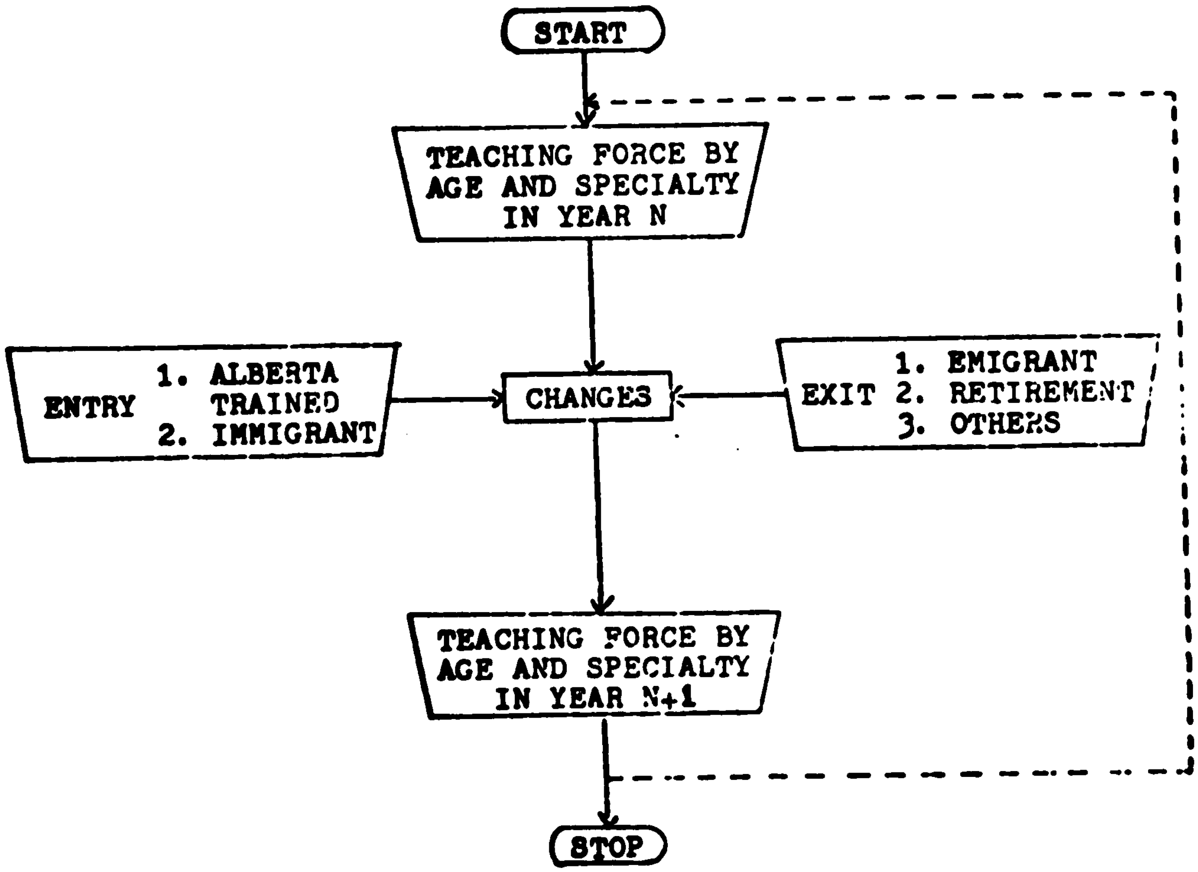

FIGURE 2

GROSS FLOW CHART OF THE TEACHER SUPPLY MODEL of various trends. That is, if a trend or trends were detected in the input variables, alternate assumptions were made and tested for effect.

Alberta trained teachers. An important avenue of entry to the Alberta teaching force is through the teacher-training institutions in Alberta. Thus it was supposed that changes in this entry pattern would have significant consequences for the Alberta teaching force. For this reason, trends in the numbers of teachers prepared in each category of the teaching force were examined.

Although the Department of Education reports the total numbers of teachers from Alberta teacher-training institutions that are certificated each year, these data are related only to level of specialization, not to subject specialization. Thus it was necessary to survey the teacher training institutions to obtain an estimate of the numbers of each of the nine high school specialties prepared in each year. Trends in the numbers prepared in each category of the teaching force matrix were examined. If trends appeared, alternate assumptions about the trends were constructed, input into the model and tested for effect.

Furthermore, other trends which obtain in society have had a direct effect on teacher training. A possible trend of the types indicated is the trend toward increased preparation of teachers. Recently, a third year of teacher training has been required of new teachers. Sufficient evidence exists to test the impact of requiring even more training.

The addition of a fourth university may have some impact on the supply of teachers depending upon the effect that it has on the existing universities. Alternate assumptions regarding the fourth university were made and tested.

Immigrant teachers. The flow of teachers into Alberta from other provinces or countries has had a significant impact on the Alberta teaching force. In 1968, these teachers composed about thirty per cent of the teaching force (4, p. 20). Thus it was considered of value to examine more closely this source of supply.

Some information about the number of immigrant teachers at various levels is available but there is no indication of the number of high school specialists. However, by making certain assumptions about the distribution of these teachers in the teaching force matrix, and by examining the trends in the entry of teachers into Alberta, alternate assumptions were made and tested for effect.

Exit. The basic model for the availability of teachers presupposes a constant rate of exit from the Alberta teaching force. However, any special circumstances that seriously changed the exit were tested.

For example, if teachers on letters of authority were required either to obtain more training or leave teaching this would have a significant and immediate impact on the supply of teachers. Also, if the age structure of the teaching force was such as to require the retirement of an inordinate number of teachers in a given year, this impact was accounted for in the prediction. In order to account for these special circumstances, an exit parameter has been allowed for in the model.

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Chapter 5

DATA FOR TEACHER DEMAND PROJECTIONS

Since the projections of teacher demand were based on a social demand approach, the actual numbers of teachers required were calculated through a chain of mathematical relationships. That is, the number of teachers required was considered to be a function of the number of children in school. The number of children in school was, in turn, considered to be a function of the total population. Also total population was considered to be a function of several factors including the past population. Thus, the data used in the study determined the nature of the mathematical functions used in the projections.

This chapter outlines the source of each of the items of data, the data itself, as well as justifiable alternate assumptions arising from the data.

POPULATION DATA

The population data, as illustrated in Table 1, were obtained from publications of the Dominion Bureau of Statistics. It should be noted that the population has been reported according to age and sex.

It was considered worthwhile, at this stage, to make a few observations about the distribution of the population.

1) The largest numbers of people were generally in the lowest age group.
2) The number in each age-sex category has generally increased

Table 1

Population of Alberta

Age	1951[1] Males	1951[1] Females	1956[2] Males	1956[2] Females	1961[3] Males	1961[3] Females	1966[4] Males	1966[4] Females
0–4	59,409	57,437	76,937	72,760	92,250	87,638	89,078	84,490
5–9	47,528	45,535	64,443	61,377	81,633	77,420	91,627	87,913
10–14	39,008	37,889	49,696	47,622	66,680	63,703	81,038	76,620
15–19	37,882	36,059	40,772	39,714	50,296	48,708	64,826	64,173
20–24	38,333	37,194	42,361	40,481	44,403	44,751	49,933	52,072
25–29	38,022	38,693	45,763	42,138	49,720	46,010	45,737	46,463
30–34	36,031	35,920	42,934	42,640	50,694	46,147	48,767	45,714
35–39	34,040	32,469	40,261	38,693	46,305	45,388	49,421	46,075
40–44	30,330	26,641	35,895	33,485	41,288	39,642	49,701	44,335
45–49	27,959	22,187	31,574	27,528	36,342	33,932	39,476	38,409
50–54	23,698	18,636	27,662	22,015	30,870	27,403	34,454	32,885
55–59	20,866	16,136	22,733	18,278	26,870	21,947	28,727	26,538
60–64	20,360	14,297	18,829	15,198	21,182	17,644	24,366	21,355
65–69	17,536	11,903	18,252	13,544	17,166	14,558	18,352	16,843
70–74	11,270	8,263	14,385	10,667	15,413	12,392	14,465	13,435
75+	9,921	8,030	13,424	11,055	18,271	15,278	21,277	19,638

1. Dominion Bureau of Statistics, Population, Ottawa: Queen's Printer, 1953.

2. Dominion Bureau of Statistics, Population, Ottawa: Queen's Printer, 1957.

3. Dominion Bureau of Statistics, Population, Ottawa: Queen's Printer, 1963.

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over the years with the largest increases in the lower age categories.

3) The number of females of child-bearing ages may be expected to increase rapidly in the next few years.

4) There are generally no instances of real population stability in any of the age-sex categories over time.

While the above observations are not exhaustive in any way, they do suggest that population of Alberta has exhibited changes to such a degree as to create changes in the school system. The school system changes will in turn create changes in the demand for teachers. The population data suggest that all three factors--births, deaths, and migration--are important in the changes. The first of these factors, births, will be dealt with next.

__Birth Rates__

The data, from which birth rates were compiled, were obtained from both Dominion Bureau of Statistics reports and the Alberta Department of Health and Vital Statistics publications. An inconsistency over time in the reporting of the birth data has necessitated the formation of an assumption that was not originally anticipated.

Table 2 illustrates the rates of male and female births per 1,000 females of various ages. These rates were obtained by totalling the number of each sex of children born to each age of mother, multiplying this by 1,000 and then dividing by the number of females in the same age categories as the mothers. Although these data are ideally suited to the demand model used in this study, the births were not reported

Table 2

Male and Female Births per 1,000 Females of Various Ages in Alberta

Year	Sex	Age of Females 15–19	20–24	25–29	30–34	35–39	40–44	45+
1951	M	28.8	112.5	105.8	73.4	42.7	14.9	1.6
	F	27.5	106.0	102.2	70.2	42.0	13.9	1.5
1960	M	44.2	141.2	125.3	78.7	44.0	14.0	1.5
	F	41.2	133.4	119.2	73.9	41.8	13.7	1.5
1961	M	43.5	143.4	116.5	77.7	40.1	13.8	1.2
	F	41.0	135.0	115.1	70.6	41.1	13.6	1.1
1962	M	41.5	139.7	118.3	72.8	38.6	13.8	1.4
	F	39.7	136.7	108.3	72.6	38.3	13.8	1.0
1963	M	39.7	135.8	113.7	74.5	40.1	13.8	0.8
	F	38.9	129.8	105.3	69.3	37.6	12.6	1.4
1964	M	35.8	125.6	105.2	68.7	35.8	13.3	1.0
	F	34.0	118.7	99.8	68.0	33.5	13.0	0.9
1965	M	34.0	109.7	93.3	62.3	34.2	11.2	1.4
	F	31.8	100.4	88.8	58.7	30.1	11.3	1.0
1966	M	33.3	99.7	85.5	52.3	30.0	10.2	1.0
	F	31.7	97.0	83.1	51.6	28.4	8.8	0.8
1967	M	31.8	104.4	85.5	51.7	27.5	8.0	0.9
	F	30.8	98.7	82.2	48.2	26.5	8.1	1.0

Compiled from: Government of Alberta, Department of Public Health and Vital Statistics, Annual Report. Edmonton: Queen's Printer, 1951-1967.

according to the sex of the child in the reports of the years 1952 through 1959. It therefore became of interest to examine the proportion of male and female births of the total for each age group.

Male and Female Births

Although the proportion of male births was generally higher than the female births, as illustrated in Table 3, there were many variations in the proportions. The largest variations though occurred in the 40-44 and 45+ age groups. Even though the variations in these groups were quite large, the number of births here are so few as to make little difference in the population projections.

When the mean proportions of male births and female births for each age of mother were weighted and averaged the overall proportions became 0.512 for males and 0.488 for females. Since this figure agrees in general with all of the proportions, it was decided to use these proportions to disaggregate the birth rate data for other years.

Trends in Birth Rates

Because some of the birth rate data were not available in the disaggregated form, it was decided to analyze all of the birth rates in the same form. Thus, a set of age-specific birth rates was prepared for all years 1951 through 1967. It was then necessary to examine each set of age-specific birth rates for trends over time.

For each age group of females, three assumptions about the future birth rates were prepared. These assumptions included a high, medium, and low value. Although the details of the assumptions are set out in Appendix H, it should be pointed out that the assumptions were

Table 3

Proportion Male and Female Births According to Year and Age of Mother

Year	Sex	Age of Mothers 15–19	20–24	25–29	30–34	35–39	40–44	45+
1951	M	.512	.510	.509	.511	.504	.517	.516
	F	.488	.490	.491	.489	.496	.483	.484
1960	M	.518	.514	.512	.516	.513	.505	.500
	F	.482	.486	.488	.484	.487	.495	.500
1961	M	.515	.515	.503	.524	.494	.504	.545
	F	.485	.485	.477	.476	.506	.496	.455
1962	M	.510	.505	.522	.501	.501	.500	.583
	F	.490	.495	.478	.499	.499	.500	.417
1963	M	.505	.511	.517	.518	.516	.525	.381
	F	.495	.489	.483	.482	.484	.475	.619
1964	M	.513	.514	.513	.503	.517	.506	.526
	F	.487	.486	.487	.497	.483	.494	.474
1965	M	.516	.522	.512	.515	.532	.477	.583
	F	.484	.478	.488	.485	.468	.523	.417
1966	M	.512	.507	.507	.503	.514	.537	.588
	F	.488	.493	.493	.497	.486	.463	.412
1967	M	.507	.513	.507	.518	.509	.497	.474
	F	.493	.487	.493	.482	.491	.503	.526
Mean	M	.512	.512	.511	.512	.511	.508	.522
	F	.488	.488	.489	.488	.489	.492	.478

Compiled from Table 2, page 43.

based on what appeared to be the most likely range. In some cases, the assumptions were based on continuing downward trends. In other cases, the assumptions were based on a constant value. In still other cases, the assumptions were based on continuing upward trends.

Actual and Projected Birth Rates

After an examination of available data, it became necessary to compile sets of birth rates for both male and female children born to females of various ages. These data were used to both fill in and extend the available data.

Male and female births: 1951 - 1967. By using the proportion of males born as 0.512 and the proportion of females born as 0.488, the age-specific birth rates for 1952 through 1959 were disaggregated to provide a rate of births for males and females. These data are illustrated in Table 4.

Male and female births: 1968 - 1980. The number of males and females born in each year of the time period under consideration depends upon the set of assumptions that is chosen. For the low assumptions about each set of age-specific birth rates, the entire set of birth rates is set out in Table 5, p. 47. It should also be noted that these birth rates have been disaggregated according to male and female births. For the medium assumptions about each set of age-specific birth rates, the entire set of birth rates, disaggregated for male and female births, is set out in Table 6, p. 48. Table 7, p. 49, illustrates the birth rates compiled from the high assumptions about each set of age-specific

Table 4

Male and Female Births per 1000 Females of Various Ages in Alberta: 1951-1967

	Ages of Females													
	15-19		20-24		25-29		30-34		35-39		40-44		45+	
Year	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1951	28.8	27.5	112.5	108.0	105.8	102.2	73.4	70.2	42.7	42.0	14.9	13.9	1.6	1.5
1952	31.2	29.7	121.0	115.4	111.3	106.1	79.0	75.2	43.2	41.1	15.4	14.7	1.4	1.3
1953	33.2	31.6	131.3	125.2	116.4	110.9	83.3	79.4	44.0	42.0	15.5	14.7	1.9	1.9
1954	38.0	36.2	140.3	133.8	119.9	114.3	86.2	82.2	45.7	43.6	16.7	16.0	1.6	1.5
1955	37.2	35.5	141.2	134.6	124.1	118.3	85.5	81.5	47.3	45.1	17.0	16.3	1.6	1.5
1956	37.7	36.0	135.2	128.6	124.6	118.7	79.4	75.6	44.6	42.5	15.4	14.7	1.5	1.4
1957	42.2	40.2	138.6	132.1	121.3	115.6	76.4	72.8	45.9	43.8	14.1	13.5	1.1	1.1
1958	41.5	39.6	141.2	134.6	125.0	119.1	77.4	73.7	45.7	43.6	13.8	13.1	1.5	1.5
1959	43.4	41.4	144.0	137.2	127.2	121.2	78.3	74.7	44.5	42.4	14.6	13.9	1.4	1.4
1960	44.2	41.2	141.2	133.4	125.3	119.2	78.7	73.9	44.0	41.8	14.0	13.7	1.5	1.5
1961	43.5	41.0	143.4	135.0	116.5	115.1	77.7	70.6	40.1	41.1	13.8	13.6	1.2	1.1
1962	41.5	39.7	139.7	136.7	118.3	108.3	72.8	72.6	38.6	38.3	13.8	13.8	1.4	1.0
1963	39.7	38.9	135.8	129.8	113.7	106.3	74.5	69.3	40.1	37.6	13.8	12.6	0.8	1.4
1964	35.8	34.0	125.6	118.7	105.2	99.8	68.7	68.0	35.8	33.5	13.3	13.0	1.0	0.9
1965	34.0	31.8	109.7	100.4	93.3	88.8	62.3	58.7	34.2	30.1	11.2	11.3	1.4	1.0
1966	33.3	31.7	99.7	97.0	85.5	83.1	52.3	51.0	30.0	28.4	10.2	8.8	1.0	0.8
1967	31.8	30.8	104.0	98.7	85.5	82.2	51.7	48.2	27.5	26.5	8.0	8.1	0.9	1.0

Table 5

Projected Male and Female Births per 1000 Females of Various Ages in Alberta: Low

Year	15-19 M	15-19 F	20-24 M	20-24 F	25-29 M	25-29 F	30-34 M	30-34 F	35-39 M	35-39 F	40-44 M	40-44 F	45+ M	45+ F
1968	28.8	27.5	100.7	96.0	86.3	82.3	51.1	48.8	25.6	24.4	7.2	6.8	0.9	0.8
1969	28.8	27.5	100.7	96.0	86.3	82.3	51.1	48.8	23.6	22.4	6.1	5.9	0.9	0.8
1970	28.8	27.5	100.7	96.0	86.3	82.3	51.1	48.8	21.8	20.7	5.3	5.1	0.9	0.8
1971	28.8	27.5	100.7	96.0	86.3	82.3	51.1	48.8	20.7	19.8	4.6	4.4	0.9	0.8
1972	28.8	27.5	100.7	96.0	86.3	82.3	51.1	48.8	19.7	18.8	4.0	3.8	0.9	0.8
1973	28.8	27.5	100.7	96.0	86.3	82.3	51.1	48.8	18.9	18.1	3.4	3.2	0.9	0.8
1974	28.8	27.5	100.7	96.0	86.3	82.3	51.1	48.8	18.4	17.6	3.2	3.0	0.9	0.8
1975	28.8	27.5	100.7	96.0	86.3	82.3	51.1	48.8	17.9	17.1	2.9	2.7	0.9	0.8
1976	28.8	27.5	100.7	96.0	86.3	82.3	51.1	48.8	17.9	17.1	2.8	2.6	0.9	0.8
1977	28.8	27.5	100.7	96.0	86.3	82.3	51.1	48.8	17.9	17.1	2.6	2.4	0.9	0.8
1978	28.8	27.5	100.7	96.0	86.3	82.3	51.1	48.8	17.9	17.1	2.5	2.3	0.9	0.8
1979	28.8	27.5	100.7	96.0	86.3	82.3	51.1	48.8	17.9	17.1	2.5	2.3	0.9	0.8
1980	28.8	27.5	100.7	96.0	86.3	82.3	51.1	48.8	17.9	17.1	2.5	2.3	0.9	0.8

Table 6

Projected Male and Female Births per 1000 Females of Various Ages in Alberta: Medium

Year	15-19 M	15-19 F	20-24 M	20-24 F	25-29 M	25-29 F	30-34 M	30-34 F	35-39 M	35-39 F	40-44 M	40-44 F	45+ M	45+ F
1968	37.5	35.7	129.6	123.6	112.9	107.6	74.0	70.5	27.6	26.4	8.2	7.9	1.3	1.3
1969	37.5	35.7	129.6	123.6	112.9	107.6	74.0	70.5	27.6	26.4	8.2	7.9	1.3	1.3
1970	37.5	35.7	129.6	123.6	112.9	107.6	74.0	70.5	27.6	26.4	8.2	7.9	1.3	1.3
1971	37.5	35.7	129.6	123.6	112.9	107.6	74.0	70.5	27.6	26.4	8.2	7.9	1.3	1.3
1972	37.5	35.7	129.6	123.6	112.9	107.6	74.0	70.5	27.6	26.4	8.2	7.9	1.3	1.3
1973	37.5	35.7	129.6	123.6	112.9	107.6	74.0	70.5	27.6	26.4	8.2	7.9	1.3	1.3
1974	37.5	35.7	129.6	123.6	112.9	107.6	74.0	70.5	27.6	26.4	8.2	7.9	1.3	1.3
1975	37.5	35.7	129.6	123.6	112.9	107.6	74.0	70.5	27.6	26.4	8.2	7.9	1.3	1.3
1976	37.5	35.7	129.6	123.6	112.9	107.6	74.0	70.5	27.6	26.4	8.2	7.9	1.3	1.3
1977	37.5	35.7	129.6	123.6	112.9	107.6	74.0	70.5	27.6	26.4	8.2	7.9	1.3	1.3
1978	37.5	35.7	129.6	123.6	112.9	107.6	74.0	70.5	27.6	26.4	8.2	7.9	1.3	1.3
1979	37.5	35.7	129.6	123.6	112.9	107.6	74.0	70.5	27.6	26.4	8.2	7.9	1.3	1.3
1980	37.5	35.7	129.6	123.6	112.9	107.6	74.0	70.5	27.6	26.4	8.2	7.9	1.3	1.3

Table 7

Projected Male and Female Births per 1000 Females of Various Ages in Alberta: High

Year	15–19 M	15–19 F	20–24 M	20–24 F	25–29 M	25–29 F	30–34 M	30–34 F	35–39 M	35–39 F	40–44 M	40–44 F	45+ M	45+ F
1968	43.2	41.2	144.0	137.2	127.2	121.2	86.2	82.7	40.9	38.9	13.9	13.3	1.9	1.9
1969	43.2	41.2	144.0	137.2	127.2	121.2	86.2	82.7	40.9	38.9	13.9	13.3	1.9	1.9
1970	43.2	41.2	144.0	137.2	127.2	121.2	86.2	82.7	40.9	38.9	13.9	13.3	1.9	1.9
1971	43.2	41.2	144.0	137.2	127.2	121.2	86.2	82.7	40.9	38.9	13.9	13.3	1.9	1.9
1972	43.2	41.2	144.0	137.2	127.2	121.2	86.2	82.7	40.9	38.9	13.9	13.3	1.9	1.9
1973	43.2	41.2	144.0	137.2	127.2	121.2	86.2	82.7	40.9	38.9	13.9	13.3	1.9	1.9
1974	43.2	41.2	144.0	137.2	127.2	121.2	86.2	82.7	40.9	38.9	13.9	13.3	1.9	1.9
1975	43.2	41.2	144.0	137.2	127.2	121.2	86.2	82.7	40.9	38.9	13.9	13.3	1.9	1.9
1976	43.2	41.2	144.0	137.2	127.2	121.2	86.2	82.7	40.9	38.9	13.9	13.3	1.9	1.9
1977	43.2	41.2	144.0	137.2	127.2	121.2	86.2	82.7	40.9	38.9	13.9	13.3	1.9	1.9
1978	43.2	41.2	144.0	137.2	127.2	121.2	86.2	82.7	40.9	38.9	13.9	13.3	1.9	1.9
1979	43.2	41.2	144.0	137.2	127.2	121.2	86.2	82.7	40.9	38.9	13.9	13.3	1.9	1.9
1980	43.2	41.2	144.0	137.2	127.2	121.2	86.2	82.7	40.9	38.9	13.9	13.3	1.9	1.9

birth rates. The three sets of birth rates determine the range that was tested for effect in the teacher demand model.

Death Rates

The data, from which the death rates were compiled, were obtained from the Alberta Department of Health and Vital Statistics publications. The way in which the deaths were reported--disaggregated by age and sex--was consistent throughout the time period under consideration. It was thus possible to construct tables of age-sex-specific death rates for each of the years 1951 through 1967.

By examining the data for trends, alternate assumptions about the death rates were constructed. The details of the actual death rates and the alternate assumptions about the future death rates are set out in Appendix I. It should be noted that for each age-sex group, a high, medium, and low assumption has been determined. The bases of the assumptions has generally been the highest value, the mean value, and the lowest value. In one case, the low assumption was based on a continuing downward trend.

As illustrated in Table 8 and Table 9, the death rates for both males and females aged 0-4 years showed a reasonably consistent downward trend. For this reason, a best-fit regression line was used to project the low death rates according to the procedure outlined by Ferguson (11, p. 120). The regression lines and the equations of the regression lines are shown in Appendix I.

The projected death rates for each age-sex cohort are illustrated in Table 10, page 53 and Table 11, page 54. It should be noted that in all cases except the 0-4 year groups, the death rates were assumed to be

Table 6

Death Rates for Males of Various Ages in Alberta

Year	Age: 0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75+
1951	10.44	0.76	0.77	1.48	1.85	1.53	2.39	2.29	3.07	6.01	6.48	13.28	21.51	29.65	32.85	112.99
1952	9.76	0.88	0.90	1.30	2.02	2.05	2.27	2.21	3.53	5.58	10.09	13.80	21.34	33.32	47.09	103.18
1953	9.53	1.33	1.09	1.51	2.45	1.54	2.22	3.09	3.87	6.05	8.70	12.91	21.72	30.19	52.25	106.52
1954	8.51	0.64	0.75	1.01	2.33	1.64	1.94	2.30	3.71	5.41	9.51	12.92	22.48	31.95	50.38	103.80
1955	8.38	0.52	0.88	1.14	1.80	1.76	2.24	2.08	3.82	5.25	8.78	13.10	22.37	35.95	51.08	113.57
1956	7.82	0.56	0.48	1.32	1.63	1.68	1.51	2.19	3.43	5.10	8.10	12.67	20.34	32.00	47.83	107.94
1957	7.79	0.60	0.58	1.24	1.87	1.78	1.78	2.03	3.33	4.70	8.27	13.20	19.79	31.72	49.76	104.73
1958	7.60	0.46	0.42	1.57	1.64	1.88	1.74	1.99	3.63	5.91	8.67	13.41	19.47	33.95	49.07	100.76
1959	7.30	0.41	0.63	1.05	1.83	1.72	2.12	2.01	3.02	4.97	8.25	13.44	20.70	32.22	49.26	103.11
1960	7.49	0.38	0.62	1.38	1.70	1.57	1.49	2.51	3.26	4.63	8.01	12.67	20.42	31.99	51.75	105.31
1961	7.57	0.45	0.48	1.27	1.82	1.86	1.72	2.05	3.29	4.98	8.65	12.17	20.44	29.83	46.19	106.23
1962	7.16	0.39	0.49	1.01	1.98	1.47	1.87	1.90	2.69	5.36	7.76	13.44	20.76	32.29	50.98	107.15
1963	6.91	0.57	0.52	0.87	2.04	1.66	1.70	2.06	3.56	5.16	6.73	13.07	19.73	29.31	48.43	109.14
1964	6.83	0.51	0.40	1.22	2.16	1.50	1.68	2.30	3.14	5.73	7.81	12.51	22.43	32.84	46.82	106.92
1965	5.84	0.32	0.46	1.15	1.88	1.81	1.87	2.19	3.07	4.74	9.01	13.26	20.19	31.63	46.39	108.36
1966	4.95	0.29	0.48	1.50	1.98	1.79	1.58	2.21	3.15	5.07	8.21	12.85	21.30	31.33	46.46	107.33
1967	4.36	0.45	0.57	1.45	2.33	1.71	1.72	1.80	3.57	4.51	7.73	13.44	19.92	30.77	44.63	101.11
Mean	7.54	0.56	0.62	1.26	1.96	1.71	1.87	2.19	3.36	5.24	8.52	13.07	20.88	31.79	47.72	106.36

Compiled from: Government of Alberta, Department of Public Health and Vital Statistics, Annual Report. Edmonton: Queen's Printer, 1951-1967.

Table 9

Death Rates for Females of Various Ages in Alberta

Year	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75+
1951	7.56	0.72	0.55	1.00	1.26	0.80	1.36	1.76	2.33	3.83	6.26	8.06	15.18	22.65	42.86	96.58
1952	7.28	0.53	0.63	0.90	1.00	0.62	1.23	1.54	2.75	3.66	5.95	8.87	15.59	20.03	42.12	94.27
1953	7.57	0.58	0.48	0.61	0.60	1.17	1.06	1.69	2.48	3.25	5.90	8.83	13.99	23.57	40.92	90.58
1954	6.44	0.62	0.27	0.52	0.69	0.71	1.83	1.57	2.02	3.31	5.47	7.69	12.13	20.56	34.28	94.46
1955	6.44	0.48	0.44	0.46	0.40	0.77	1.07	1.50	2.15	3.29	3.57	8.12	12.39	20.73	32.48	93.40
1956	7.02	0.73	0.58	0.49	0.59	0.68	0.83	1.55	2.03	4.45	5.42	8.16	14.91	26.72	34.31	89.32
1957	6.87	0.40	0.35	0.65	0.58	0.70	0.97	1.25	1.81	2.85	5.85	7.68	13.58	18.84	32.15	90.42
1958	6.00	0.39	0.67	0.59	0.59	0.48	1.11	1.14	1.59	2.56	4.96	5.87	11.50	19.28	31.70	86.47
1959	5.46	0.35	0.38	0.53	0.56	0.79	0.72	0.96	1.56	3.12	4.83	7.23	11.82	16.89	35.12	86.61
1960	5.68	0.42	0.41	0.87	0.57	0.75	0.70	1.20	1.87	2.75	5.13	7.50	11.89	19.16	30.80	87.30
1961	5.58	0.31	0.22	0.70	0.51	0.52	0.72	1.30	1.72	3.04	3.90	6.33	10.71	16.97	29.13	82.01
1962	5.54	0.40	0.30	0.48	0.76	0.59	0.85	1.10	2.14	2.81	3.89	8.05	9.57	17.58	31.11	85.69
1963	4.85	0.29	0.19	0.58	0.80	0.54	0.63	1.20	3.12	2.69	4.93	6.77	11.29	18.35	32.32	86.77
1964	4.92	0.29	0.27	0.48	0.65	0.76	0.72	1.44	1.91	2.70	4.63	6.52	10.87	16.89	26.35	82.03
1965	4.43	0.37	0.35	0.49	0.49	0.73	0.83	1.13	1.77	3.52	4.22	7.34	9.99	16.29	29.26	83.02
1966	3.73	0.36	0.33	0.55	0.61	0.67	0.85	1.32	1.69	2.50	4.17	7.16	11.00	15.29	28.95	84.47
1967	3.02	0.33	0.30	0.49	0.64	0.56	0.90	1.38	2.12	2.95	4.65	7.82	9.82	17.17	27.55	77.62
Mean	5.79	0.45	0.38	0.62	0.66	0.70	0.90	1.35	2.00	3.14	4.93	7.53	12.13	19.41	33.02	87.57

Compiled from: Government of Alberta, Department of Public Health and Vital Statistics, Annual Report. Edmonton: Queen's Printer, 1951-1967.

Table 10

Projected Death Rates for Males of Various
Ages in Alberta: 1968-1980

Age	Projection Low	Medium	High
0 - 4	5.1[1]	7.5	10.4
5 - 9	0.3	0.5	1.3
10 - 14	0.4	0.6	1.1
15 - 19	0.9	1.3	1.6
20 - 24	1.6	2.0	2.5
25 - 29	1.5	1.7	2.1
30 - 34	1.5	1.9	2.4
35 - 39	1.8	2.2	3.1
40 - 44	2.7	3.4	3.7
45 - 49	4.5	5.2	6.0
50 - 54	7.7	8.5	10.1
55 - 59	12.2	13.1	13.8
60 - 64	19.5	20.9	22.4
65 - 69	29.3	31.8	36.0
70 - 74	32.9	47.7	52.2
75+	100.8	106.4	113.6

[1] Decreases through 5.1 in 1968, 4.9 in 1969, 4.6 in 1970, 4.2 in 1971, 4.0 in 1972, 3.7 in 1973, 3.4 in 1974, 3.1 in 1975, 2.8 in 1976, 2.5 in 1977, 2.2 in 1978, 1.9 in 1979, 1.7 in 1980.

Compiled from Appendix I.

Table 11

Projected Death Rates for Females of Various Ages in Alberta: 1968-1980

Age	Projection		
	Low	Medium	High
0 - 4	3.4[1]	5.8	7.6
5 - 9	0.3	0.5	0.7
10 - 14	0.2	0.4	0.6
15 - 19	0.4	0.6	0.9
20 - 24	0.4	0.7	1.3
25 - 29	0.5	0.7	1.2
30 - 34	0.6	0.9	1.4
35 - 39	1.0	1.3	1.8
40 - 44	1.5	2.0	2.8
45 - 49	2.5	3.1	4.5
50 - 54	3.6	4.9	6.3
55 - 59	5.9	7.5	8.9
60 - 64	9.1	12.1	15.5
65 - 69	16.3	19.4	26.7
70 - 74	26.4	33.0	42.9
75+	77.6	87.9	98.9

[1]Decreases through 3.4 in 1968, 3.2 in 1969, 2.9 in 1970, 2.6 in 1971, 2.4 in 1972, 2.1 in 1973, 1.8 in 1974, 1.6 in 1975, 1.3 in 1976, 1.0 in 1977, 0.8 in 1978, 0.5 in 1979, 0.3 in 1980.

Compiled from Appendix I.

constant.

ENROLMENT DATA

The enrolment by age and grade were obtained directly from the annual reports of the Department of Education. Also, the data related to enrolment by high school subject were obtained from the A Cards of the Department of Education.

Enrolment by Age and Grade

Since the number of males and females of each age category was determined by the projection of population, it was considered essential to determine the proportion of each age-sex group in each grade in each census year. Changes over the years allowed trends in proportions to be isolated. For the purpose of testing the model, attendance rates were assumed to change linearily over the years between census years.

Also, it should be noted that the attendance of various ages was not reported in a consistent way by the Department of Education (12) and thus had to be corrected to September 30th of the years under consideration. The slight errors created by this technique produced a few attendance rates which appeared to exceed one hundred per cent. However, since the error appeared small, and since the use of the technique was simply to relate attendance to population the inconsistency was overlooked in order to retain year-to-year comparability of attendance rates.

The data and the alternate assumptions about the distribution of students by age and grade are set out in Appendix J. While it ...

obvious that three sets of assumptions--high, medium, and low--about the attendance of each age have been made, it should be pointed out that the distribution of each age group over the grades was assumed to remain constant at the 1967 proportions. The alternate assumptions about each age group were based on the highest possible attendance rate, the lowest experience attendance rate, and a rate mid-way between the other two. The high, medium, and low attendance rates are summarized in Table 12, Table 13, and Table 14.

Effect of Distribution

As can be seen from the previous sections, a great deal of data were required to partially account for the distribution of various ages over various grades. Thus it was thought advisable to attempt to determine the necessity for the technique used. To do this, an assumption of a perfect relationship between ages and grades was made. Thus, all six-year olds were assumed in grade one, all seven-year olds were assumed in grade two, and so on. The assumptions of low, medium and high attendance rates are set out in Table 15, page 60.

Effect of Kindergarten

Since the idea of establishing kindergarten in the school system has been the topic of some discussion in Alberta, it was decided to test the effect on the demand for teachers of allowing all students of five years old to attend school. This was accomplished by assuming an attendance rate of 1000.0 per thousand of five-year olds in grade one.

The projections from the enrolment data allowed various assumptions about the future to be made. These assumptions, in turn,

Table 12

Low Projected Enroment Rates by Age and Grade in Alberta:
1968-69 Through 1980-81

Age	Sex	Grade 1	2	3	4	5	6	7	8	9	10	11	12
5	M	262.8[1]											
	F	265.8[2]											
6	M	712.6	241.3										
	F	699.2	253.5										
7	M	64.1	664.4	221.5									
	F	44.4	659.9	245.7									
8	M	11.0	101.7	621.6	215.7								
	F	6.5	68.6	607.0	249.4								
9	M		19.4	121.0	593.5	196.3							
	F		12.0	79.9	617.4	225.7							
10	M			30.2	123.1	536.1	209.2						
	F			16.2	86.1	573.5	249.4						
11	M				41.8	147.9	544.4	196.3					
	F				22.6	95.4	567.5	245.1					
12	M					58.5	153.8	546.1	181.6				
	F					33.7	102.6	570.9	232.8				
13	M						66.6	182.2	527.6	183.6			
	F						34.4	113.4	558.5	236.5			
14	M							81.9	164.7	478.1	145.3		
	F							44.4	113.0	530.3	182.3		
15	M								75.6	149.4	513.0	162.0	
	F								56.7	168.3	494.1	180.9	
16	M									85.0	183.6	436.9	144.5
	F									42.5	138.6	483.7	185.3
17	M									20.8	60.0	138.1	381.2
	F									13.0	33.6	93.2	410.1
18	M									4.2	17.6	46.8	231.4
	F									1.7	7.0	17.4	123.9
19	M										4.6	10.7	74.7
	F										1.7	2.0	16.2

[1]Decreases through 262.8 in 1968-69 down to 218.0 in 1980-81.

[2]Decreases through 265.8 in 1968-69 down to 237.9 in 1980-81.

Compiled from Appendix J.

Table 13

Medium Projected Enrolment Rates by Age and Grade in Alberta: 1968-69 Through 1980-81

Age	Sex	Grade 1	2	3	4	5	6	7	8	9	10	11	12
5	M	266.2											
	F	267.9											
6	M	728.4	246.6										
	F	715.6	259.4										
7	M	65.8	681.9	227.3									
	F	45.5	677.3	252.2									
8	M	11.3	104.4	638.0	221.4								
	F	6.7	70.6	623.0	256.0								
9	M		20.0	125.5	615.9	203.6							
	F		12.4	82.4	637.2	232.9							
10	M			31.3	123.9	540.5	217.0						
	F			16.8	89.4	595.0	258.7						
11	M				43.4	153.0	564.9	203.7					
	F				23.5	99.0	588.9	254.4					
12	M					60.4	158.7	563.5	187.4				
	F					34.8	105.9	589.1	240.3				
13	M						67.9	186.0	538.6	187.4			
	F						35.1	115.7	570.2	241.5			
14	M							88.1	177.0	513.8	156.1		
	F							47.7	121.5	569.9	167.0		
15	M								79.8	157.7	541.5	171.0	
	F								59.9	177.7	521.6	171.0	
16	M									92.5	199.8	475.5	157.3
	F									46.3	150.8	526.3	201.7
17	M									25.1	72.5	166.8	460.6
	F									16.0	41.3	114.4	503.3
18	M									4.9	20.5	54.6	270.0
	F									2.5	10.5	26.1	185.8
19	M										4.8	11.3	78.9
	F										3.0	3.6	28.[illegible]

Table 14

High Projected Enrolment Rates by Age and Grade in Alberta: 1968-69 Through 1980-81

Age	Sex	Grade 1	2	3	4	5	6	7	8	9	10	11	12
5	M	1000.0											
	F	1000.0											
6	M	747.0	253.0										
	F	733.9	266.1										
7	M	67.5	699.4	233.1									
	F	46.7	694.6	258.7									
8	M	11.6	107.0	654.3	227.0								
	F	6.9	72.4	638.9	262.5								
9	M		20.7	130.1	638.2	211.0							
	F		12.9	85.4	660.4	241.3							
10	M			32.4	124.7	545.6	224.9						
	F			17.4	92.6	616.6	268.1						
11	M				44.9	158.6	585.4	211.1					
	F				24.3	102.6	610.2	263.6					
12	M					62.3	163.6	581.0	193.2				
	F					35.8	109.1	607.3	247.7				
13	M						69.3	189.8	549.6	191.2			
	F						35.8	118.1	581.8	146.4			
14	M							94.2	189.3	549.5	167.0		
	F							51.0	129.9	609.6	209.5		
15	M								84.0	166.0	570.0	180.0	
	F								63.0	187.0	549.0	201.0	
16	M									100.0	216.0	514.0	170.0
	F									50.0	163.0	569.0	218.0
17	M									29.4	85.0	195.6	540.0
	F									18.9	48.9	135.6	596.5
18	M									5.6	23.4	62.4	308.6
	F									3.4	14.0	34.8	247.7
19	M										5.1	11.9	83.0
	F										4.3	5.1	40.6

Table 15

Attendance per Thousand of Children of Various Ages in Various Grades 1967-68 Through 1980-81

Age	Grade	Alternate Assumptions: Low	Medium	High
6	1	953.9	975.0	1000.0
7	2	950.0	975.0	1000.0
8	3	950.0	975.0	1000.0
9	4	930.0	965.0	1000.0
10	5	930.0	965.0	1000.0
11	6	930.0	965.0	1000.0
12	7	940.0	970.0	1000.0
13	8	960.0	980.0	1000.0
14	9	870.0	935.0	1000.0
15	10	900.0	950.0	1000.0
16	11	850.0	925.0	1000.0
17	12	575.0	700.0	825.0

allowed a range of enrolment in each grade to be determined. The next step was to relate this range of enrolment to the number of teachers.

Students in High School Subjects

In order to take into account the number of high school teachers of various subjects, it was necessary to determine the probable enrolment in subject fields. To accomplish this, the enrolment in subjects open to each year of high school students was related to the total students in that grade. This figure was disaggregated according to sex.

Grade ten. The data in Table 16 illustrate the relationship between the enrolment of grade ten males and females in various subjects and the total number of males and females in grade ten in that year. An examination of the data in Table 16 showed that there were variations in the enrolment-student ratios for some subject fields but no real trends. Also, the enrolment-student ratios tend to be interdependent. Thus, an increase in one ratio, over time, resulted in a decrease in other ratios. The interdependency made the problem of testing alternate assumptions much more difficult.

To test the model, an assumption of linear change over time was made. To complete the projections, the ratios that obtained in 1966-67 were used.

Grade eleven. The data summarized in Table 17, page 63, illustrates the relationship between the enrolment of males and females in various subject fields and the total number of males and females in grade eleven. Although the data indicated many variations in enrolment

Table 16

Grade Ten Students and Enrolment in High School Subjects in Alberta

Year	Students: Males	Students: Females	Subject Field	Enrolment: Males	Enrolment: Females	Enrol-Stu. Ratio: Males	Enrol-Stu. Ratio: Females
1951-52	4,131	4,874	Math-Sci.	11,932	12,236	2.888	2.508
			Eng.-Soc.	9,643	9,605	2.334	1.969
			Languages	2,778	3,384	0.672	0.694
			Fine Arts	1,695	2,714	0.410	0.556
			Phys. Ed.	3,726	3,954	0.902	0.811
			Commercial	4,048	6,786	0.980	1.391
			Ind. Arts	2,918	309	0.706	0.063
			Home Ec.	89	2,494	0.022	0.511
			Trades & Tech.	0	0	0	0
1956-57	6,211	6,459	Math-Sci.	15,587	15,481	2.509	2.397
			Eng.-Soc.	25,695	27,844	4.137	4.311
			Languages	730	880	0.117	0.136
			Fine Arts	2,721	3,531	0.438	0.547
			Phys. Ed.	6,218	6,756	1.001	1.046
			Commercial	5,969	10,149	0.961	1.571
			Ind. Arts	5,189	265	0.835	0.041
			Home Ec.	104	4,690	0.017	0.726
			Trades & Tech.	0	0	0	0
1961-62	8,989	9,215	Math-Sci.	23,298	22,235	2.592	2.412
			Eng.-Soc.	27,689	29,149	3.080	3.163
			Languages	5,948	6,658	0.662	0.723
			Fine Arts	2,506	2,881	0.279	0.313
			Phys. Ed.	9,165	9,678	1.019	1.050
			Commercial	7,990	12,308	0.889	1.336
			Ind. Arts	6,731	277	0.749	0.030
			Home Ec.	298	4,833	0.033	0.524
			Trades & Tech.	0	0	0	0
1966-67	12,408	12,238	Math-Sci.	30,133	27,443	2.429	2.242
			Eng.-Soc.	25,740	25,906	2.074	2.117
			Languages	7,893	8,206	0.636	0.671
			Fine Arts	4,070	4,577	0.328	0.374
			Phys.Ed.	12,039	12,212	0.970	1.000
			Commercial	13,306	17,287	1.072	1.412
			Ind. Arts	6,420	679	0.517	0.055
			Home Ec.	152	5,628	0.012	0.460
			Trades & Tech.	5,595	825	0.451	[illegible]

Table 17

Grade Eleven Students and Enrolment in High School Subjects in Alberta

Year	Students: Males	Students: Females	Subject Field	Enrolment: Males	Enrolment: Females	Enrol-Stu. Ratio: Males	Enrol-Stu. Ratio: Females
1951-52	3,152	3,904	Math-Sci.	3,241	4,102	1.028	1.051
			Eng.-Soc.	7,554	9,447	2.397	2.420
			Languages	1,559	2,036	0.495	0.521
			Fine Arts	214	266	0.068	0.068
			Phys.Ed.	313	304	0.100	0.078
			Commercial	378	1,679	0.120	0.430
			Ind. Arts	893	53	0.283	0.014
			Home Ec.	9	598	0.003	0.153
			Trades & Tech.	0	0	0	0
1956-57	4,623	5,042	Math.-Sci.	7,947	7,209	1.719	1.430
			Eng.-Soc.	13,607	18,814	2.943	3,731
			Languages	3,900	4,082	0.844	0.812
			Fine Arts	266	483	0.058	0.096
			Phys.Ed.	664	230	0.144	0.046
			Commercial	1,248	4,139	0.270	0.821
			Ind. Arts	1,702	19	0.368	0.004
			Home Ec.	18	886	0.004	0.176
			Trades & Tech.	0	0	0	0
1961-62	7,253	7,253	Math-Sci.	12,650	11,525	1.744	1.589
			Eng.-Soc.	27,448	28,405	3.784	3,916
			Languages	5,834	6,038	0.804	0.832
			Fine Arts	397	304	0.055	0.042
			Phys.Ed.	1,429	787	0.197	0.109
			Commercial	2,732	6,550	0.377	0.903
			Ind. Arts	1,834	20	0.253	0.003
			Home Ec.	21	1,068	0.003	0.147
			Trades & Tech.	0	0	0	0
1966-67	10,544	10,419	Math-Sci.	17,226	14,554	1.634	1.397
			Eng.-Soc.	30,963	32,942	2.937	3.162
			Languages	5,015	6,234	0.476	0.598
			Fine Arts	946	972	0.090	0.093
			Phys.Ed.	2,730	1,215	0.259	0.117
			Commercial	3,923	11,506	0.372	1.104
			Ind. Arts	1,430	76	0.136	0.007
			Home Ec.	360	1,487	0.034	0.143
			Trades & Tech.	1,823	642	0.174	0.062

patterns, no real trends were apparent. Also, the interdependency among the various fields precluded any possibility of testing the effect of alternate assumptions. Thus, for the purpose of testing the model, linear interpolation between years was used. To complete the projections the data that obtained in 1966-67 were used.

Grade twelve. The relationship between the enrolment of males and females in various subject fields and the number of males and females in grade twelve is summarized in Table 18. As was the case with the grade ten and eleven data, no real trends were in evidence in the grade twelve data. Thus, linear interpolation was used to test the model and the 1966-67 ratios were used to complete the projections.

It should be noted that many grade eleven and twelve students were likely taking grade ten subjects and were thus counted with the grade ten students. Similarly, many grade twelve students were likely taking grade eleven subjects and were counted with the grade elevens. Because it was impossible to disaggregate the enrolments according to real grade level this problem had to be ignored. However, on the basis of the relationship between population changes and social changes rather than biological changes (4, p. 596) and the conclusion that population changes occur over a period of years, the problem stated above should have little effect on the resulting projections.

PUPIL-TEACHER RATIOS

In order to relate the number of students in various grades to the number of teachers required, it was decided to use a variety of pupil-teacher ratios. By using data reported in the Department of

Table 18

Grade Twelve Students and Enrolment in High School Subjects in Alberta

Year	Students Males	Students Females	Subject Field	Enrolment Males	Enrolment Females	Enrol-Stu. Ratio Males	Enrol-Stu. Ratio Females
1951-52	3,043	3,115	Math-Sci.	5,317	5,136	1.747	1.649
			Eng.-Soc.	3,869	4,503	1.271	1.446
			Languages	807	1,015	0.265	0.326
			Fine Arts	55	61	0.018	0.020
			Phys.Ed.	313	304	0.103	0.098
			Commercial	45	247	0.015	0.079
			Ind. Arts	211	6	0.069	0.002
			Home Ec.	0	46	0.000	0.015
			Trades & Tech.	0	0	0	0
1956-57	4,192	3,531	Math-Sci.	9,761	7,521	2.328	2.130
			Eng.-Soc.	6,999	6,817	1.670	1.931
			Languages	2,163	2,375	0.516	0.701
			Fine Arts	44	147	0.010	0.042
			Phys.Ed.	0	0	0.000	0.000
			Commercial	114	753	0.027	0.213
			Ind. Arts	189	1	0.045	0.000
			Home Ec.	1	73	0.000	0.021
			Trades & Tech.	0	0	0	0
1961-62	7,791	6,369	Math-Sci.	15,943	12,251	2.046	1.924
			Eng.-Soc.	12,708	11,456	1.631	1.799
			Languages	3,810	4,091	0.489	0.642
			Fine Arts	95	67	0.012	0.011
			Phys.Ed.	0	0	0.000	0.000
			Commercial	400	2,109	0.051	0.331
			Ind. Arts	212	0	0.027	0.000
			Home Ec.	1	97	0.000	0.015
			Trades & Tech.	0	0	0	0
1966-67	11,759	10,211	Math-Sci.	21,168	16,171	1.800	1.584
			Eng.-Soc.	18,729	17,165	1.593	1.681
			Languages	3,359	4,778	0.286	0.468
			Fine Arts	323	317	0.027	0.031
			Phys.Ed.	212	65	0.018	0.006
			Commercial	1,512	6,427	0.129	0.629
			Ind. Arts	90	4	0.008	0.000
			Home Ec.	2	318	0.000	0.031
			Trades & Tech.	997	229	0.085	0.022

Education Annual Reports, estimates of the number of teachers at each level were obtained. The relationship between the number of high school students and various specialist teachers was estimated from data obtained from the Department of Education A Cards.

Teachers at various levels. Although the total number of teachers employed in Alberta was reported for each year in the Annual Reports of the Department of Education there was not a complete disaggregation by levels. However, because the total number of high school teachers was reported, the total number of elementary and junior high school teachers could be found. By assuming a relationship between the number of classrooms and the number of teachers and using the reported number of elementary and junior high school classrooms, the number of elementary and the number of junior high school teachers was estimated. This estimate for 1966-67 agreed with an estimate made by the A.I.A. (2, p. 35). The estimates and the pupil-teacher ratios are reported in Table 19.

As illustrated in Table 19, the pupil-teacher ratio in the junior high school as well as in the high school has remained relatively static while the pupil-teacher ratio in the elementary schools has been decreasing. Thus, while the alternate assumptions about the pupil-teacher ratio in the junior high schools could be based on the low, medium, and high values, the alternate assumptions about the pupil-teacher ratio in elementary schools had to take into account the existing trend. The high value for elementary schools was based on the mean value over the past years. The medium value was based on a continuation of the 1966-67 value. The low value was based on [illegible]

Table 19

Pupil-Teacher Ratio in Alberta in Various Years

Year	Level	Teachers	Pupils	Pupil-Teacher Ratio
1951-52	Elementary	4,097	115,655	28.2:1
	Jr. High	1,714	41,813	24.4:1
	High	1,127	22,223	19.7:1
1956-57	Elementary	5,487	149,111	27.2:1
	Jr. High	2,316	55,228	23.8:1
	High	1,470	30,058	20.4:1
1961-62	Elementary	7,880	184,659	23.4:1
	Jr. High	3,017	76,173	25.2:1
	High	2,445	46,870	19.2:1
1966-67	Elementary	10,393	213,058	20.5:1
	Jr. High	4,362	92,256	21.1:1
	High	3,559	67,579	19.0:1

estimated from a best-fit regression line. The equation of the regression line that was used was

$$X = -0.538Y + 1078.5$$

where X was the pupil-teacher ratio and Y was the year.

The alternate assumptions regarding the pupil-teacher ratio for elementary schools over the period 1967-68 through 1980-81 were that the pupil-teacher ratio would

1) decrease to 20.3 in 1967-68, 19.7 in 1968-69, 19.2 in 1969-70, 18.6 in 1970-71, 18.1 in 1971-72, 17.6 in 1972-72, 17.0 in 1973-74, 16.5 in 1974-75, 16.0 in 1975-76, 15.4 in 1976-77, 14.9 in 1977-78, 14.3 in 1978-79, 13.8 in 1979-80, and 13.3 in 1980-81.
2) remain at 20.5.
3) increase to and remain at 24.8.

The alternate assumptions regarding the pupil-teacher ratio for junior high schools over the period 1967-68 through 1980-81 were that the pupil-teacher ratio would

1) remain at 21.1.
2) increase to and remain at 23.6.
3) increase to and remain at 25.2.

The pupil-teacher ratios for high schools were somewhat more complex due to the attempt to account for various specialties.

High school specialists. To attempt to account for specific shortages and over supplies of teachers, pupil-teacher ratios were constructed to relate the total pupils registered in various courses to the number of teachers required.

As illustrated in Table 20, the pupil-teacher ratio for the subject areas varied from 14.76 to 23.78 in 1961-62. These pupil-teacher ratios were found by a random sampling of the Department of Education A-Cards. The number of students in each subject area was compiled from the Annual Report of the Department of Education. From these two sets of figures, the number of classes was calculated.

According to the A.T.A. report The Professional Load of Alberta Teachers the reported teaching time amounts to an average of 7.4 full courses. For physical education, where the class time ranges from less than one-half of a full course to a full course, the teaching time amounts to about 10.6 classes. However, the data reported by the A.T.A. includes only full-time classroom teachers and not department heads, coordinators, supervisors, or administrators (3, p. 8). Thus, the teaching load can be expected to be high.

From the teaching load and the number of classes, the number of teachers was calculated. The number of teachers was then corrected to the total number as reported by the Department of Education. For comparative purposes, the corrected average teaching load was calculated and shown in Table 20.

The data for 1966-67 were treated in a similar way to the data for 1961-62. These data are shown in Table 21, page 71. It should be noted that some decrease has assumed in the teaching load.

Because data were not available for 1951-52 and 19[illegible], changes in pupil-teacher ratios and teaching load were extrapolated back over time to estimate the values that obtained. The extrapolated values were

Table 20

Number of Teachers of Various High School Subjects in Alberta 1961-62

Subject Field	Pupil-teacher Ratio[1]	Number of Students[2]	Number of Classes	Teaching Load[3] Req't'd	Teaching Load[3] Corr'd	Number of Teachers Cal'd	Number of Teachers Corr'd
Math-Science	21.78	98,296	4,513	7.4	6.26	610	721
English-Social St.	23.78	134,073	5,638	7.4	6.26	762	900
Languages	21.19	32.379	1,528	7.4	6.26	206	243
Fine Arts	14.76	6,250	423	7.4	6.26	57	67
Physical Ed.	17.31	21,059	1,216	10.6	8.94	115	136
Commercial	22.23	32,089	1,443	7.4	6.26	195	230
Industrial Arts	17.20	8,928	519	7.4	6.26	70	83
Home Economics	15.87	6,291	396	7.4	6.26	54	64
Trades & Tech.	0	0	0	0	0	0	0

[1] Appendix A.

[2] Government of Alberta, Department of Education, Annual Report. Edmonton: Queen's Printer, 1951-1967.

[3] Alberta Teachers' Association, The Professional Load of Alberta Teachers. Edmonton: Alberta Teachers' Association, 1963.

Table 21

Number of Teachers of Various High School Subjects in Alberta: 1966-67

Subject Field	Pupil-Teacher Ratio[1]	Number of Students[2]	Number of Classes	Teaching Load Rept'd	Teaching Load Cal'd	Number of Teachers Cal'd	Number of Teachers Corr'd
Math-Science	21.66	126,695	5,849	7.4	5.63	790	1,038
English-Social St.	23.15	151,445	6,542	7.4	5.63	884	1,162
Languages	20.47	34,485	1,734	7.4	5.63	234	308
Fine Arts	18.34	11,205	611	7.4	5.63	83	109
Physical Ed.	21.21	28,473	1,342	10.6	8.04	127	167
Commercial	21.91	53,961	2,463	7.4	5.63	332	436
Industrial Arts	15.09	8,699	576	7.4	5.63	78	103
Home Economics	14.50	7,947	548	7.4	5.63	74	97
Trades & Tech.	15.94	10,120	635	6.0	4.57	106	139

[1] Appendix B.

[2] Government of Alberta, Department of Education, Annual Report. Edmonton: Queen's Printer, 1951-1967.

used to test the model.

In order to complete the projections, the pupil-teacher ratios that obtained in 1966-67 were used. As Dressel claims, it is in order to assume no change in pupil-teacher ratios unless there is a deliberate attempt being made to change them (9, p. 276).

Special education. One of the present trends in Alberta's education is toward the provision of special education classes for the handicapped children. Although no exact data as to the present extent of these services were available, it was thought advisable to test various assumptions about the development of special education in the future.

Although special education has often been claimed to be for students who have exceptional learning abilities, there are specific learning problems that are associated with special education programs. Specifically, children in need of special education include, according to Cameron,

> Children with: (1) intellectual limitations (the slow learners, the mentally retarded), (2) intellectual superiority (the gifted, the talented), (3) behavior limitations (the emotionally disturbed, the socially maladjusted), (4) special impairments, (5) learning impairments (the hard of learning, the deaf), (6) visual impairments (the partially sighted, the blind), and (7) nonsensory physical handicaps and neuralogical defects (the crippled, the chronic health problems, and the brain damaged) (5, p. 58).

The main thrust of special education programs has been to provide services for children in all categories above except those of intellectual superiority (5, p. 62). Thus, according to the Dominion Bureau of Statistics data, special education would have to accommodate about 7.24 per cent of all children (7). Dunn estimates the proportion to be about 8 per cent of all children (10, p. 51).

In 1963-64, the public schools of Alberta provided special education classes for about 1,923 children and required the services of 153 teachers. Thus 0.94 per cent of the elementary school children were being accommodated by 1.72 per cent of the teachers with an average class size of 12.57 pupils per teacher (5, p. 62).

If in the future the size of the special classes is to be maintained as proportionately smaller than the normal classes and if a deliberate attempt is made to accommodate handicapped children in the elementary schools, then when 8 per cent of the children are in special classes, 14.64 per cent of the elementary teachers will be special education teachers.

The effect of a deliberate policy of accommodation of exceptional students was tested by examination of the output of the model without any additional assumptions as input since this variable was controllable.

SUMMARY

Since the purpose of the study was to predict the demand for teachers, the number of teachers was related to the number of pupils through specific pupil-teacher ratios. The number of pupils was related to the population through attendance ratios. In order to predict the population, data were gathered on births and deaths.

In many cases, data were assumed for future time periods. If the variable in question was largely uncontrollable by the school system, alternate assumptions were made so that they could be tested for effect. Also, as was the case with special education, where limited data were available and objectives not clear, alternate assumptions were made and tested for effect.

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Chapter 6

TEACHER DEMAND PROJECTIONS

In order to establish the projected demand for teachers, it was necessary to make use of the data outlined in Chapter 4. These data were used with the programs listed in Appendix C, Appendix D, and Appendix E to produce two sets of tests of the demand model as well as one set of demand projections.

TOTAL DEMAND FOR TEACHERS

Although the model was designed to calculate the demand for teachers at various levels and of various high school specialties, it was thought desirable to examine both the tests of the model and the actual projections for total teacher demand.

Tests of the Demand Model

Although the basic data for the tests of the demand model were available, it was necessary to include some alternate assumptions near the end of the time period. Thus two sets, including high, medium, and low assumptions, of test projections were produced.

Tests using 1951 and 1956 population data. The 1951 and 1956 census population data were used with the demand model illustrated in Appendix C. Alternate sets of birth and death rates were used for 1968 and 1969; alternate sets of attendance rates and pupil-teacher ratios were used for 1967-68, 1968-69, 1969-70, and 1970-71. The use of the alternate sets of data resulted in three sets of test projections. The total number of teachers demand according to the test projections as well as the total that obtained is illustrated in Table 22.

As illustrated in Figure 3 the projections that resulted from the test of the model all produced the same values up to the 1966-67 school year. Beginning in 1967-68, due to the lack of complete data, alternate assumptions were necessary and resulted in three different sets of values.

The single projected values differed slightly from reality in all years. In 1961-62, the projected value was less than the real value by 0.7 per cent. Over the period 1962-63 to 1966-67 the projected values were more than the real values by 1.7 per cent, 3.1 per cent, 3.7 per cent, 3.6 per cent, and 3.9 per cent respectively. For the 1967-68 term, the high projection was 7.0 per cent above the actual, the medium projection was 0.6 per cent below the actual, and the low projection was 16.1 per cent below the actual. For the 1968-69 term, the high projection was 6.2 per cent above the actual, the medium projection was 3.0 per cent below the actual, and the low projection was 18.2 per cent below the actual.

Although the range between the high projection and the low projection includes the actual value, the range itself is so broad as to be of little value toward making predictions. Bradley suggests that a distribution which is the result of variations in a large number of factors is likely to result in a normal distribution (1, p. 2). Since each of the variables in this study were the result of a number of factors, it is reasonable to believe that a normal distribution would be

Table 22

Test of Demand Model Using 1951 and 1956 Data

Year	Teachers Demanded Low	Medium	High	Actual
1961-62	13,248	13,248	13,248	13,342
1962-63	14,227	14,227	14,227	13,988
1963-64	15,437	15,437	15,437	14,972
1964-65	16,600	16,600	16,600	16,007
1965-66	17,805	17,805	17,805	17,183
1966-67	19,025	19,025	19,025	18,314
1967-68	16,418	19,459	20,948	19,579
1968-69	16,930	20,057	21,974	20,687
1969-70	17,383	20,576	22,864	
1970-71	17,779	21,130	23,984	

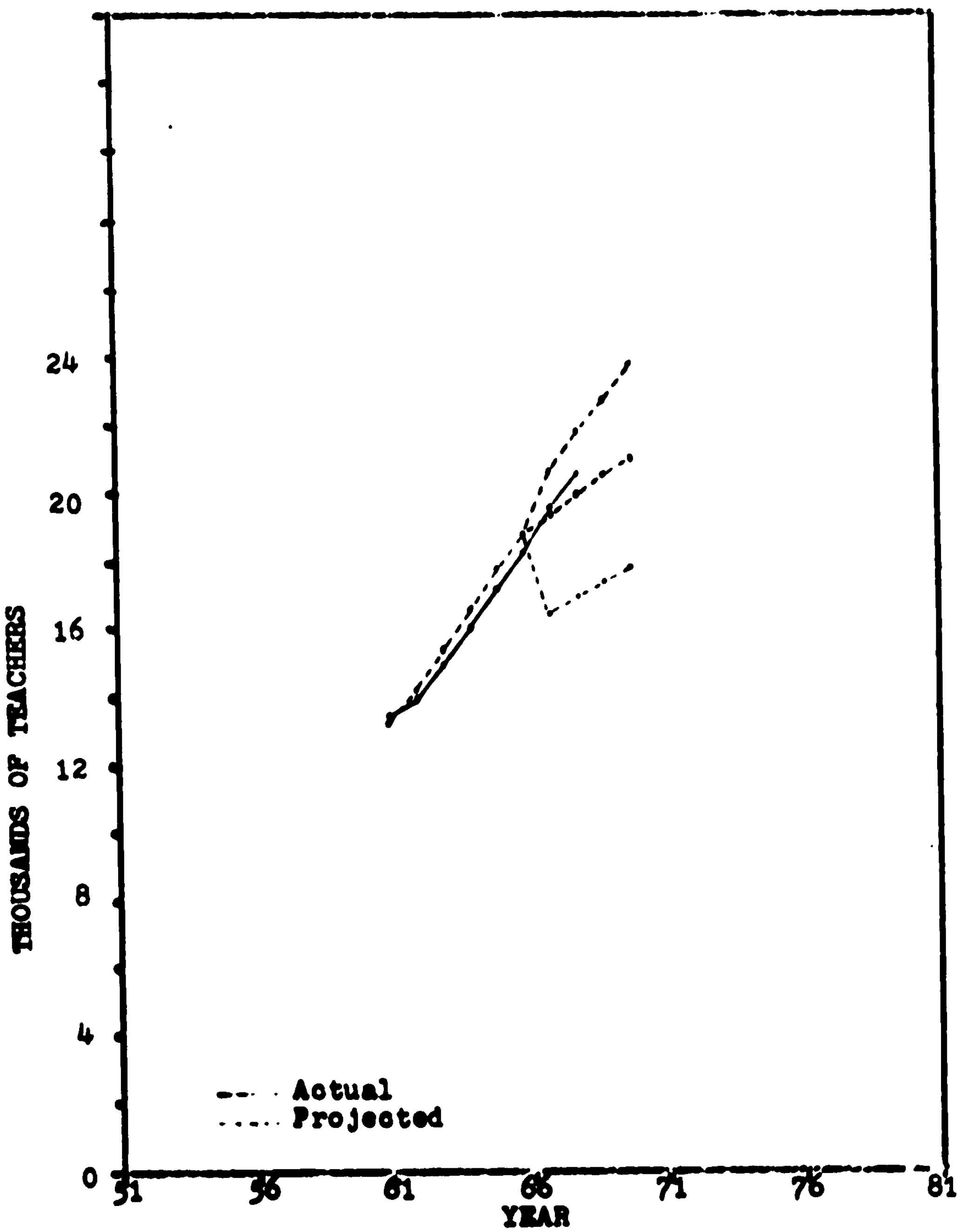

FIGURE 3

PROJECTED TOTAL DEMAND FOR TEACHERS IN ALBERTA FROM 1951 AND 1956 DATA representative of the projected demand for teachers. Thus the procedure outlined by Hillier and Lieberman in a discussion of PERT was used to reduce the range of the projections (2, p. 229). Essentially, the method discussed treats the range between the high and low value as six standard deviations. The distribution is considered centered about a point two-thirds of the way between the mid-range and the medium value (2, p. 230).

The above procedure was used to establish the 95 per cent confidence limits for the projections and to test these limits against the actual values. For 1967-68 the 95 per cent confidence limits were 17,720 to 20,679 and included the actual value of 19,579. For 1968-69 the 95 per cent confidence limits were 18,207 to 21,503 and included the actual value of 20,687. Thus, the predictions using this procedure would appear to have some degree of accuracy.

Tests using 1956 and 1961 population data. The 1956 and 1961 population data were used with the demand model illustrated in Appendix D. As with the previous test, alternate sets of assumptions were used to produce a high, medium and low value where complete data were not available.

As illustrated in Figure 4 the demand predicted for 1966-67 was 3.6 per cent too high. For 1967-68, the low value predicted was 16.5 per cent too low, the medium value was 1.1 per cent too high, and the high value was 6.5 per cent too high. For 1968-69 the low value was 18.6 per cent too low, the medium value was 3.7 per cent too low and the high value was 5.6 per cent too high.

Table 23

Test of Demand Model Using 1956 and 1961 Data

Year	Teachers Demanded			Actual
	Low	Medium	High	
1966-67	18,971	18,971	18,971	18,314
1967-68	16,350	19,357	20,856	19,579
1968-69	16,832	19,925	21,840	20,687
1969-70	17,262	20,409	22,686	
1970-71	17,632	20,932	23,756	
1971-72	17,961	21,495	24,925	
1972-73	18,258	22,106	26,263	
1973-74	18,529	22,765	27,873	
1974-75	18,792	23,470	29,583	
1975-76	19,051	24,227	31,476	

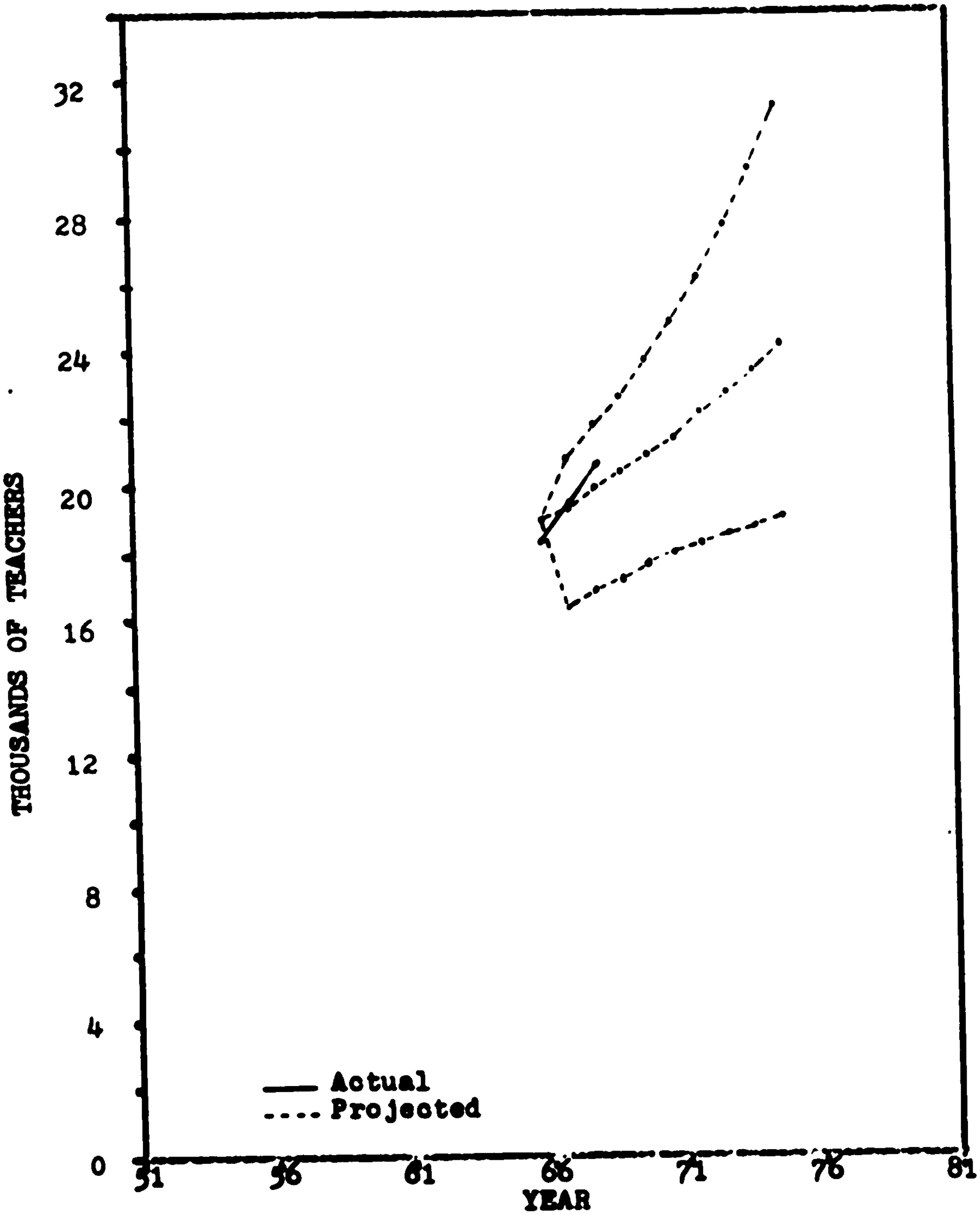

FIGURE 4

PROJECTED TOTAL DEMAND FOR TEACHERS IN ALBERTA FROM 1956 AND 1961 DATA

When the 95 per cent confidence limits were calculated, the result was an interval from 17,634 to 20,578 for 1967-68 and from 18,093 to 21,365 for 1968-69. It should be noted that in both cases, the confidence limits included the actual value.

Projected Total Demand

The 1961 and 1966 population data were used with the demand model illustrated in Appendix E. Alternate sets of assumptions regarding birth rates, death rates, attendance rates, and pupil-teacher ratios were also used. Three sets of projections resulted from the use of these data.

As illustrated in Table 24, the set of assumptions used in the projections was important in terms of the projected demand. For the 1971-72 school term, the low projection was 17.6 per cent less than the medium and the high was 14.1 per cent more than the medium. By 1980-81 the low projection was 28.4 per cent less than the medium and the high projection was 53.6 per cent more than the medium. The variations in the projections can be illustrated by examining the range between the high and low projection. In 1971-72 the range was 6,284 and in 1980-81 the range was 19,303. The graphs in Figure 5 illustrate the extent to which the range increases over the time period between 1971-72 and 1980-81.

Even though the range of the projected demand was large, some conclusions about the total demand for teachers could be drawn. If the conditions which produce the lowest likely demand were to obtain throughout the period of the study, after an initial decrease in demand,

Table 24

Projected Total Demand for Teachers in Alberta:
1971-72 to 1980-81

Year	Demand			95 per cent Confidence Limits	
	Low	Medium	High	Lower	Upper
1971-72	16,343	19,529	22,627	17,662	21,767
1972-73	16,413	19,940	23,537	17,624	22,279
1973-74	16,460	20,184	24,660	17,631	22,988
1974-75	16,500	20,569	25,847	17,717	23,824
1975-76	16,537	20,987	27,163	17,804	24,746
1976-77	16,579	21,439	28,729	17,875	25,813
1977-78	16,629	21,922	30,327	17,966	26,915
1978-79	16,690	22,438	32,210	18,039	28,178
1979-80	16,768	22,975	34,107	18,132	29,460
1980-81	16,875	23,539	36,160	18,223	30,834

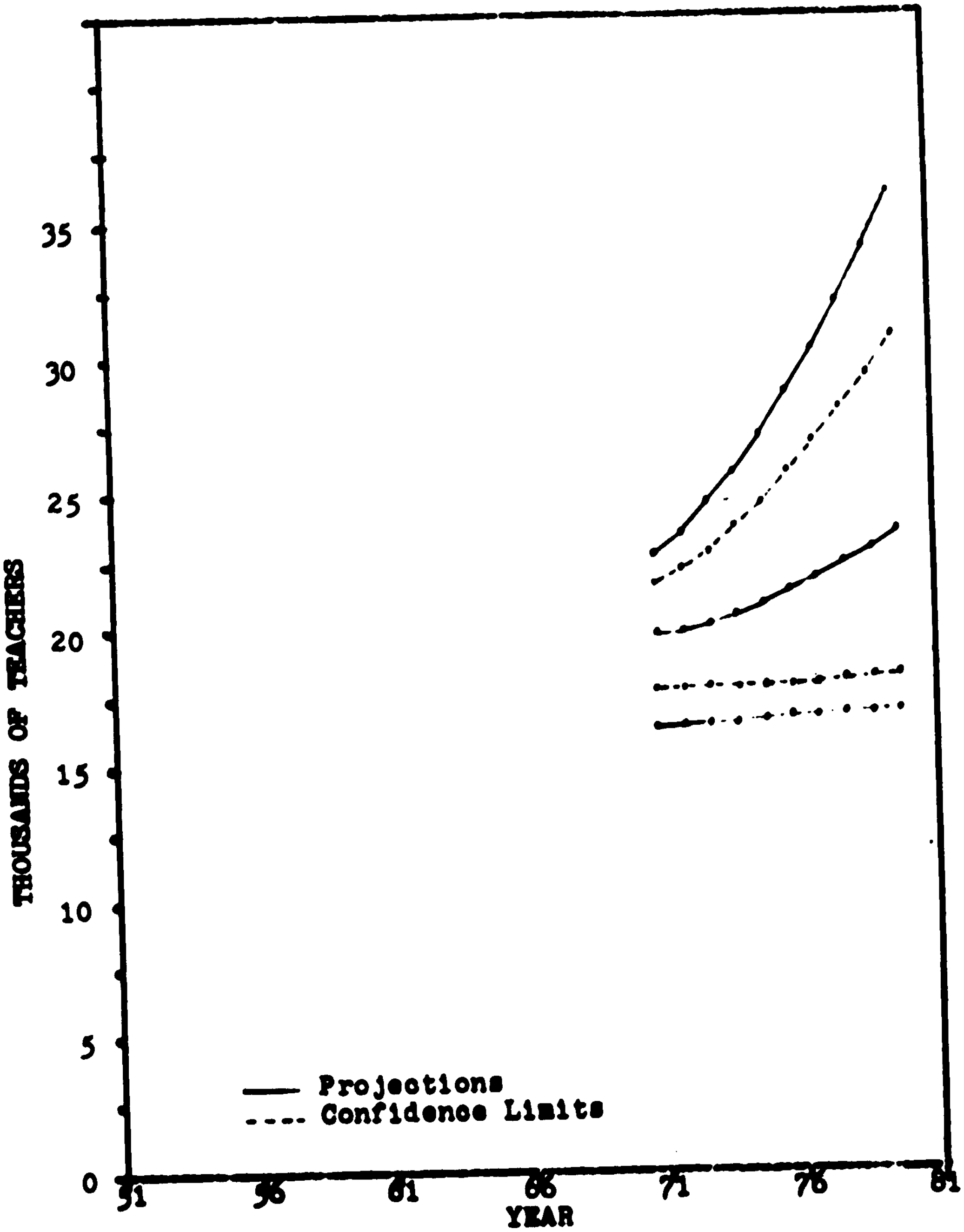

FIGURE 5

PROJECTED TOTAL DEMAND FOR TEACHERS IN ALBERTA
FROM 1961 AND 1966 DATA

a continuing slight increase would occur. If the conditions which produced the highest demand were to obtain, the teaching force in Alberta would have to be increased in size by nearly 50 per cent over the next ten years. Any conditions between these two extremes will produce a continuing increase in the demand for teachers which will be much like the increase that has occurred in the past.

DEMAND FOR TEACHERS AT VARIOUS LEVELS

Although there may be some utility in projecting the total demand for teachers, some gains can be made by disaggregating the demand. For this reason, the models were tested and used to project the demand for teachers of elementary school, junior high school, and high school.

Tests of the Demand Model

The projections that resulted from the use of the test data in the models was disaggregated to project the demand for teachers at various levels. In some cases, these projections could be compared to the conditions that actually obtained.

Tests using 1951 and 1956 population data. As was mentioned previously, the model shown in Appendix C was tested. The results of this test are illustrated in Table 25, Table 26, and Table 27.

At each of the levels, alternate assumptions produced low, medium and high estimates of the teacher demand for the years following 1966-67. The actual demand was available for the years 1961-62 and 1966-67 allowing the accuracy of the projection to be examined. In the case of the demand for elementary school teachers the projections were

Table 25

Test Demand for Elementary School Teachers in Alberta
Using 1951 and 1956 Population Data

Year	Demand			Actual
	Low	Medium	High	
1961-62	7,896	7,896	7,896	7,880
1962-63	8,497	8,497	8,497	
1963-64	9,115	9,115	9,115	
1964-65	9,745	9,745	9,745	
1965-66	10,395	10,395	10,395	
1966-67	11,028	11,028	11,028	10,393
1967-68	9,178	11,410	11,836	
1968-69	9,379	11,666	12,471	
1969-70	9,540	11,855	12,988	
1970-71	9,664	12,109	13,769	

Table 26

Test Demand for Junior High School Teachers in Alberta
Using 1951 and 1956 Population Data

Year	Demand			Actual
	Low	Medium	High	
1961-62	2,936	2,936	2,936	3,017
1962-63	3,207	3,207	3,207	
1963-64	3,495	3,495	3,495	
1964-65	3,800	3,800	3,800	
1965-66	4,114	4,114	4,114	
1966-67	4,450	4,450	4,450	4,362
1967-68	3,678	4,096	4,769	
1968-69	3,828	4,262	4,963	
1969-70	3,964	4,416	5,143	
1970-71	4,088	4,550	5,296	

Table 27

Test Demand for High School Teachers in Alberta
Using 1951 and 1956 Population Data

Year	Demand			
	Low	Medium	High	Actual
1961-62	2,416	2,416	2,416	2,445
1962-63	2,523	2,523	2,523	
1963-64	2,827	2,827	2,827	
1964-65	3,055	3,055	3,055	
1965-66	3,296	3,296	3,296	
1966-67	3,547	3,547	3,547	3,559
1967-68	3,562	3,953	4,343	
1968-69	3,723	4,129	4,540	
1969-70	3,879	4,305	4,933	
1971-72	4,027	4,471	4,919	

0.2 per cent high for 1961-62 and 6.1 per cent high for 1966-67. In the case of the demand for junior high school teachers, the projections were 2.7 per cent low for 1961-62 and 2.0 per cent high for 1966-67. In the case of the demand for high school teachers, the projections were 1.2 per cent low for 1961-62 and 0.3 per cent low for 1966-67.

Tests using 1956 and 1961 population data. Since the only projection produced from the 1956 and 1961 population data that could be compared with the actual was for 1966-67, it was not thought necessary to include the complete set of projections. The projections for 1966-67 for the demand for elementary teachers were 4.1 per cent high, for the demand for junior high school teachers were 4.7 per cent high, and for the demand for high school teachers were 0.6 per cent high.

The tests of the model illustrate the fact that the margin of error of the predictions was far less than the range of projections resulting from the alternate assumptions.

Projected Demand for Elementary School Teachers

The projection, resulting from the use of the 1961 and 1966 population data as well as alternate assumptions about attendance and pupil-teacher ratios, were disaggregated to show the specific demand for elementary school teachers. These projections are illustrated in Table 28.

As illustrated in Figure 6 the low projections decrease from 8,372 in 1971-72 to 8,263 in 1975-76 and then increase to 8,433 in 1980-81. The medium projections gradually increase from 10,654 in 1971-72 to 13,092 in 1980-81. The high projections increase rapidly

Table 28

Projected Demand for Elementary School Teachers in Alberta: 1971-72 to 1980-81

Year	Demand			95 per cent Confidence Limits	
	Low	Medium	High	Lower	Upper
1971-72	8,372	10,654	12,578	9,198	11,975
1972-73	8,331	10,816	13,300	9,193	12,439
1973-74	8,296	11,019	14,223	9,163	13,035
1974-75	8,272	11,255	15,184	9,154	13,671
1975-76	8,263	11,519	16,247	9,156	14,372
1976-77	8,268	11,805	17,528	9,144	15,194
1977-78	8,289	12,109	18,807	9,153	16,025
1978-79	8,324	12,427	20,339	9,137	16,987
1979-80	8,373	12,755	21,859	9,137	17,947
1980-81	8,433	13,092	23,508	9,127	18,976

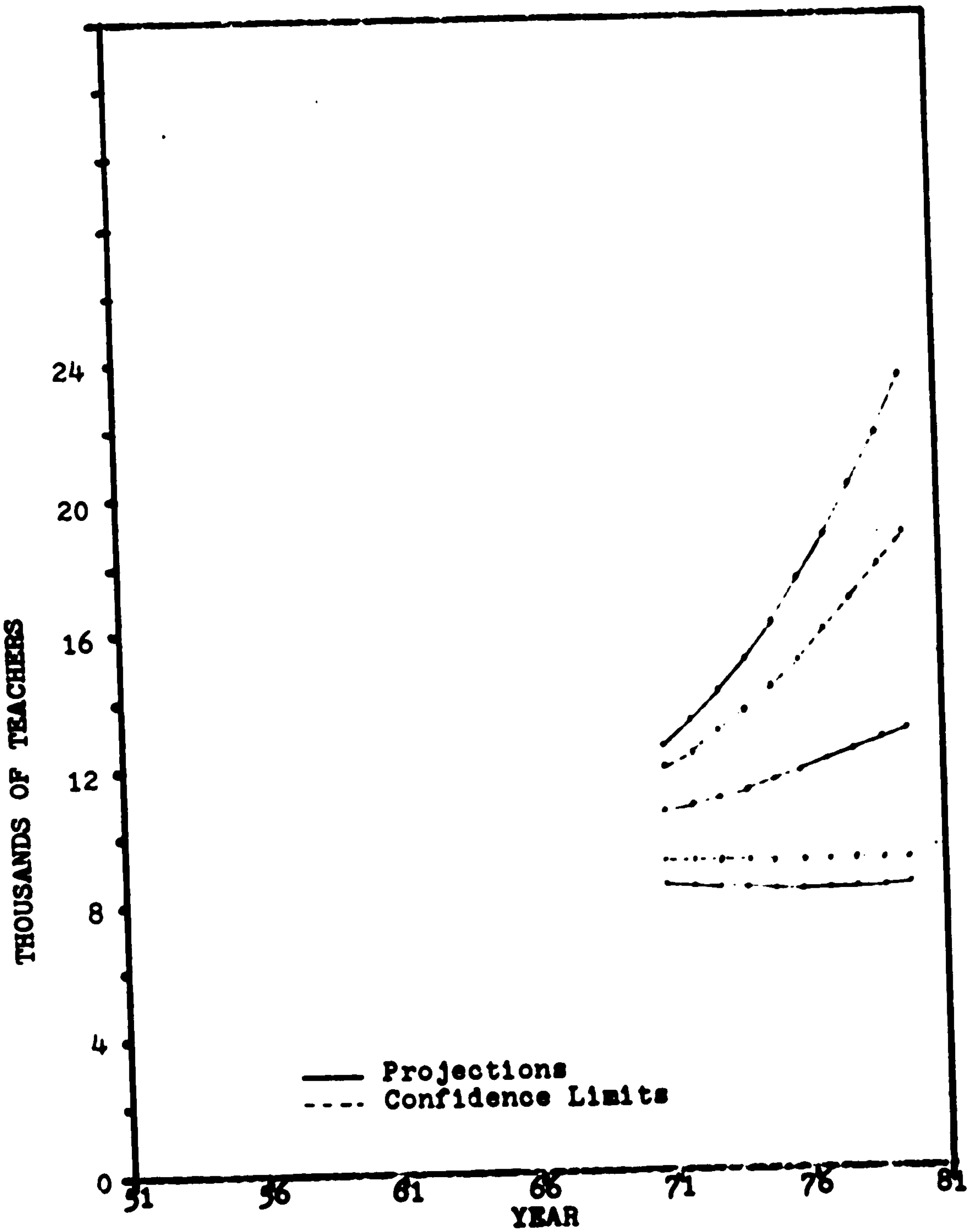

FIGURE 6

PROJECTED DEMAND FOR ELEMENTARY SCHOOL TEACHERS
IN ALBERTA

from 12,578 in 1971-72 to 23,508 in 1980-81.

When the 95 per cent confidence limits were used, the rahge of the projections was reduced to some extent. The demand for elementary school teachers was predicted to be between 9,198 and 11,975 in 1971-72. In 1980-81, the demand for elementary school teachers was predicted between 9,127 and 18,976. It is interesting to note that if all the conditions necessary to produce the lowest demand for teachers obtained, after an initial decrease in demand, the year-to-year decrease in demand would be slight. The configuration of the projection illustrated in Figure 6 would suggest a continuing gradual increase in the demand for elementary school teachers.

Projected Demand for Junior High School Teachers

The projected demand for junior high school teachers resulting from the use of 1961 and 1966 population data and the alternate assumptions are listed in Table 29.

As illustrated in Figure 7, the low projection of the demand for junior high school teachers increase slightly and gradually from 3,889 in 1971-72 to 4,008 in 1980-81. The medium projection for the demand for junior high school teachers shows a relatively steady increase from 4,346 in 1971-72 to 5,088 in 1980-81. The high projections for the demand of junior high school teachers shows a fairly rapid increase from 5,063 in 1971-72 to 6,422 in 1980-81.

The 95 per cent confidence limits tend to emphasize the fact that the demand for junior high school teachers will likely increase gradually. The lower confidence limit increases from 4,011 in 1971-72

Table 29

Projected Demand for Junior High School Teachers in Alberta:
1971-72 to 1980-81

Year	Demand Low	Demand Medium	Demand High	95 per cent Confidence Limits Lower	95 per cent Confidence Limits Upper
1971-72	3,899	4,346	5,063	4,011	4,771
1972-73	3,931	4,399	5,139	4,050	4,839
1973-74	3,951	4,455	5,232	4,082	4,919
1974-75	3,964	4,519	5,346	4,113	5,016
1975-76	3,971	4,591	5,481	4,143	5,129
1976-77	3,975	4,672	5,636	4,174	5,159
1977-78	3,980	4,763	5,810	4,209	5,405
1978-79	3,986	4,863	6,001	4,248	5,565
1979-80	3,995	4,972	6,205	4,293	5,737
1980-81	4,008	5,008	6,422	4,342	5,919

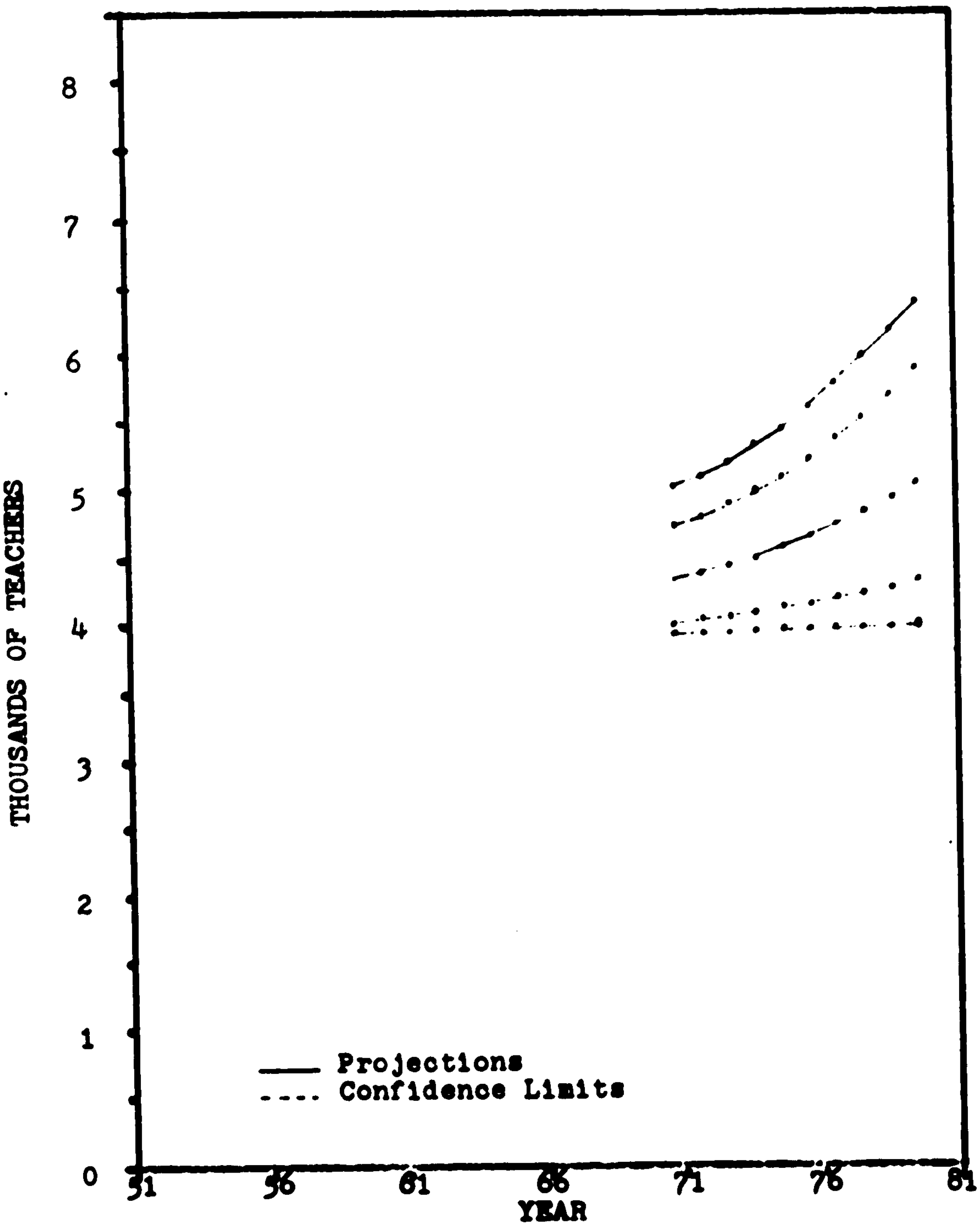

FIGURE 7

PROJECTED DEMAND FOR JUNIOR HIGH SCHOOL
TEACHERS IN ALBERTA

to 4,342 in 1980-81. The upper confidence limit shows an increase from 4,771 in 1971-72 to 5,919 in 1980-81.

Projected Demand for High School Teachers

The projected demand for high school teachers, illustrated in Table 30, resulted from the use of 1961 and 1966 population data as well as alternate assumptions about the other variables.

As illustrated in Figure 8, the low projections of the demand for high school teachers increased gradually from 4,072 in 1971-72 to 4,416 in 1980-81. The medium projections of the demand for high school teachers increased from 4,529 in 1971-72 to 5,359 in 1980-81. The high projections of the demand for high school teachers increased from 4,986 in 1971-72 to 6,230 in 1980-81.

The use of the 95 per cent confidence limits, while reducing the range, also lends support to the idea that the demand for high school teachers will continue to increase throughout the time period of the study since the lower limit of 1980-81 is very nearly as great as the upper limit of 1971-72.

Thus, the projected demand at various levels would suggest a steady or slightly increasing demand for elementary school teachers, a slight increase in demand for junior high school teachers, and a continuing moderately increasing demand for high school teachers over the time period 1971-72 through 1980-81.

Table 30

Projected Demand for High School Teachers in Alberta:
1971-72 to 1980-81

Year	Demand			95 per cent Confidence Limits	
	Low	Medium	High	Lower	Upper
1971-72	4,072	4,529	4,529	4,230	4,828
1972-73	4,151	4,625	5,098	4,315	4,934
1973-74	4,213	4,710	5,205	4,386	5,034
1974-75	4,264	4,795	5,317	4,450	5,137
1975-76	4,303	4,877	5,435	4,505	5,244
1976-77	4,336	4,962	5,565	4,557	5,360
1977-78	4,360	5,050	5,710	4,604	5,486
1978-79	4,380	5,148	5,870	4,654	5,627
1979-80	4,400	5,248	6,043	4,702	5,776
1980-81	4,416	5,359	6,230	4,754	5,940

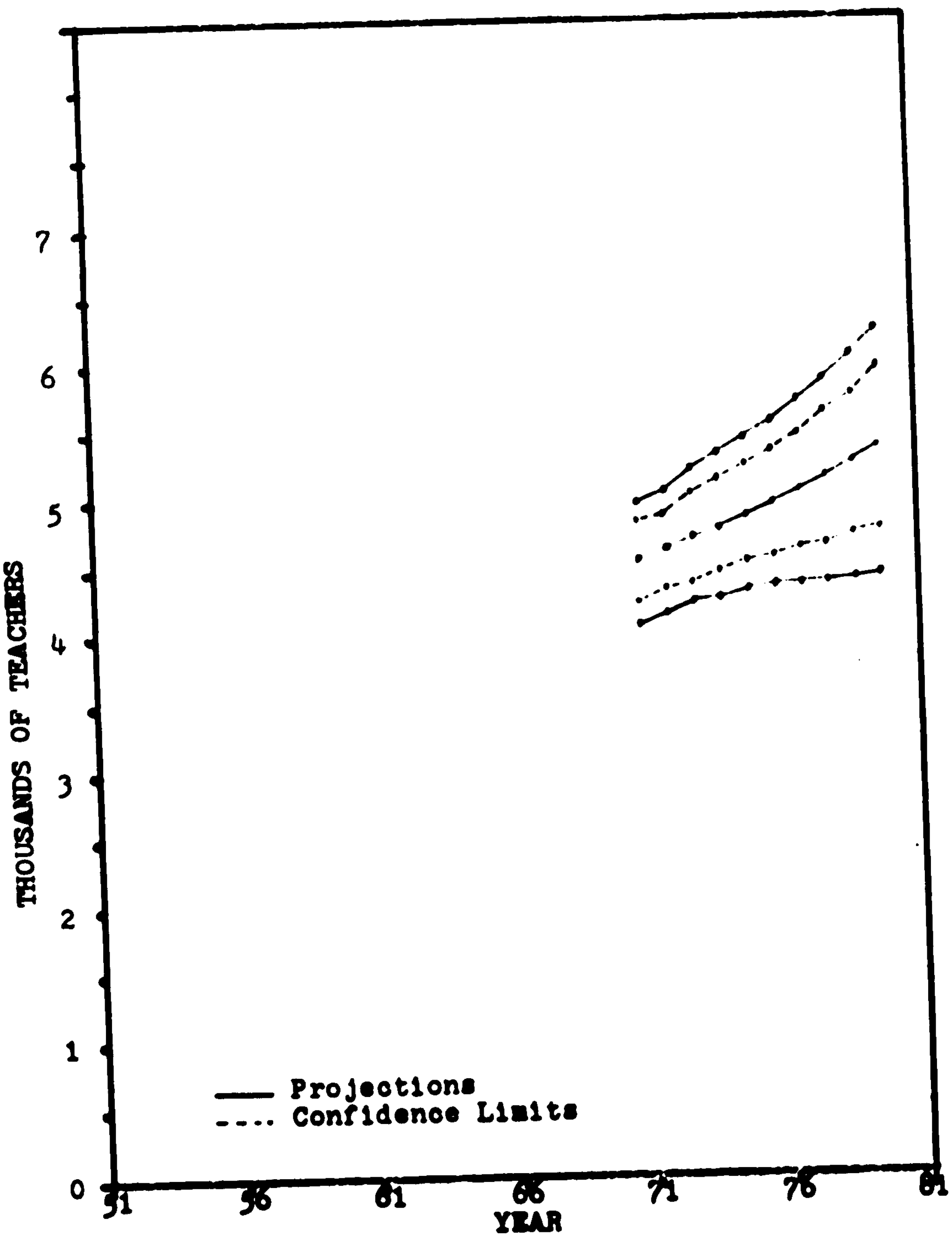

FIGURE 8

PROJECTED DEMAND FOR HIGH SCHOOL TEACHERS
IN ALBERTA

DEMAND FOR HIGH SCHOOL TEACHERS OF VARIOUS SPECIALTIES

Since the teaching of high school subjects is becoming highly specialized, a large discrepancy between the supply and demand of a particular kind of high school teacher would constitute a shortage or over supply of teachers. Thus, the demand for high school teachers was further disaggregated into nine broad specialties. The model was also tested in this regard.

Tests of the Model

Since the actual number of each of the high school specialties was estimated only for 1961-62 and 1966-67, the projections from the test runs for only these years were considered.

As illustrated in Table 31, the projected demand for high school teachers of various subjects compares closely to the actual number for each year. To determine the differences between the various distributions a Chi Square test was used. In comparing the 1951-1956 projection to the actual for 1961-62, a Chi Square value of 0.60 was found. In comparing the 1951-1956 projection to the actual for 1966-67, a Chi Square of 0.50 was found. In comparing the 1956-1961 projection to the actual for 1966-67, a Chi Square of 0.73 was found. All of the Chi Square values calculated indicate no significant difference at a level beyond the 0.01 level.

Table 31

Test Projections of Demand for High School Specialists in Alberta in 1961-62 and 1966-67

	1961-62		1966-67		
Specialty	1951-56 Test	Actual	1951-56 Test	1956-61 Test	Actual
Math-Sci.	705	721	1,030	1,039	1,038
Eng.-Soc.	899	900	1,147	1,157	1,162
Languages	239	243	306	309	308
Fine Arts	67	67	110	112	109
Phys.Ed.	134	136	170	172	167
Commercial	226	230	438	443	436
Ind. Arts	84	83	106	107	103
Home Ec.	62	64	98	100	97
Trade & Tech.	0	0	142	143	139

Projected Demand for High School Teachers of Various Specialties

The use of the 1961 and 1966 population data as well as sets of alternate assumptions resulted in three projections of the demand for high school teachers of each of a number of specialties. The projections are illustrated in Table 32, Table 33 and Table 34.

Even the low projection indicates a continued increase in the demand for all different categories of teachers. It should be noted however that the low projections indicate a diminishing increase in the demand for all specialties beginning in about 1975-76.

The medium projections indicate a steady, moderate increase in the demand for all specialties. The overall increase indicated appears to be about fifteen to twenty per cent over the ten-year period.

The high projections indicate a fairly substantial increased demand in each category for each year. The overall increase appears to be about 25 to 30 per cent over the ten-year period.

Thus, the projections would indicate continued increase in the demand for high school specialists. In terms of actual numbers, the biggest increases would be in English-social studies, mathematics-sciences, commercial, and languages, in that order. In terms of numbers, the smallest increases in demand would be in home economics, industrial arts and fine arts, in that order.

Table 32

Low Projected Demand for High School Specialists
in Alberta: 1971-72 to 1980-81

Year	Math-Science	Eng.-Soc.	Language	Fine Arts	Phys. Ed.	Commercial	Ind. Arts	Home Ec.	Trades & Tech.
1971-72	1,181	1,328	352	125	192	500	121	109	164
1972-73	1,204	1,355	359	127	195	510	123	111	167
1973-74	1,223	1,376	364	129	197	517	125	113	169
1974-75	1,238	1,394	369	130	199	523	126	114	171
1975-76	1,250	1,407	372	131	201	528	127	115	172
1976-77	1,260	1,418	375	132	202	532	128	116	173
1977-78	1,267	1,426	377	133	203	535	129	116	174
1978-79	1,273	1,433	379	133	204	537	129	117	175
1979-80	1,278	1,439	380	134	205	540	130	118	176
1980-81	1,283	1,445	382	134	206	542	130	118	176

Table 33

Medium Projected Demand for High School Specialists in **Alberta**: 1971-72 to 1980-81

Year	Math-Science	Eng.-Soc.	Language	Fine Arts	Phys. Ed.	Commercial	Ind. Arts	Home Ec.	Trades & Tech.
1971-72	1,323	1,486	393	136	207	554	132	119	179
1972-73	1,351	1,518	401	139	211	566	134	122	183
1973-74	1,376	1,547	409	141	215	576	136	124	186
1974-75	1,401	1,575	416	144	219	586	139	126	189
1975-76	1,425	1,602	423	146	222	597	141	128	193
1976-77	1,450	1,630	431	149	226	607	143	130	196
1977-78	1,476	1,659	438	151	230	618	146	133	199
1978-79	1,504	1,691	447	154	235	630	149	135	203
1979-80	1,533	1,724	455	157	240	642	152	138	207
1980-81	1,565	1,759	465	161	245	656	155	141	212

Table 34

High Projected Demand for High School Specialists in Alberta: 1971-72 to 1980-81

Year	Math-Science	Eng.-Soc.	Language	Fine Arts	Phys. Ed.	Commercial	Ind. Arts	Home Ec.	Trades & Tech.
1971-72	1,464	1,644	434	147	223	608	142	219	195
1972-73	1,497	1,681	444	150	228	622	145	132	199
1973-74	1,529	1,717	453	153	232	635	148	135	203
1974-75	1,561	1,754	463	157	237	648	151	138	208
1975-76	1,596	1,793	473	160	243	663	154	141	212
1976-77	1,634	1,836	484	164	249	679	158	144	217
1977-78	1,676	1,883	497	169	255	697	162	148	223
1978-79	1,723	1,935	511	173	263	717	167	152	229
1979-80	1,773	1,991	526	179	271	738	172	157	236
1980-81	1,828	2,053	542	184	279	761	177	162	244

DEMAND FOR TEACHERS UNDER SPECIFIC CIRCUMSTANCES

The demand model, with new assumptions used in the input variables, was used to predict the demand for teachers under specific special circumstances. Data were set up to test the effect of kindergarten, the effect of lock-step progression through school, and the effect of uncontrollable variables.

Effect of Kindergarten

Table 35 illustrates the change produced in low, medium and high projections by kindergarten for all five-year old students beginning in 1971-72. The low projections suggest that universal kindergarten would increase the demand for elementary teachers by about 1,100 for any given year or approximately thirteen per cent. The medium projections suggest that universal kindergarten would increase the demand for elementary teachers by between 1,300 and 1,700 or about twelve per cent. The high projections suggest that universal kindergarten would increase the demand for elementary teachers by between 1,500 and 3,000 or about thirteen per cent. The rather consistent results would suggest with some certainty that the demand for elementary school teachers would be increased by between twelve and thirteen per cent if a universal kindergarten program for five-year old children was introduced.

Effect of Lock-step Progression

Table 36 illustrates the effect of the development of a totally lock-step system, with twelve steps, on the total demand for

Table 35

Effect of Kindergarten on Demand for Elementary School Teachers in Alberta: 1971-72 to 1980-81

Year	Low		Medium		High	
	No K.G.	K.G.	No K.G.	K.G.	No K.G.	K.G.
1971-72	8,372	9,413	10,654	11,980	12,578	14,153
1972-73	8,331	9,370	10,816	12,174	13,300	14,987
1973-74	8,296	9,337	11,019	12,413	14,223	16,045
1974-75	8,272	9,318	11,255	12,688	15,184	17,142
1975-76	8,263	9,315	11,519	12,993	16,247	18,351
1976-77	8,268	9,331	11,805	13,321	17,528	19,802
1977-78	8,289	9,364	12,109	13,668	18,807	21,248
1978-79	8,324	9,413	12,427	14,029	20,339	22,978
1979-80	8,373	9,478	12,755	14,401	21,859	24,691
1980-81	8,433	9,554	13,092	14,781	23,508	26,551

Table 36

Effect of Lock-step Progression on Demand for Teachers in Alberta: 1971-72 to 1980-81

Year	Low		Medium		High	
	Normal	Lock-Step	Normal	Lock-Step	Normal	Lock-Step
1971-72	16,343	15,786	19,829	18,759	22,627	21,677
1972-73	16,413	15,853	19,940	19,049	23,537	22,536
1973-74	16,460	15,902	20,184	19,373	25,660	23,608
1974-75	16,500	15,937	20,569	19,737	25,847	24,741
1975-76	16,537	15,973	20,987	20,134	27,163	26,001
1976-77	16,579	16,017	21,439	20,567	28,729	27,507
1977-78	16,629	16,063	21,922	21,031	30,327	29,042
1978-79	16,690	16,123	22,438	21,522	32,210	30,849
1979-80	16,768	16,197	22,975	22,040	34,107	32,675
1980-81	16,857	16,285	23,539	22,578	36,160	34,649

teachers. The lock-step projections tend to be low in all cases. The difference appears to be of such a degree, even for total demand, that the use of the distribution of various ages and sexes over different grades would appear not only to be justified, but to be necessary to produce accuracy.

Effect of Uncontrollable Variables

Since the variables of attendance ratios and pupil-teacher ratio are to some extent controllable to the school systems, it was thought desirable to test the effect of variations in birth rates and death rates on demand for teachers. The medium attendance ratios and pupil-teacher ratios were selected and used with combination of low birth rates and high death rates as well as high birth rates and low death rates. The results of this test are listed in Table 37.

The use of the low birth rates and high death rates reduces the projection by about 1.1 per cent for 1971-72. The use of high birth rates and low death rates for the same year increases the projection by about 0.8 per cent. For 1980-81, the low birth rates and high death rates reduce the projection by about 15.3 per cent while the use of the high birth rates and low death rates increases the projection by about 10.6 per cent.

Figure 9 illustrates the relationship between the effect of the variations of birth rates and death rates as compared to the effect of the variation of all of the variables. The graph would suggest that if attendance ratios and pupil-teacher ratios are really controllable variables, changes in the birth or death rate need have very little

Table 37

Effect of Uncontrollable Variables on the Total Demand for Teachers in Alberta: 1971-72 to 1980-81

Year	Low Births High Deaths	Medium Projection	High Births Low Deaths
1971-72	19,298	19,529	19,689
1972-73	19,376	19,840	20,159
1973-74	19,431	20,184	20,704
1974-75	19,480	20,569	21,317
1975-76	19,527	20,987	21,990
1976-77	19,578	21,439	22,716
1977-78	19,643	21,992	23,489
1978-79	19,723	22,438	24,301
1979-80	19,818	22,975	25,146
1980-81	19,931	23,539	26,025

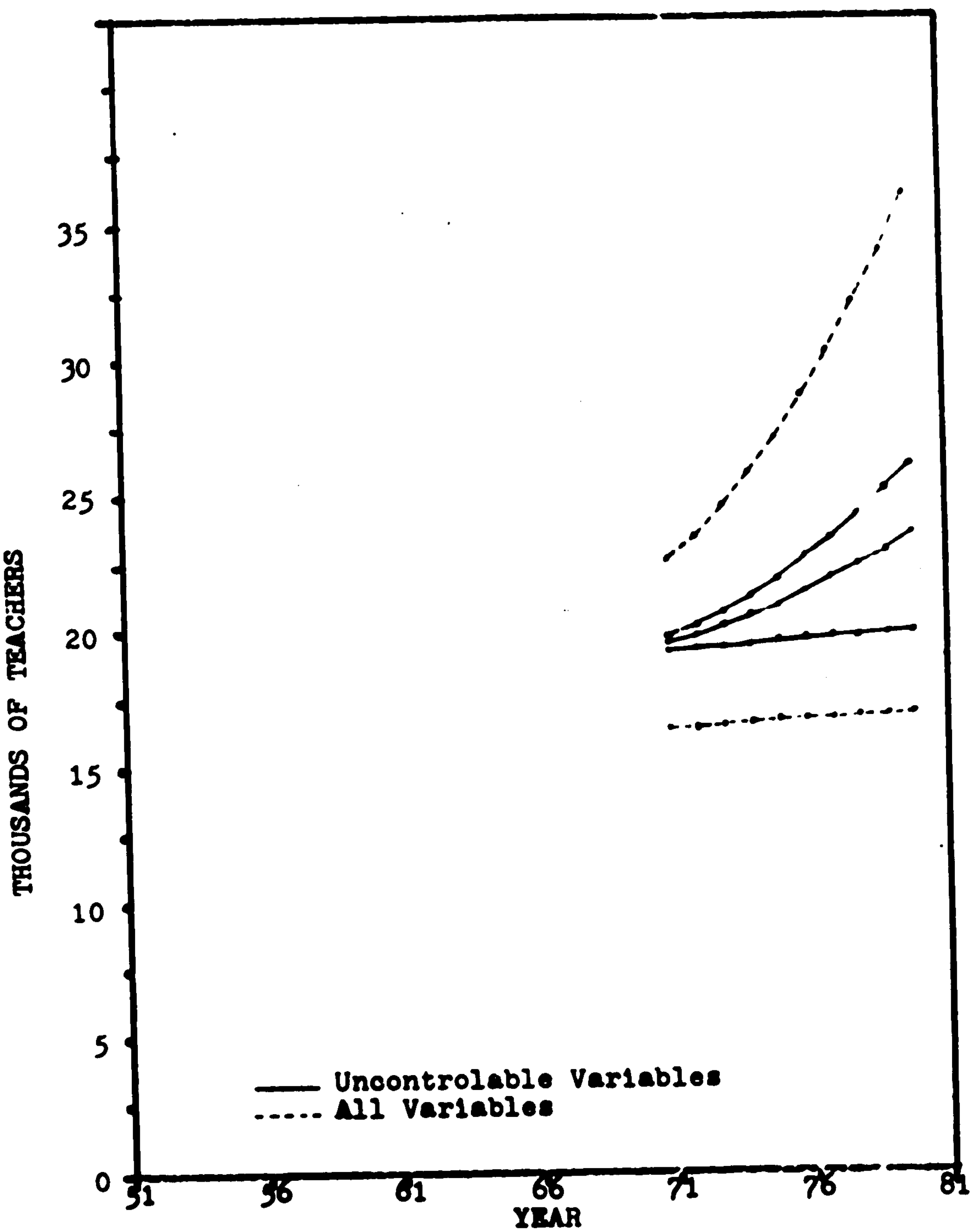

FIGURE 9

EFFECT OF UNCONTROLLABLE VARIABLES ON TOTAL DEMAND
FOR TEACHERS IN ALBERTA

impact on the total demand for teachers.

SUMMARY

The teacher demand model was tested and found to produce reasonably accurate results. The model was then used, under a variety of circumstances, to predict the total demand for teachers, the demand for teachers at various levels, and the demand for certain high school specialists. The model was also used to test the effect of specific changes, namely the effect of universal kindergarten and a total lock-step system. Finally, the model was used to test the effect of uncontrollable variables.

The low projections indicated a diminishing demand for teachers beginning in about 1975-76. The medium projections indicated a ten to fifteen per cent increase over the next ten years. The high projections indicated an increase of between twenty-five to thirty per cent over the next ten years.

REFERENCES FOR CHAPTER 6

1. Bradley, James V., Distribution-Free Statistical Tests, New Jersey: Prentice-Hall, Inc., 1968.

2. Hillier, Fredrick S., and Gerald J. Lieberman, Introduction to Operations Research, San Francisco: Holden-Day, Inc., 1967.

Chapter 7

TEACHER SUPPLY

It was of interest to examine, using the available data, the projected supply of teachers in Alberta to determine under what conditions a difference between supply and demand would obtain. While it is readily admitted that many assumptions were necessary in predicting teacher supply, any major differences between supply and demand that were predicted indicate areas for action. A necessary first step in predicting teacher supply was the preparation of data describing the teaching force.

THE TEACHING FORCE

Data gathered by Ratsoy (5) served to describe the teaching force as it existed in 1968-69. The proportions reported in Ratsoy's study were combined with Department of Education data to provide a profile of the teaching force by age and specialty.

Table 38 illustrates the proportion distribution, by per cent, of the teaching force in Alberta in 1968-69 by age and specialty. Ratsoy's data indicate an approximately equal distribution by age over each of the specialties, thus an equal distribution was assumed. Also Ratsoy's data provided the distribution between elementary, junior high school and high school. Thus each of the specialties were assumed distributed proportionately over the junior high school and senior high school (5).

Table 38

Distribution of Teachers by Age and Specialty in Alberta: 1968-69

Age	Elem.	Jr. High	Math-Sci.	Eng.-Soc.	Lang.	Fine Arts	Phys. Ed.	Comm.	Ind. Arts	Home Ec.	Trade & Tech.
20-24 years	8.5	4.3	1.1	1.4	0.3	0.2	0.3	0.1	0.1	0.1	0.1
25-29	10.2	5.2	1.3	1.7	0.3	0.3	0.3	0.2	0.1	0.2	0.1
30-34	6.8	3.5	0.9	1.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1
35-39	5.1	2.6	0.6	0.8	0.2	0.1	0.2	0.1	0.1	0.1	0.1
40-44	4.9	2.5	0.6	0.8	0.2	0.1	0.2	0.1	0.1	0.1	0.1
45-49	4.3	2.2	0.5	0.7	0.1	0.1	0.1	0.1	0.1	0.1	0.0
50-54	4.2	2.1	0.5	0.7	0.1	0.1	0.1	0.1	0.1	0.1	0.0
55-59	3.8	2.0	0.5	0.6	0.1	0.1	0.1	0.1	0.1	0.1	0.0
60-64	3.6	1.8	0.4	0.6	0.1	0.1	0.1	0.1	0.1	0.1	0.0

Compiled from: E. W. Ratsoy, Characteristics and Instructional Practises of Alberta Teachers in 1968-69, Edmonton: The Alberta Advisory Committee on Educational Studies, 1970.

The Department of Education reported 20,687 teachers in Alberta in 1968-69. This total was used with the percentages indicated in Table 38 to produce Table 39.

Although the data of Table 39 are not the actual numbers of teachers of various ages in each specialty, the information is similar enough to Ratsoy's Table 36 (5, p. 47) to be acceptable as a basis for projections of the teaching force.

ENTRY TO THE TEACHING FORCE

Two means of entry to the teaching force are open to prospective Alberta teachers. The entry routes are Alberta teacher training programs or immigration into Alberta after completion of a teacher training program elsewhere.

Alberta Teacher Training

Although various institutions in Alberta share the responsibility for teacher training, basically two different routes are open. Students can, through colleges and universities, complete all or part of the four-year B. Ed. program or, after completion of another degree, take an after-degree program at one of the universities.

The four-year B. Ed. program. As Table 40 indicates, the number of students enrolled in the first year of the B.Ed. program relates reasonably well to the total enrolment of grade twelve students. The proportion varies from a low of 0.065 in 1965 to a high of 0.090 in 1968. Since the model of the B.Ed. program, included in Appendix F, made use of the number of grade twelve students in Alberta as well as

Table 39

Estimated Number of Teachers by Age and Specialty in Alberta: 1968-69

Age	Elem.	Jr. High	Math-Sci.	Eng.-Soc.	Lang.	Fine Arts	Phys. Ed.	Comm.	Ind. Arts	Home Ec.	Trade & Tech.
20-24 yrs.	1,758	890	228	290	62	41	62	21	21	21	21
25-29	2,110	1,076	269	352	62	72	62	41	21	41	21
30-34	1,407	724	186	228	41	41	41	21	21	21	21
35-39	1,055	538	124	165	41	21	41	21	21	21	21
40-44	1,014	517	124	165	41	21	41	21	21	21	21
45-49	890	455	103	145	21	21	21	21	21	21	0
50-54	869	434	103	145	21	21	21	21	21	21	0
55-59	786	414	103	124	21	21	21	21	21	21	0
60-64	745	372	83	124	21	21	21	21	0	21	0

Table 40

Grade Twelve and First Year Education
Enrolments in Alberta

Year	Grade Twelve	First Year Education	Proportion Grade Twelve in First Year Education
1962	14,160	1,076	0.076
1963	14,692	1,042	0.071
1964	16,697	1,207	0.072
1965	20,172	1,386	0.065
1966	21,781	1,478	0.068
1967	21,970	1,670	0.076
1968	22,484	2,031	0.090
1969	25,199	2,058	0.082
1970	27,138	1,809	0.067
		Mean	0.074

Compiled from data supplied by Alberta Universities Commission.

the proportion of those entering education, the values of 0.065, 0.074, and 0.090 were input in the model. The grade twelve enrolments used were the high, medium and low values from the teacher demand model.

Since the computer model of the B.Ed. program made use of the proportion continuing from year to year of the program, data relating each year to the subsequent year were required.

As illustrated in Table 41, the enrolment in the second year as compared to the first varied from a low of 0.96 to a high of 1.09 with a mean of 1.02. These proportions were input into the model in the high, medium, and low projections. It should be noted that the second year enrolment may actually be higher than the first year enrolment of the previous year due to transfers from other faculties and teachers returning to university. The three ratios reported above were all used in the model.

As illustrated in Table 42, the enrolment in the third year as a proportion of the second year enrolment of the previous years varied from a low of 0.73 to a high of 0.92 with a mean of 0.80. Only the value of 0.92 was used in the model since certification regulations no longer allow students to become teachers after two years of training.

Table 43, page 121, illustrates the relationship between fourth year enrolments and the third year enrolments of the previous years. The ratio varies from a low of 0.72 to a high of 0.86 with a mean of 0.78. Each of these ratios was used in the model to produce the low, high, and medium projections.

By making a few assumptions, the distribution of the first year

Table 41

First and Second Year B. Ed. Enrolments in Alberta

Year	First Year	Second Year	Second/First Year Ratio
1966-67	1,478		
1967-68	1,670	1,508	1.02
1968-69	2,031	1,818	1.09
1969-70	2,058	2,001	0.99
1970-71		1,968	0.96
		Mean	1.02

Compiled from data supplied by Alberta Universities Commission.

Table 42

Second and Third Year B. Ed. Enrolments
in Alberta

Year	Second Year	Third Year	Third/Second Year Ratio
1966-67	1,344		
1967-68	1,508	986	0.73
1968-69	1,818	1,122	0.74
1969-70	2,001	1,434	0.79
1970-71		1,832	0.92
		Mean	0.80

Compiled from data supplied by Alberta Universities Commission.

Table 43

Third and Fourth Year B. Ed. Enrolments
in Alberta

Year	Third Year	Fourth Year	Fourth/Third Year Ratio
1966-67	877		
1967-68	986	654	0.75
1968-69	1,122	782	0.79
1969-70	1,434	961	0.86
1970-81		1,038	0.72
		Mean	0.78

Compiled from data supplied by Alberta Universities Commission.

students, in the B. Ed. program, over various specialties could be determined. It was assumed that the students in the University of Alberta were representative of all of the first-year students in Alberta. Also, it was assumed that the students in the secondary program were distributed evenly over junior high and high school teaching. The resulting distribution is illustrated in Table 44.

To complete the predicted supply of teachers from the B. Ed. program, the distribution that obtained in 1970-71 was used. It should be noted that this distribution differs slightly from the mean over five years but represents the most recent figures in case of any trends.

Teacher supply from the B.Ed. program. The teacher supply from the B.Ed. program appeared low in terms of teachers of trades and technical skills. Upon examining the basic data of the B.Ed. program, it was discovered that many of the students of vocational education began in the second year of the program due to advance credit for skills. The number of people registered in the second year of vocational education in 1970-71 was about six times the number in the first year of the program in 1969-70. For this reason, it was assumed that the value predicted from the model was one-sixth of the value that it should have been.

The numbers of teachers available from the B.Ed. program are illustrated in Tables 45, 46, and 47. Table 45 is composed of the projections from the set of assumptions such as to generally produce the lowest set of values. Table 46 is composed of the projections from the

Table 44

Distribution of First Year B. Ed. Students over Programs and Specialties in Alberta

Year	Elem.	Jr. High	Math-Sci.	Eng.-Soc.	Lang.	Fine Arts	Phys. Ed.	Comm.	Ind. Arts	Home Ec.	Trade & Tech.
1966-67	34.8	32.6	9.6	11.9	2.4	1.7	2.2	0.6	0.9	2.8	0.5
1967-68	35.8	32.1	8.6	12.8	2.0	2.6	2.5	0.9	0.7	1.6	0.3
1968-69	33.6	33.2	6.3	14.5	2.2	2.2	4.2	0.5	0.9	1.6	0.7
1969-70	33.7	33.2	5.9	14.5	2.8	2.2	4.2	1.0	0.9	1.5	0.3
1970-71	38.1	31.0	5.1	14.7	1.9	2.9	4.1	0.7	0.8	1.4	0.3
Mean	35.2	32.4	7.1	13.7	2.3	2.3	3.4	0.7	0.8	1.8	0.4

Compiled from: S. Hunka, "Students Survey', Faculty of Eduction," unpublished report of the Faculty of Eduction, University of Alberta, 1966-1971.

Table 45

Projected Number of Teachers Available from the
B. Ed. Program - Low

Year	Elem.	Jr. High	Math-Sci.	Eng.-Soc.	Lang.	Fine Arts	Phys. Ed.	Comm.	Ind. Arts	Home Ec.	Trade & Tech.
1971-72	543	502	119	207	35	38	47	14	12	24	28
1972-73	597	590	110	258	42	39	75	11	16	28	64
1973-74	570	561	100	245	47	37	71	17	15	25	30
1974-75	520	512	91	224	48	34	65	15	14	28	28
1975-76	459	452	80	197	38	30	57	14	12	20	25
1976-77	471	464	82	203	39	31	59	14	13	21	25
1977-78	481	474	84	207	40	31	60	14	13	21	26
1978-79	489	482	86	211	41	32	61	15	13	22	26
1979-80	496	489	87	214	41	32	62	15	13	22	27
1980-81	502	494	88	216	42	33	63	15	13	22	27

Table 46

Projected Number of Teachers Available from the
B. Ed. Program - Medium

Year	Elem.	Jr. High	Math-Sci.	Eng.-Soc.	Lang.	Fine Arts	Phys. Ed.	Comm.	Ind. Arts	Home Ec.	Trade & Tech.
1971-72	506	466	113	191	32	36	43	13	11	23	26
1972-73	610	602	113	263	42	40	76	11	16	29	67
1973-74	625	616	109	269	52	41	78	19	17	28	33
1974-75	597	589	105	257	50	39	74	20	16	27	32
1975-76	666	656	117	286	55	43	83	20	18	30	36
1976-77	684	673	120	294	57	45	85	20	18	30	37
1977-78	699	689	122	301	58	46	87	21	19	31	37
1978-79	714	703	125	307	59	47	89	21	19	32	36
1979-80	727	717	127	313	60	47	91	22	19	32	39
1980-81	740	729	130	319	62	48	92	22	20	33	40

Table 47

Projected Number of Teachers Available from the
B. Ed. Program - High

Year	Elem.	Jr. High	Math-Sci.	Eng.-Soc.	Lang.	Fine Arts	Phys. Ed.	Comm.	Ind. Arts	Home Ec.	Trade & Tech.
1971-72	457	417	104	170	28	33	37	12	10	20	23
1972-73	619	611	115	269	42	40	77	10	17	29	71
1973-74	669	660	117	288	56	44	88	20	16	30	36
1974-75	672	662	118	289	56	44	84	20	18	30	36
1975-76	1,007	992	176	433	84	66	126	30	27	45	54
1976-77	1,035	1,020	181	445	86	68	129	31	28	46	55
1977-78	1,060	1,044	186	456	88	69	132	31	27	47	57
1978-79	1,084	1,068	190	466	90	71	135	32	29	48	58
1979-80	1,107	1,091	194	476	92	72	138	33	30	49	59
1980-81	1,131	1,115	198	487	94	74	141	34	30	50	60

set of assumptions such as to generally produce the medium set of values. Table 47 is composed of the projections from the set of assumptions such as to generally produce the highest set of values.

It should be noted that the first set of projections are reversed in order due, likely, to the assumed retention rate at the end of the third year. That is, it was assumed that students not continuing for the fourth year would likely be available as teachers. Thus a high retention rate at the end of the third year of the program would reduce the number of teachers available for one year.

With the low set of assumptions, the relative minimum in the number of teachers available is predicted to be in 1975-76. The medium set of assumptions results in a set of projections with a relative low in 1974-75. With the high set of assumptions, although a slight leveling off occurs in 1974-75 and again in 1976-77, no relative low was predicted.

<u>The after-degree programs</u>. In the past, the after-degree program has allowed students to obtain a B.Ed. degree after completion of another degree. Although the program involved two years of work in education, the student was allowed to teach at the end of one year. The after-degree programs were available only through the universities.

At the University of Alberta, the data suggest that most of the students of the after-degree program went out teaching at the end of their first year of education. Table 48 illustrates that between seventy-five and eighty-five per cent of the students in the after-degree program enter teaching rather than completing the second year.

Table 48

Enrolment in the After-Degree Programs
at the University of Alberta

Year	First Year	Second Year	Second/First Year Ratio
1966-67	180		
1967-68	244	43	0.24
1968-69	338	60	0.25
1969-70	326	55	0.16
1970-71		57	0.17

Compiled from: S. Hunka, Student Survey Faculty of Education, Edmonton: Unpublished document of the Faculty of Education, 1967-1970.

The Annual Reports of the Alberta Universities Commission (1), for all years except 1966-67, include the after-degree students with the students taking a diploma in education. The 1966-67 report indicates that about ninety per cent of the students in the "Other" category were after-degree students. Thus, the figure of ninety per cent was used to arrive at the total number of after-degree students as illustrated in Table 49.

Although many attempts were made to obtain a predictor of the number of after-degree students, it was found that the number of grade twelve students from three years previously related most consistently with the number of after-degree students. As illustrated in Table 49, the number of after-degree students as a percentage of the number of grade twelve students varies from a low of 1.91 per cent to a high of 3.39 per cent with a mean of 2.81 per cent. These data were used as predictors of the total number of after-degree students to produce a high, medium and low set of values. The predicted total number of after-degree students is illustrated in Table 50.

It was also of interest to determine the distribution of the after-degree students over various specialties. Again, it was necessary to consider the students at the University of Alberta as representative. This procedure allowed the proportion of elementary to be determined as well as the proportion secondary by specialty. To estimate the proportion of junior high school teachers, no data were available but taking into account the amount of specialized subject training after-degree students generally have, it was estimated that about one-third of the secondary students would teach junior high school.

Table 49

Total Enrolment in the After-Degree
Program in Alberta

Year	After-Degree	Year	Grade Twelve Students	Per cent Grade Twelve in After-Degree
1965-66	271	1961-62	14,160	1.91
1966-67	354	1962-63	14,692	2.41
1967-68	448	1963-64	16,697	2.68
1968-69	664	1964-65	20,172	3.29
1969-70	687	1965-66	21,781	3.15
1970-71	745	1966-67	21,970	3.39
			Mean	2.81

Compiled from data obtained from the Universities Commission and the Department of Education, Government of Alberta.

Table 50

Predicted Total Number of After-Degree
Students in Alberta

	Grade Twelve Students				After-Degree Students		
Year	Low	Medium	High	Year	Low	Medium	High
1967-68		22,484		1971-72	429	632	762
1968-69		25,227		1972-73	481	709	855
1969-70		27,138		1973-74	518	763	920
1970-71	23,376	28,120	32,866	1974-75	446	790	1,114
1971-72	24,034	28,919	53,805	1975-76	459	813	1,146
1972-73	24,607	29,624	34,642	1976-77	470	832	1,174
1973-74	25,093	30,254	35,417	1977-78	479	850	1,201
1974-75	25,492	30,836	36,175	1978-79	487	866	1,226
1975-76	25,815	31,391	36,957	1979-80	493	882	1,253

The percentage of after-degree students in each specialty for various years is illustrated in Table 51. With the exception of the elementary teachers, the variations in each specialty tend to be relatively small. Thus, it was decided that the mean values of each proportion would be representative. For this reason, and in the absence of any specific trends, the mean was used to calculate the projected number of teachers of each specialty.

Teacher supply from the after-degree program. The projected total number of students in the after-degree program was used as basic data to project the number of teachers available from the after-degree program. It was considered that eighty per cent of the students from any given year would be available to teach in that year and the other twenty per cent would be available in the following year. Those available teachers were then assumed distributed, according to the mean shown in Table 51, over the various specialties.

Table 52, Table 53, and Table 54 are composed of the projections of the number of teachers of each specialty available from the after-degree program. The low projections indicate a relative minimum in 1975-76. Both the medium and high projections indicate gradual increases in the number of teachers available in each year.

Immigrant Teachers

An estimate of the rate of immigration of teachers into Alberta was obtainable through the Department of Education Annual Reports (3). In these reports, the total number of certificates issued to teachers from outside the province were reported. While it was recognized that

Table 51

Estimated Distribution of After-Degree Students by Specialty at The University of Alberta

Year	Elem.	Jr. High	Math-Sci.	Eng.-Soc.	Lang.	Fine Arts	Phys. Ed.	Comm.	Ind. Arts	Home Ec.	Trade & Tech.
1966-67	22.4	25.9	16.2	18.4	2.2	8.1	0.5	0.9	0.5	4.0	0.9
1967-68	21.6	62.1	13.0	19.8	3.5	1.4	6.5	1.6	0.7	2.3	3.5
1968-69	16.8	27.7	14.9	19.4	3.7	2.1	7.0	1.3	0.0	4.9	2.3
1969-70	22.8	25.7	14.4	20.3	3.1	1.9	4.5	1.4	0.2	4.0	1.7
1970-71	30.2	23.3	10.7	22.8	4.2	1.8	2.4	1.3	0.4	2.4	0.4
Mean	22.8	25.7	13.8	20.1	3.3	3.1	4.2	1.3	0.4	3.5	1.8

Compiled from: S. Hunka, "Students' Survey, Faculty of Education," unpublished report of the Faculty of Education, University of Alberta, 1966-1971.

Table 52

Projected Number of Teachers Available from After-Degree Program in Alberta - Low

Year	Elem.	Jr. High	Math-Sci.	Eng.-Soc.	Lang.	Fine Arts	Phys. Ed.	Comm.	Ind. Arts	Home Ec.	Trade & Tech.
1971-72	223	172	79	169	31	13	18	10	3	18	3
1972-73	96	108	58	85	14	13	18	5	2	15	8
1973-74	107	121	65	95	16	14	20	6	2	16	9
1974-75	116	130	70	102	17	16	21	7	2	18	8
1975-76	100	112	60	88	14	14	18	6	2	15	8
1976-77	103	116	62	90	15	14	19	6	2	16	8
1977-78	105	118	64	93	15	14	19	6	2	16	8
1978-79	107	121	65	94	15	15	20	6	2	16	8
1979-80	109	123	66	96	16	15	20	6	2	17	9
1980-81	110	124	67	97	16	16	10	6	2	17	9

Table 53

Projected Number of Teachers Available from After-Degree Program in Alberta - Medium

Year	Elem.	Jr. High	Math-Sci.	Eng.-Soc.	Lang.	Fine Arts	Phys. Ed.	Comm.	Ind. Arts	Home Ec.	Trade & Tech.
1971-72	223	172	79	169	31	13	18	10	3	18	3
1972-73	141	159	85	124	20	19	26	8	2	22	11
1973-74	158	179	96	140	23	22	29	9	3	24	13
1974-75	170	192	103	150	25	23	31	10	3	26	13
1975-76	177	199	107	156	26	24	33	10	3	27	14
1976-77	182	205	110	160	26	25	33	10	3	28	14
1977-78	186	210	113	164	27	25	34	11	3	29	15
1978-79	190	214	115	167	27	26	35	11	3	29	15
1979-80	193	218	117	171	28	26	36	11	3	30	15
1980-81	197	222	119	174	29	27	36	11	3	30	16

Table 54

Projected Number of Teachers Available from After-Degree Program in Alberta - High

Year	Elem.	Jr. High	Math-Sci.	Eng.-Soc.	Lang.	Fine Arts	Phys. Ed.	Comm.	Ind. Arts	Home Ec.	Trade & Tech.
1971-72	223	172	79	169	31	13	18	10	3	18	3
1972-73	170	192	103	150	25	23	31	10	3	26	13
1973-74	191	215	116	168	28	26	35	11	3	29	15
1974-75	206	232	124	181	30	28	38	12	4	32	16
1975-76	249	281	151	219	36	34	46	14	4	38	20
1976-77	256	289	155	226	37	35	47	15	4	39	20
1977-78	262	296	159	231	38	36	48	15	5	40	21
1978-79	268	302	162	237	39	36	49	15	5	41	21
1979-80	274	309	166	241	40	37	50	16	5	42	22
1980-81	280	316	169	247	41	38	52	16	5	43	22

the number of immigrant teachers was likely a function of excessive demand, it was thought necessary to examine the rate of immigration and make some alternate assumptions about the rate in the future.

As illustrated in Table 55, the rate of immigration of teachers into Alberta has varied from a low of 48.5 per thousand teachers to a high of 84.7 per thousand teachers with a mean of 59.1 per thousand teachers. In order to predict the future teacher supply, it was assumed that the rate of migration of teachers into Alberta would

1. decrease to and remain at 48.5 per thousand teachers,
2. decrease to and remain at 59.1 per thousand teachers,
3. increase to and remain at 84.7 per thousand teachers.

It was also assumed that the teachers migrating into Alberta would be distributed by age and specialty in proportion to the Alberta teaching force as it existed in 1968-69.

EXIT FROM THE TEACHING FORCE

Teachers exiting from the Alberta teaching force were considered under one of three classifications--leaving Alberta to teach elsewhere, retiring, or other such as leaving teaching or death.

As illustrated in Table 56, the rates at which teachers left Alberta to teach elsewhere, were estimated. These rates varied from a low of 11.9 per thousand teachers to a high of 18.3 per thousand teachers, with a mean of 14.9 per thousand. These rates were each assumed to continue to make up a high, medium, and low rate for the projections.

The age and specialty distribution of the teachers leaving

Table 55

Teacher Migration Into and Out of Alberta

Year	Total Teachers	Immigration Number	Immigration Rate/1000	Emigration Number	Emigration Rate/1000
1960-61	12,607	622	49.3	231	18.3
1961-62	13,342	647	48.5	179	13.4
1962-63	13,988	692	49.5	182	13.0
1963-64	14,972	743	49.6	252	16.8
1964-65	16,007	812	50.7	243	15.2
1965-66	17,183	891	51.9	264	15.4
1966-67	18,314	1,158	63.2	218	11.9
1967-68	19,579	1,659	84.7	301	15.4
1968-69	20,687	1,744	84.3	303	14.6
	Mean		59.1		14.9

Compiled from Department of Education, Annual Report, Edmonton: Queen's Printer, 1961-1969.

Table 56

Rates of Teachers Leaving Teaching in Alberta

Year	Total Teachers	New Teachers Alberta	Immigrants	Emigrants	Retirements	Left Teaching No.	Left Teaching Rate/1000
1960-61	12,607	847	642	231	81	442	35.1
1961-62	13,342	1,163	647	179	92	893	66.9
1962-63	13,988	1,070	692	182	84	512	36.6
1963-64	14,972	1,186	743	252	91	551	36.8
1964-65	16,007	1,418	812	243	119	692	43.2
1965-66	17,183	1,435	891	264	101	812	47.3
1966-67	18,314	1,343	1,158	218	144	874	47.7
1967-68	19,579	1,899	1,659	301	197	1,952	94.4
						Mean	51.0

Retirements compiled from data supplied by the Alberta Teachers' Association.

Alberta to teach elsewhere was assumed to be in proportion to the distribution of the teachers in the teaching force during the 1968-69 school year.

Table 56 illustrates the number of teachers retiring from the teaching force. In order to complete the projection, normal retirement at the age of sixty-five years was assumed.

The rate at which teachers left the teaching force varied from 35.1 per thousand to 94.4 per thousand with a mean of 51.0 per thousand. These data are illustrated in Table 56.

Since no data were available on the distribution of the teachers over the teaching force either in terms of age or specialty, a distribution had to be assumed. There was no reason to believe that one specialty was affected more than any other thus a distribution by specialty proportional to the total 1968-69 distribution was assumed. There was reason to believe that age could be a factor in leaving the teaching force.

It is likely that younger teachers more readily leave teaching than older teachers; younger teachers may find teaching unsatisfactory and then move to another career. Older teachers have either found teaching satisfactory or have too great a possibility of loss in terms of salary and retirement benefits to leave teaching. Charters found that the rate of leaving teaching tends to be a logarithmic function of age (2, p. 4). If the main reason for the loss of older teachers to the profession is through death then average death rates for ages 60-64 years may be used to establish a base for the estimates. The rates of leaving the teaching profession are listed in Table 57.

Table 57

Rates of Leaving Teaching per Thousand
Teachers in Alberta

Age	Low	Medium	High
20-24 years	62.3	109.9	259.1
25-29	52.8	86.7	183.7
30-34	44.7	68.4	130.2
35-39	37.9	54.0	92.3
40-44	32.1	42.6	65.4
45-49	27.2	33.6	46.3
50-54	23.0	26.5	32.8
55-59	19.5	20.9	23.3
60-64	16.5	16.5	16.5

Values of the variables were used to produce projections of the future teacher supply in Alberta. The lowest set of projections of Alberta-trained teachers, lowest immigration rates, and the highest rates of leaving teaching in Alberta were used to produce the lowest projections. All of the medium values of the variables were used to produce the medium projections. The highest immigration rates, and lowest rates of leaving teaching in Alberta were used to produce the highest projections.

PROJECTIONS OF TEACHER SUPPLY

Sets of projections of total teacher supply, teacher supply by levels, and teacher supply by high school specialty were produced from the entry and exit data.

Total Teacher Supply

The projections of the total teacher supply are illustrated in Table 58. Predictions as to the future teacher supply in Alberta depend to some extent upon the projection that is considered.

The low projections suggest that a gradual decrease in the teacher supply in Alberta could occur in the next ten years. The medium projections suggest a relatively gradual increase over the next ten years. The high projections suggest a fairly sharp increase over the next ten years.

By setting 95 per cent confidence limits, the range of the projections was decreased to some extent. Even the lower confidence limit suggests a gradual increase.

Table 58

Projected Total Supply of Teachers in Alberta: 1971-72 to 1980-81

Year	Supply: Low	Supply: Medium	Supply: High	95% Confidence Limits: Lower	95% Confidence Limits: Upper
1971-72	21,256	24,237	26,373	22,424	25,767
1972-73	21,153	25,866	29,461	22,966	28,394
1973-74	20,949	27,511	32,810	23,426	31,175
1974-75	20,622	29,038	36,291	23,726	33,963
1975-76	20,067	30,733	41,030	23,824	37,519
1976-77	19,636	32,424	45,961	23,949	41,148
1977-78	19,290	34,110	51,078	24,084	44,852
1978-79	19,009	35,787	56,388	24,124	48,635
1979-80	18,771	37,455	61,898	24,327	52,503
1980-81	18,555	39,120	67,620	24,415	56,470

Examination of the projected teacher supply became somewhat more meaningful when it was compared to projected total teacher demand. The 95 per cent confidence limits of total teacher supply and demand are illustrated in Figure 10.

The lower confidence limit of supply is above the upper confidence limit for demand over the period 1971-72 to 1973-74. In the years 1974-75, the lower confidence limit for supply is approximately equal to the upper confidence limit for demand. Over the time period 1975-76 to 1980-81 the lower confidence limit for supply is below the upper confidence limit for demand.

Supply of Elementary School Teachers

The projected supply of elementary school teachers is illustrated in Table 59. The low projection suggests a fairly sharp decrease in elementary school teachers. The medium projection suggests a steady increase in supply of elementary school teachers. The high projection suggests a rather sharp increase in elementary school teachers.

When the 95 per cent confidence limits were set, the lower confidence limit suggests a slight but steady decrease in the supply of elementary school teachers while the upper confidence limit suggests a fairly rapid increase in the supply of elementary school teachers.

The 95 per cent confidence limits of supply and demand are compared in Figure 11. Some overlap of the confidence intervals exists in all years. Also, the upper confidence limit of the supply is consistently above the upper confidence limit of demand. The lower confidence limit of supply is above the lower confidence interval for

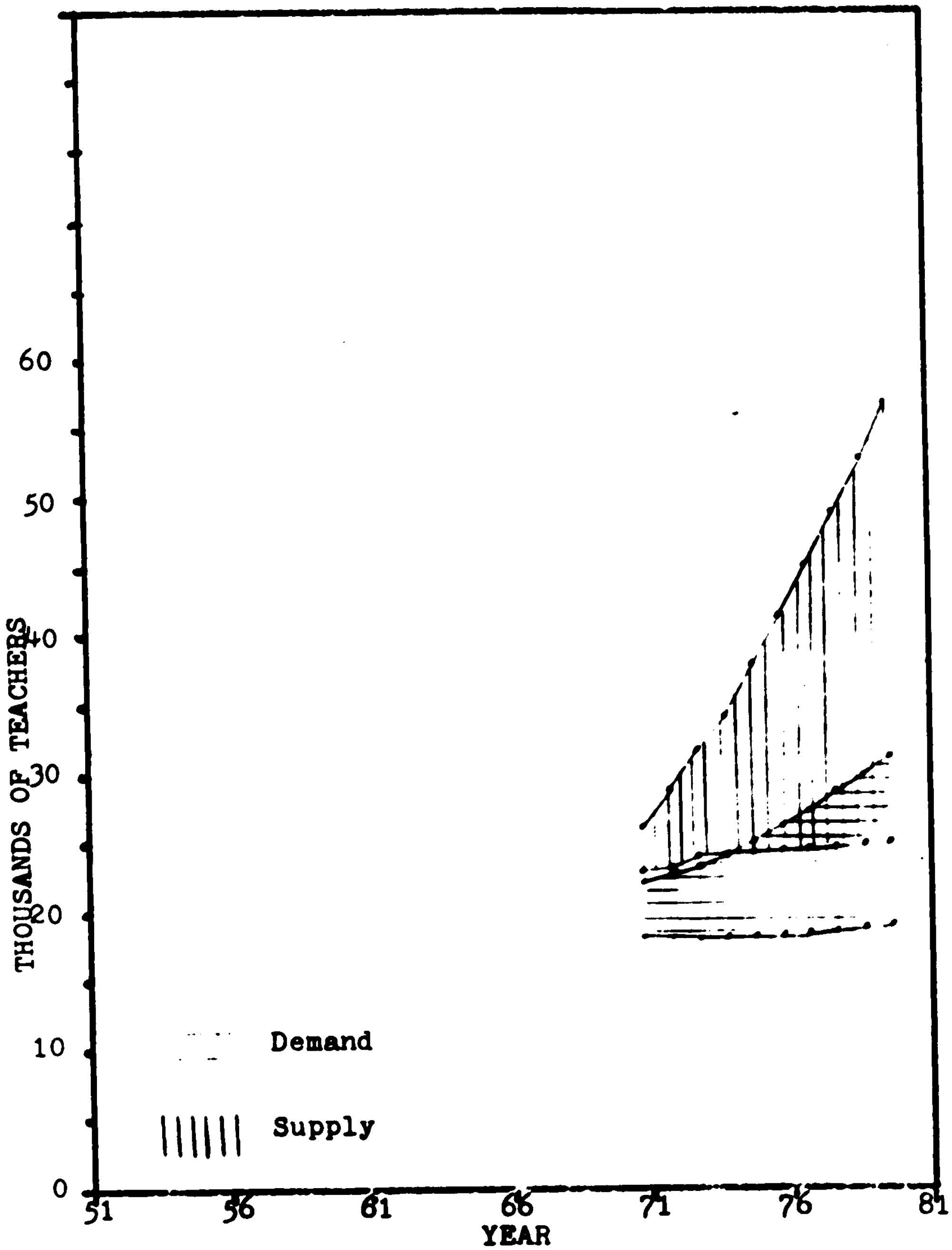

FIGURE 10

TOTAL SUPPLY AND DEMAND OF TEACHERS IN ALBERTA

Table 59

Projected Supply of Elementary School Teachers in Alberta: 1971-72 to 1980-81

Year	Supply			95% Confidence Limits	
	Low	Medium	High	Lower	Upper
1971-72	10,220	11,712	12,808	10,801	12,491
1972-73	9,856	12,069	13,817	10,698	13,285
1973-74	9,521	12,444	14,914	10,607	14,130
1974-75	9,184	12,787	16,048	10,488	14,972
1975-76	8,810	13,193	17,580	10,329	16,059
1976-77	8,500	13,604	19,173	10,195	17,168
1977-78	8,236	14,018	20,823	10,077	18,300
1978-79	8,006	14,435	22 534	9,968	19,459
1979-80	7,802	14,852	24,305	9,862	20,643
1980-81	7,616	15,270	26,141	9,755	21,858

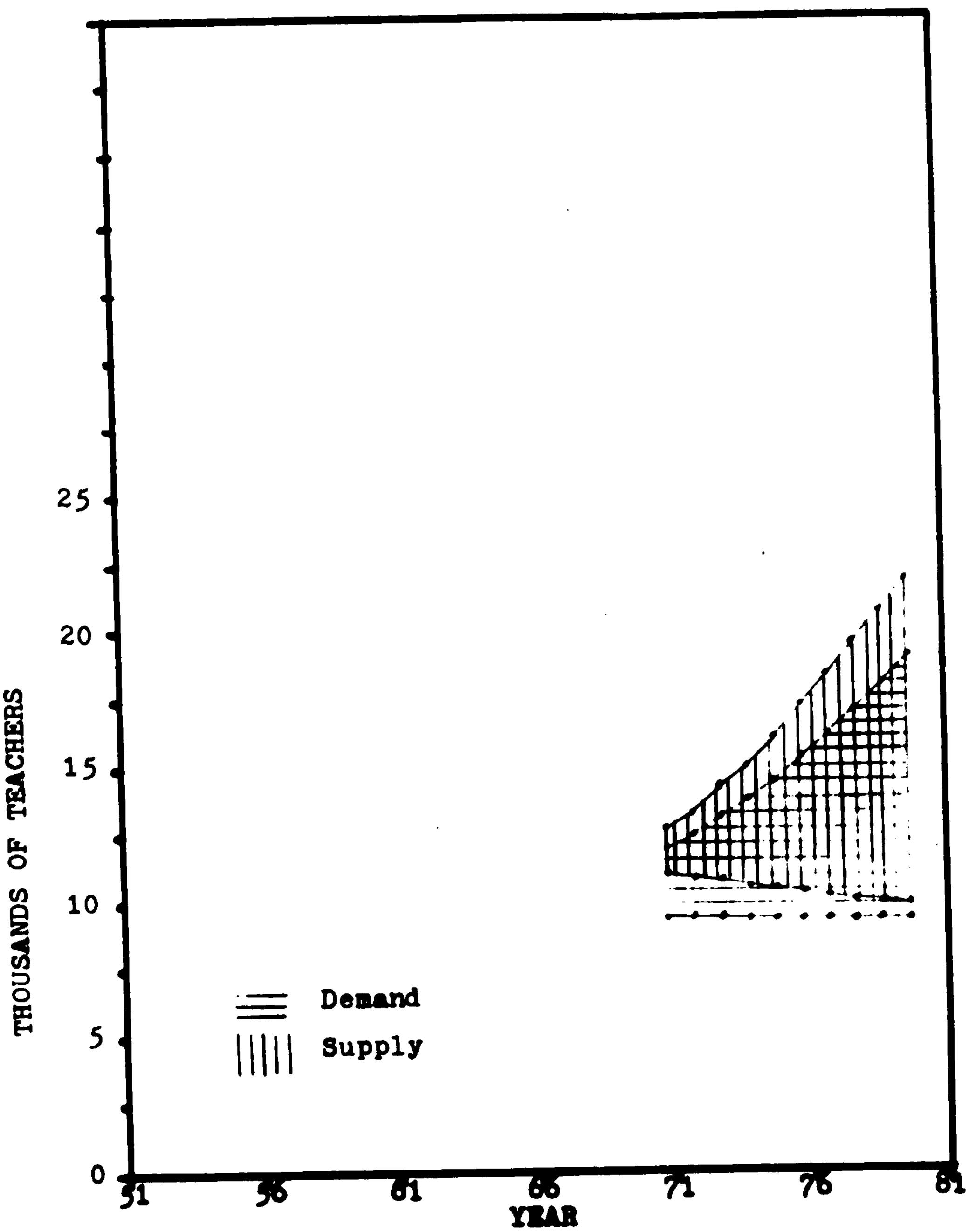

FIGURE 11

SUPPLY AND DEMAND OF ELEMENTARY SCHOOL
TEACHERS IN ALBERTA

demand but the difference between these two decreases in the later years of the projections.

Supply of Junior High School Teachers

The projected supply of junior high school teachers is illustrated in Table 60. The low projection indicates a very slight decline in the number of junior high school teachers. The medium projection indicates an increase in the supply of junior high school teachers. The high projection suggests a very rapid increase in the number of junior high school teachers.

Considering the 95 per cent confidence limits, the lower confidence limit indicates a slight increase and the upper limit indicates a fairly sharp increase in the supply of junior high school teachers.

The 95 per cent confidence limits of the supply and demand of junior high teachers are compared in Figure 12. In all years of the projections, the lower confidence interval of the supply of junior high school teachers is above the upper confidence interval of the demand for junior high school teachers. It is interesting to note that the gap between the above-mentioned two intervals at first widens and then narrows down again. However, the distance is such that the lower confidence interval of supply in the first year of the projection is nearly equal to the upper confidence interval of demand in the tenth year.

Table 60

Projected Supply of Junior High School Teachers in Alberta: 1971-72 to 1980-81

Year	Supply			95% Confidence Limits	
	Low	Medium	High	Lower	Upper
1971-72	5,703	6,490	7,046	6,013	6,890
1972-73	5,754	7,018	7,467	6,243	7,688
1973-74	5,762	7,552	8,974	6,441	8,540
1974-75	5,716	8,044	10,017	6,580	9,390
1975-76	5,592	8,588	11,456	6,651	10,482
1976-77	5,501	9,130	12,954	6,728	11,597
1977-78	5,432	9,669	14,509	6,804	12,735
1978-79	5,378	10,204	16,123	6,876	13,896
1979-80	5,334	10,736	17,798	6,941	15,084
1980-81	5,295	11,265	19,539	6,996	16,302

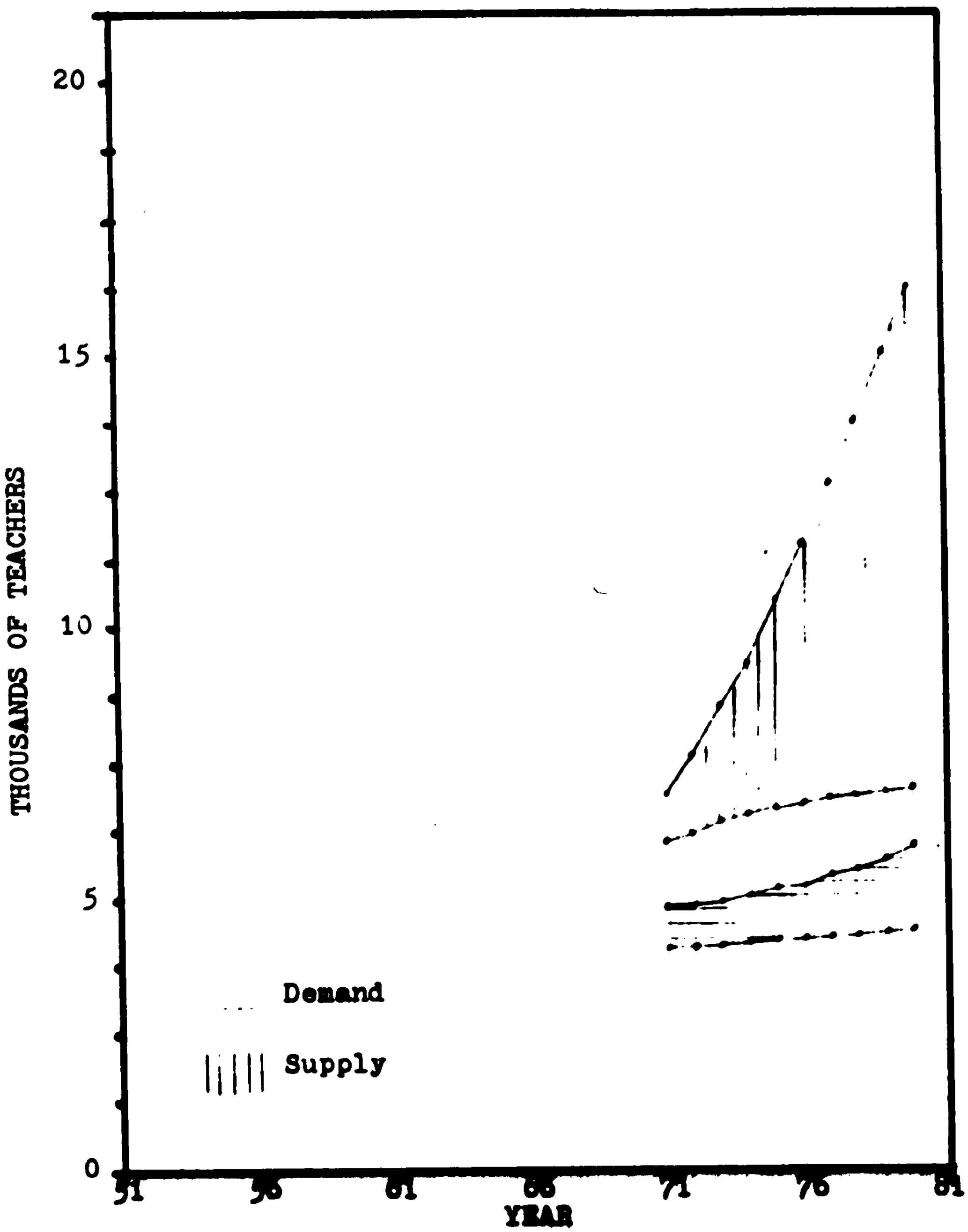

FIGURE 12

SUPPLY AND DEMAND OF JUNIOR HIGH SCHOOL TEACHERS IN ALBERTA

Supply of High School Teachers

The projected supply of high school teachers is illustrated in Table 61. The low projection indicates a slight increase in the supply of high school teachers. The medium projection indicates a relatively rapid increase in the supply of high school teachers--doubling in ten years. The high projection indicates a very rapid increase in the supply of high school teachers--more than tripling in ten years.

When the 95 per cent confidence limits were considered, the lower confidence limit indicated an increase in the supply of high school teachers while the upper confidence limit indicated a very rapid increase in the supply of high school teachers.

The 95 per cent confidence limits of the supply and demand for high school teachers are compared in Figure 13. In all years of the projections the lower confidence limit of the supply of high school teachers is above the upper confidence limit of the demand for high school teachers. The difference between the two above-mentioned limits varies from about 800 in 1971-72 to 1,500 in 1976-77. It is also interesting to note that the lower confidence limit of supply for the first year of the projections is only slightly below the upper confidence limit of demand for the last year of the projections.

Supply of high school specialists. Although no confidence intervals were established, it was of interest to examine the supply and demand of high school specialists. Since the projections of high and low demand and supply of high school specialists were extreme conditions

Table 61

Projected Supply of High School Teachers in Alberta: 1971-72 to 1980-81

Year	Supply			95% Confidence Limits	
	Low	Medium	High	Lower	Upper
1971-72	5,333	6,034	6,519	5,611	6,385
1972-73	5,543	6,779	7,677	6,026	7,420
1973-74	5,666	7,515	8,922	6,378	8,505
1974-75	5,722	8,207	10,226	6,658	9,601
1975-76	5,665	8,952	11,994	6,844	10,979
1976-77	5,635	9,690	13,834	7,026	12,383
1977-78	5,622	10,423	15,746	7,203	13,817
1978-79	5,625	11,148	17,731	7,370	15,279
1979-80	5,635	11,867	19,795	7,524	16,775
1980-81	5,644	12,585	21,940	7,664	18,311

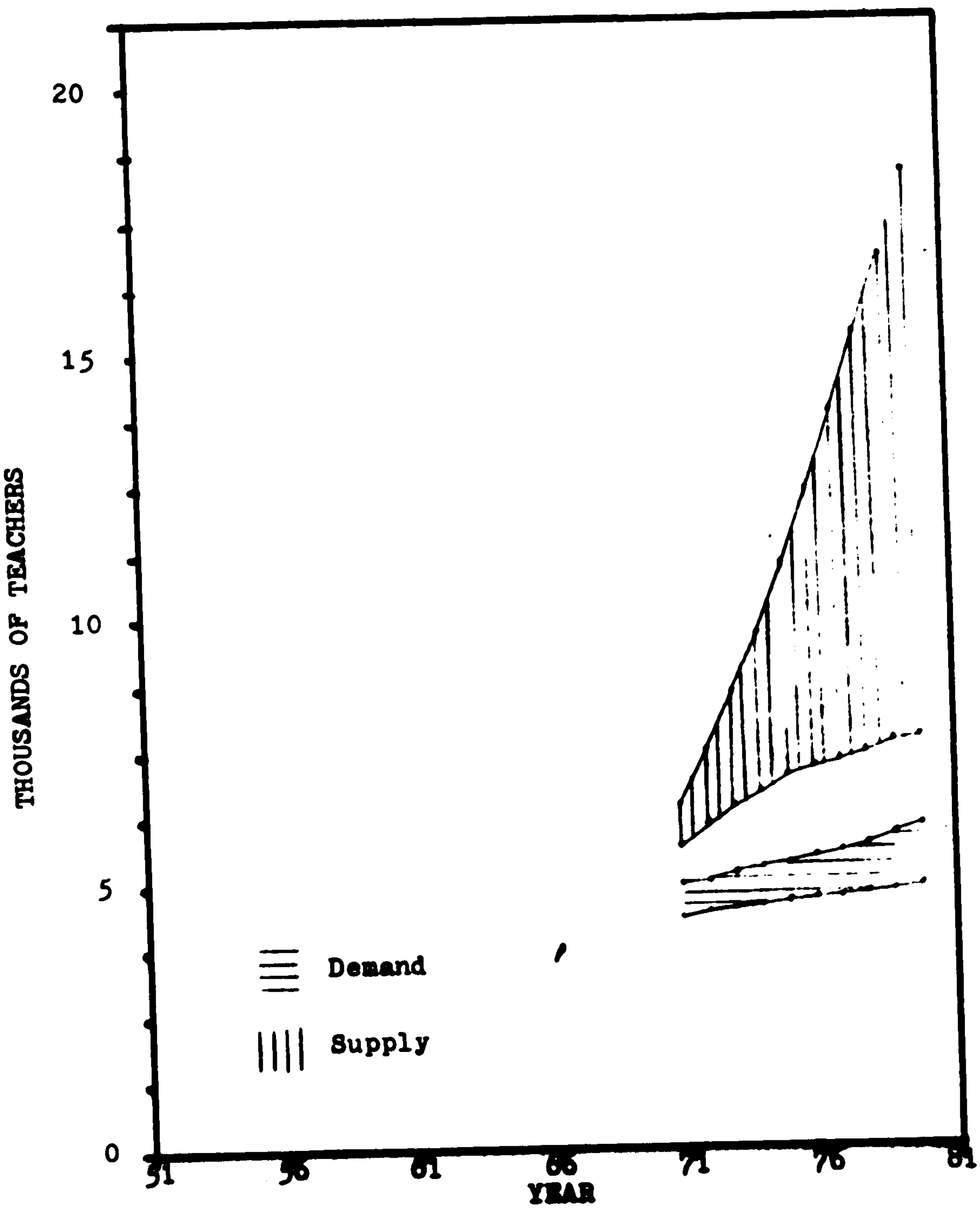

FIGURE 13

SUPPLY AND DEMAND OF HIGH SCHOOL
TEACHERS IN ALBERTA

which would almost certainly never obtain, any discrepancies which are observable indicate major problems. That is, although a comparison of the extreme projections of supply and demand may fail to predict some problems, any problems that are predicted are almost certain to be real.

The comparison of the low projections of supply from Table 62 and the high projections of demand from Table 34 was made to determine excessive supply of some specialists. It was found that, in all years of the projections, the low projection of supply exceeded the high projection of demand for high school teachers of English-social studies, fine arts, physical education, and home economics. The low projection for the supply of teachers of high school English-social studies exceeded the high projection of demand by a mean of 19.9 per cent. The low projection of supply of high school fine arts teachers exceeded the high projection of demand by a mean of 119.0 per cent. The low projection of supply of high school physical education teachers exceeded the high projection of demand by a mean of 90.2 per cent. The low projection of supply of high school home economics teachers exceeded the high projection of demand by a mean of 80.3 per cent.

The comparison of the high projections of supply from Table 64 and the low projections of demand from Table 32 was made to determine excessive demand for some specialists. In all except the last two years of the projection, the high projection of the supply of high school commercial teachers was less than the low projection of demand. The mean difference between supply and demand was 36.6 per cent.

Table 62

Low Projected Supply of High School Specialists in Alberta: 1971-72 to 1980-81

Year	Math-Sci.	Eng.-Soc.	Lang.	Fine Arts	Phys. Ed.	Comm.	Ind. Arts	Home Ec.	Trade & Tech.
1971-72	1,464	2,041	379	340	382	194	147	239	147
1972-73	1,458	2,129	389	352	428	188	149	250	200
1973-74	1,448	2,191	402	360	461	190	149	257	208
1974-75	1,433	2,223	410	364	481	190	147	262	212
1975-76	1,399	2,207	407	361	486	188	144	260	213
1976-77	1,373	2,202	407	359	493	185	142	261	213
1977-78	1,373	2,202	407	357	500	183	140	261	215
1978-79	1,341	2,210	408	358	508	182	138	263	217
1979-80	1,330	2,219	410	357	516	181	137	265	220
1980-81	1,320	2,227	412	358	523	180	135	266	223

Table 63

Medium Projected Supply of High School Specialists in Alberta: 1971-72 to 1980-81

Year	Math-Sci.	Eng.-Soc.	Lang.	Fine Arts	Phys. Ed.	Comm.	Ind. Arts	Home Ec.	Trade & Tech.
1971-72	1,667	2,300	428	386	431	220	167	271	164
1972-73	1,803	2,598	474	430	516	232	179	311	236
1973-74	1,939	2,902	530	477	602	251	193	350	271
1974-75	2,071	3,187	583	519	681	270	205	388	303
1975-76	2,214	3,494	640	565	766	289	218	427	339
1976-77	2,355	3,798	696	612	850	308	230	467	374
1977-78	2,496	4,100	751	657	932	328	244	506	409
1978-79	2,637	4,399	805	702	1,014	347	256	545	443
1979-80	2,776	4,696	859	746	1,096	366	268	583	477
1980-81	2,915	4,991	914	790	1,176	385	281	621	512

Table 64

High Projected Supply of High School Specialists in Alberta: 1971-72 to 1980-81

Year	Math-Sci.	Eng.-Soc.	Lang.	Fine Arts	Phys. Ed.	Comm.	Ind. Arts	Home Ec.	Trade & Tech
1971-72	1,810	2,478	462	418	463	240	182	291	175
1972-73	2,058	2,936	536	487	578	264	205	351	262
1973-74	2,324	3,438	629	565	705	299	230	415	317
1974-75	2,604	3,963	725	647	838	336	256	484	373
1975-76	2,974	4,678	857	757	1,024	386	291	574	453
1976-77	3,360	5,424	993	872	1,215	438	328	669	535
1977-78	3,761	6,199	1,136	991	1,415	491	366	766	621
1978-79	4,176	7,005	1,283	1,115	1,622	546	406	868	710
1979-80	4,608	7,840	1,437	1,243	1,837	605	448	974	803
1980-81	5,056	8,711	1,597	1,376	2,061	665	491	1,084	899

SUMMARY

The supply of teachers in Alberta was projected through consideration of the present teaching force, entrance to the teaching force through teacher training in Alberta and immigration into Alberta, and exit through emigration, retirement, and other causes. The number of teachers in the teaching force was projected for each of the years 1971-72 through 1980-81 by elementary, junior high school and various high school specialties.

The projected supply was compared to the projected demand for the total number of teachers, elementary school teachers, junior high school teachers, and senior high school teachers. Also, the supply and demand of high school specialists were compared.

The projections indicated a possible shortage of elementary school teachers and high school business education teachers. A definite over-supply of high school teachers of English-social studies, fine arts, physical education, and home economics was also indicated. A general excess supply of junior high school teachers was in evidence.

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Chapter 8

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

The projections of the demand for teachers in Alberta has been based on a social demand approach. By examining past trends and making alternate assumptions about birth rates, death rates, attendance rates, and pupil-teacher ratios, three sets of projections of the demand for teachers have been produced.

The variables in the demand model were also changed in selected combinations to test the effect of particular circumstances. In particular, the effect of a system of schooling with no acceleration or retardation, the effect of universal kindergarten, and the effect of the uncontrollable variables were tested.

The projection of the supply of teachers in Alberta was attempted in order to examine the available manpower in education in relation to the projected demand. The supply model was based on cohort survival and consideration of exit and entry. By examining past conditions and making alternate assumptions regarding the exit and entry variables, it was possible to produce three sets of projections of teacher supply. No attempt was made to test the effect of any specific conditions on teacher supply.

CONCLUSIONS

It is possible to classify the conclusions of this study into three somewhat different categories. Conclusions could be drawn related to the demand for teachers in Alberta, the supply of teachers in Alberta, and the balance between demand and supply.

Demand

The tests of the model indicated that population, providing the attendance rates and pupil-teacher ratios were accurate, was a reasonably good predictor of the demand for teachers in Alberta. Using the 1951 and 1956 population data, it was possible to predict the total demand for teachers in 1966-67 to within less than four per cent. Using the 1956 and 1961 population data, it was possible to predict the total demand for teachers in 1966-67 to within less than four per cent. Furthermore, the test of the effect of the uncontrollable variables illustrated the fact that, in comparison to other variables, birth rates and death rates have little impact on the demand for teachers.

As to the projected total demand for teachers, although ranges tended to be very large, some general conclusions could be drawn. Although the demand for teachers appears to a large extent to be controllable, the projections indicate at least a steady, if not increasing, demand.

The tests of the demand for teachers at various levels indicated that the model was most accurate in predicting the demand for high school teachers, moderately accurate in predicting the demand for junior high school teachers, and least accurate in predicting the demand for elementary school teachers. Using the 1951 and 1956 population data, the demand for teachers at various levels in 1966-67 was predicted to within six per cent for elementary teachers, two per cent for junior high school teachers, and less than one per cent for high school teachers.

The projections of the demand for teachers at various levels indicated at least a steady if not slightly increasing demand for elementary school teachers, a slightly increasing demand for junior high school teachers, and a moderately increasing demand for high school teachers.

Similarly, the projections of the demand for high school specialists indicated a consistent increase in the demand for teachers in all specialties.

In examining the effect of selected special circumstances on the demand for teachers, the introduction of a universal kindergarten program for five-year old children would increase the demand for elementary school teachers by between twelve and thirteen per cent. The introduction of a program of twelve years of school, with no repetition or acceleration for any students, would lower the total demand for teachers by about five per cent. Fluctuations in birth rates and death rates account for about thirty per cent of the total variation in the projections at a time fifteen years after the last real population data.

Supply

Since the teacher supply was projected in terms of total, teachers at each level, and high school specialists, it was possible to examine the projections from several points of view.

The projection of the total supply of teachers indicated a probable even or slightly increasing total supply.

The projection of teacher supply by level indicated a possible slight decrease in the supply of elementary school teachers, at least an even supply of junior high school teachers, and a slightly increasing supply of high school teachers.

In terms of high school specialists, an even or slightly decreasing supply was projected for teachers of mathematics and science, commercial and industrial arts. An increasing supply was projected for high school teachers of English and social studies, languages, fine arts, physical education, home economics, and trades and technical.

Supply and Demand Balance

Conclusions regarding the supply and demand for teachers in Alberta were based on the projections only and do not take into account any market imperfections. Two market imperfections should be mentioned because they may affect decisions based on the conclusions of this study.

Complete mobility of all teachers in Alberta was assumed. In fact, it is possible that some teachers do not have the necessary mobility to seek employment in all places in Alberta. That is, female teachers in particular may remain unemployed in one place even though they may be able to be employed in another place, Certain specialists may work less than full-time in their specialty when employed in a smaller school. In this way, the demand for certain specialists may appear to be reduced.

In spite of the above-mentioned problems, conclusions regarding the balance between the supply of and demand for teachers were drawn. In terms of the total teaching force, an excessive supply of teachers will obtain until at least 1974-75. In the years 1975-76 to 1980-81 the possibility of a perfect balance or even slightly excessive demand exists.

The projections of the supply of and demand for teachers at various levels indicated no excessive supply of elementary school teachers. In fact, a possibility of an excessive demand of elementary school teachers was in evidence. A continuing excessive supply of both junior high school teachers and high school teachers appeared almost certain.

The supply and demand for various high school specialists was also examined. A definite, continuing, excessive supply of high school teachers of English and social studies, fine arts, physical education, and home economics was indicated. An excessive demand over the period 1971-72 through 1978-79 followed by a possible balance in 1979-80 and 1980-81 was indicated for commercial teachers.

IMPLICATIONS

The major implications of this study have to do with the selection of teachers for positions and the training of future teachers.

With the apparent continuing excessive supply of some categories of teachers, school authorities in Alberta may become more selective in their employment of teachers. On the other hand, in the case of commercial teachers and highly qualified elementary teachers, the apparent shortage would indicate that school authorities will continue to compete for those teachers.

A student, selecting a program in a faculty of education, would be most assured of future employment if the commercial or elementary pattern is selected. The poorest choice of a pattern on the part of the student, considering future employment, would be English-social studies, physical education, fine arts, or home economics.

Faculties of education can help reduce the apparent excessive supply of teachers by making the elementary education pattern more attractive to prospective students.

SUGGESTED RESEARCH

Further research would help to increase the predictability of teacher demand. Both cross-sectional and longitudinal research of pupil-teacher ratios and attendance ratios could help to establish the degree of controllability of these variables. Also, research into the trends in high school programs would provide a basis for predicting enrolments in various subjects and thus the demand for teachers of those subjects.

As to teacher supply, studies concentrating on the students of faculties of education could help to determine the reasons for their entry into education and their intended teaching field. Longitudinal studies of teachers in the teaching force could help to establish other entry and exit patterns and parameters.

As soon as new census data become available a follow-up to this study would help to determine the sensitivity and utility of the models used.

COMMENTS ON THE SOCIAL DEMAND APPROACH

Although the social demand approach has been advocated for the projection of the resources required for basic education, a few shortcomings should be noted.

When generally available data are used, such as in this study, and alternate assumptions based on the ranges suggested by the data, very wide ranges of demand are predicted. These ranges are so broad as to be of little value in educational planning. It is possible that the ranges of predicted demand may be reduced by investigating further the distributions of each of the independent variables and establishing alternate assumptions on the bases of known probability levels. Although this procedure would have the effect of lowering the probability levels of the limits of the dependent variable, it would also reduce the range of the projections.

It is quite possible that the information from a study such as this can, in fact, serve to ensure that the predictions do not come true. If the investment aspect of education is considered, information as to market conditions for teachers of various kinds can help the student make a better choice of training program and thus a better investment decision. Knowledge of a possible over-supply of some kinds of teachers may influence students in their selection of career preparation and thus reduce the possibility of massive over-supply.

On the other hand, if education--even specialized career-oriented education--is being viewed as essentially consumption, then students' choices may be made on the basis of the attractiveness of program content. This being the case, administrators might use information from this kind of a study to change programs and avoid the over-supply or excessive demand situations.

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APPENDIX

APPENDIX A

CLASS SIZES 1961-62

MATHEMATICS

10: 11, 14, 33, 19, 30, 4, 6, 11, 2x22, 11, 11, 16, 24, 2x23, 3, 9, 25, 32, 16, 11x40

11: 14, 10, 14, 9, 9, 17, 3x28

12: 13, 2x30

20: 7, 13, 31, 19, 19, 5, 16, 2x17, 12, 16, 11, 22, 19, 7, 5, 24, 18, 10, 9x35

21: 11, 25, 11, 15, 9 3x24

30: 23, 6, 13, 9, 20, 8, 6, 12, 18, 17, 15, 11, 8x34

31: 10, 8, 7, 3x28

Mean - 21.89

SCIENCE

10: 11, 16, 2x24, 19, 28, 6, 6, 8, 2x23, 10, 15, 17, 23, 2x22, 3, 9, 31, 32, 14, 14x34

12: 13, 4, 31

20: 10, 11, 25, 19, 20, 7, 13, 28, 14, 18, 12, 25, 20, 6, 5, 23, 21, 9x30

BIOLOGY

11: 21, 27, 31, 30, 14, 19, 22, 6, 4, 2x25, 3x33

32: 27, 8, 14, 11, 19, 9, 6, 11, 23, 15, 23, 7, 6x36

CHEMISTRY

30: 2x16, 6, 11, 11, 21, 9, 6, 11, 21, 15, 19, 13, 6x40

PHYSICS

30: 15, 14, 5, 8, 6, 5, 5x28

Mean = 21.69

ENGLISH

Lang. 10: 2x22, 19, 35, 6, 14, 2x22, 22, 2x17, 2x23 4, 34, 2x20, 18, 19x28

Lit. 10: 19, 33, 6, 14, 2x23, 2x17, 2x22, 4, 32, 32, 17, 19x29

Lang.20: 21, 27, 32, 22, 24, 13, 17, 34, 28, 33, 14, 29, 23, 7, 14, 22, 25, 10, 14x27

Lit.20: 21, 27, 33, 22, 16, 13, 18, 35, 27, 33, 36, 31, 21, 7, 14, 25, 19, 9, 14x27

Lit.21: 25, 22, 29, 15, 25, 20, 17

Eng.30: 2x20, 8, 11, 12, 32, 14, 6, 23, 25, 14, 22, 14, 13x30

Mean = 24.16

SOCIAL STUDIES

10: 2x22, 19, 37, 6, 13, 2x25, 11, 2x17, 2x23, 4, 33, 2x19, 17,18, 31

20: 21, 27, 31, 22, 22, 13, 15, 39, 16, 33, 36, 28, 21, 7, 14, 23. 21, 9, 12x32

30: 2x20, 8, 14, 10, 29, 12, 6, 26, 27, 32, 22, 14, 13x29

H+Pd.

10: 2x9, 6

GEOG. 20: 21, 9, 33, 21, 10, 27, 2x24

LAW 20: 14, 13 30

PSYCH 20: 11, 10, 2x23

SOCIAL 20:13, 9, 26

Mean = 23.22

LANGUAGES

Fr. 10: 11, 14, 2x22, 19, 28, 13, 13 32, 12, 23, 22, 2x23, 4, 9, 2x15, 17, 14, 9x33

Fr. 20: 10, 29, 22, 19, 19, 35, 13, 11, 22, 23, 7, 5, 14, 16, 7

30: 20, 6, 11, 15, 22, 6, 11, 20, 25, 16, 8, 7x28

Ger.20: 16, 35

Ger.30: 30

Latin
20: 5, 2x32

30: 30

Ukr.20: 10

Fr. 21: 10, 10, 2x23

Fr. 31: 9, 7

Mean = 21.19

FINE ARTS

Art 10: 4, 8, 9, 14, 2x19

20: 11

30: 9

Mus.10: 9, 12

20: 3

Drama
10: 27, 32, 45

20: 22

30: 8

Mean = 14.76

PHYSICAL EDUCATION

10: 11, 10, 27, 2x22, 19, 2x16, 13, 6, 16, 2x23, 11, 12, 2x16

2x17, 2x17, 2x23, 4, 31, 32, 16, 18x29

20: 19, 3x33

Mean = 17.31

COMMERCIAL

Typ. 10: 4x27, 2x17, 6, 17, 2x22, 23, 15, 28, 4, 13, 19, 18, 10x31

20: 5, 21, 4, 13, 4x29

30: 4, 2x30

Bkkg. 20: 14, 4x32

Acct. 30: 20

Shnd. 10: 22, 11, 2x27

20: 3, 28

B.Fund 10: 19, 8, 15, 15, 26

Rec.Kg. 10: 33, 22, 11

Of.Pr. 20: 2x25

B.Mach. 30: 2x20

Of.Pr. 30: 18

Sec.Tr. 30: 24

Mean = 22.23

INDUSTRIAL ARTS

W.W. 10: 2x12, 19, 13, 3x23

G.M. 15: 15, 9, 14

16: 11

A + C 10: 25, 15

W.W. 21: 14

Elect. 10: 4x19

Auto. 10: 7x19

W.W. 20: 2x15

Elect. 20: 19

Auto. 20: 2x20

Elect.	30:	5
Auto.	30:	20
Draft	10:	2x21
Draft	20:	9
	Mean = 17.20	

HOME ECONOMICS

F+D	10:	13, 2x10, 19, 15, 6, 19, 6x19
H.Ec.	10:	13, 16
F&D	20:	19, 3x18
F&N	10:	15, 18, 4x20
F&N	20:	2x13
F&D	30:	2x12
F&N	30:	5
	Mean = 15.87	

APPENDIX B

CLASS SIZES 1966-67

MATHEMATICS

10: 7, 19, 2x27, 2x22, 22, 11, 33, 2x30, 17, 2x17, 27, 15, 32, 17, 18, 9x29

11: 2x27, 18, 14, 2x21, 2, 13, 10, 8, 6x26

12: 15, 11, 17, 34, 13

21: 19, 20, 14, 21, 9, 5, 2x36

22: 7, 3

30: 4, 2x30, 18, 14, 12, 18, 36, 13, 13, 16, 5, 10, 6x34

31: 19, 7, 7, 4, 5, 4, 2x22

20: 9, 11, 2x33, 30, 17, 9, 18, 2x27, 12, 15, 9, 15, 10, 6, 6x29

14: 2x27

25: 15

Mean = 21.03

SCIENCE

Biol. 20: 15, 2x25, 25, 28, 18, 2x25, 14, 30, 7, 23, 13, 12, 2x38

Sci. 10: 8 18, 3x30, 2x23, 29, 12, 33, 2x32, 19, 33, 23, 15 29, 16 22, 7x38

20: 9, 13, 2x26, 2x15, 24, 10, 19, 2x24, 20, 15, 9, 14, 13, 11, 6x33

Bio. 32: 10, 2x19

Chem. 30: 4, 3x33, 16, 13, 11, 16, 2x16, 14, 13, 15, 4, 9, 6x31

Phys. 30: 30, 6, 6, 9, 16, 7, 8, 8, 4x36

11: 18, 2x24, 14, 19, 14, 2x20, 12, 24, 7, 35, 6x32

Biol. 30: 5, 3x17, 8, 11, 12, 12, 30, 9, 5, 18, 5, 15, 3x38

14: 2x29

Mean = 22.17

ENGLISH

10: 20, 25, 5x20, 2x21, 25, 26, 2x24, 3x31, 19, 39, 2x21,
20, 2x35, 28, 23, 15x27

Lit. 11: 7, 18

Lang. 20: 26, 2x14, 29, 13, 2x20, 32, 17, 23, 11, 26, 12, 12, 5x29

Lang. 21: 2x34, 25, 14

30: 12, 2x26, 19, 15, 13, 17, 2x19, 20, 10 5, 19, 8, 9, 8x29

Lit. 20: 27, 2x17, 29, 15, 21, 32, 24, 19, 13, 11, 12, 5x28

Lit. 21: 2x34, 14, 18, 25, 15, 8 33, 27

33: 2x25, 8, 7, 4, 20, 24, 8, 10, 4, 12, 4, 8, 5x29

23: 2x28, 36, 10, 17, 6x31

Rdg. 10: 27, 19, 19, 2x21, 14

Mean = 22.63

SOCIAL STUDIES

10: 20, 25, 5x21, 2x21, 25, 16, 2x24, 3x31, 19, 40, 2x21
20, 2x35, 28, 23, 15x30

20: 21, 2x34, 2x17, 35, 15, 2x24, 2x29, 21, 20, 7, 22, 10
12, 8x31

30: 10, 2x29, 23, 14, 15, 2x21, 33, 16, 18, 4, 32, 7, 17, 7x34

H&Pd. 10: 2x20, 7

Geog. 20: 20, 16, 2x24, 17, 5, 13, 16

Law 20: 2x28, 25, 33, 17, 2x36

Psych. 20: 17, 14, 17, 28, 34, 32, 9, 3x31

Sociol. 20: 14, 2x24, 6, 12, 31, 27, 28, 31, 7, 12, 4x35

Econ. 30: 8, 30, 20, 27, 10, 9, 8, 13, 7, 19

Mean = 23.71

LANGUAGES

Fr.	10:	7, 16, 3x26, 2x22, 16, 26, 25, 2x28, 19, 27, 2x23, 15, 25, 16, 20, 5x33
Fr.	20:	11, 10, 2x25, 22, 24, 14, 12, 2x20, 9, 15, 13, 5, 3x36
Gr.	10:	37
Gr.	20:	17
Latin	20:	16
Ukr.	20:	8
Fr.	30:	2x21, 17, 12, 15, 5, 25, 13, 9, 10, 4, 3x34
Fr.	31:	9
Gr.	30:	14
Latin	30:	17
Ukr.	30:	4
	Mean = 20.47	

FINE ARTS

Art	10:	20, 23, 2x18, 3x30
Art	20:	29
A&C	10:	2x24, 12
Dr.	10:	18, 16, 26, 8, 7, 2x24
Dr.	20:	10, 23
Music	10:	14, 11
Music	20:	6
Art	30:	17
Dr.	30:	14
Music	30:	7
Music	11:	26, 26

Music 21: 12, 13

Music 31: 19,8

Mean = 18.34

PHYSICAL EDUCATION

10: 8, 12, 5x27, 2x20, 33, 26, 2x24, 4x22, 19, 43, 2x21,
29, 2x33, 28, 23, 15x26

20: 5, 13, 2x16, 18, 16, 4, 5, 6x32

Mean = 21.21

COMMERCIAL

Bkkg. 20: 25, 9, 3, 36

Bus.F. 10: 15, 7, 24, 22, 16, 21, 3x26

Mer. 20: 25

Of.Pr. 20: 2x17, 11, 32, 9, 9, 3x22

Rec.K. 10: 12, 12, 2x19

Shnd. 10: 5x20, 7, 4, 38

Shnd. 20: 20, 32

Typ. 10: 8, 28, 5x32, 2x20, 36, 26, 3x19, 3x28, 19, 43, 2x21,
18, 2x21, 25, 22, 9x31

Typ. 20: 8, 3x19, 10, 12, 2x12, 2x20, 15, 8, 11, 4, 4x35

Bus.M. 30: 2x19, 5x29

Of.Pr. 30: 10, 2x33

Typ. 30: 20, 14, 8, 2, 3x28

Bkkg 10: 30, 2x19, 2x21, 25, 33, 25, 6, 3x33

Shnd 30: 8, 15

C.Pr. 20: 2x20

Acct. 30: 8

Mean = 21.91

INDUSTRIAL ARTS

Auto. 10: 2x15, 6x16

Auto. 20: 4x9

Auto. 21: 15

Draft. 10: 14, 4x24

Draft. 20: 17

Elect. 10: 15, 3x23

Elect. 21: 13

Met. 10: 11

Met. 12: 3x17

Met. 21: 15

W.W. 10: 19, 2x19

W.W. 21: 13

Auto. 32: 10

Draft. 30: 10

10: 2x10, 8, 8, 21, 8, 18, 8

P.M. 10: 15

20: 5

Mean = 15.09

HOME ECONOMICS

F&D 10: 22, 16, 2x13, 15, 2x14

F&D 20: 18, 18

F&N 10: 27, 13, 15, 3x14

F&N 20: 26

10: 2x10, 16, 7, 11

11: 20

	21:	27, 7, 21, 14
H&H.F.	20:	11
C.S.D.	30:	13
F&D	30:	5,7
F&N	30:	4
H.EC.CR.	10:	15

Mean = 14.50

TRADES AND TECHNICAL

Auto.	12:	19
Auto.	22:	4x13
Auto.	32:	22
B.Cul.	12:	2x12
B.Cul.	22:	2x13
B.Cul.	32:	16
Carp.	12:	5
Carp.	22:	10
Carp.	32:	11
C.Art	12:	2x24
C.Art	22:	2x24
C.Art	32:	2x17
D.Pr.	22:	4x16
D.Pr.	32:	24
Draft.	12:	17
Draft.	22:	2x20
Draft.	32:	23
Elect.	12:	3x15

Elect.	22:	4x12
Elect.	32:	17
Eltr.	12:	3x13
Eltr.	22:	2x18
Eltr.	32:	2x12
F.Pr.	12:	2x14
F.Pr.	22:	2x25
F.Pr.	32:	21
G.Art	12:	17
G.Art	22:	17
G.Art	32:	11
M.S.	12:	3x17
M.S.	22:	3x17
M.S.	32:	13
P.Art	12:	19
P.Art	22:	19
P.Art	32:	15
P.T.	12:	17
P.T.	22:	17
P.T.	32:	7
Weld.	22:	18
Weld.	32:	5

Mean = 15,94

APPENDIX C

COMPUTER PROGRAM FOR DEMAND MODEL USING 1951 AND 1956 POPULATION DATA

The program for the teacher demand model used the following data in order:

1. Population in 1951 in 16F5.0 format--16 five year age groups of males followed by 16 five year age groups of females.

2. Population in 1956 as above.

3. Title in 20A4 format--must have one non-blank in any of the first four columns.

4, Age specific birth rates--one set for each of the years 1951 through 1969 in 7F5.0 format.

5. Age-sex-specific death rates--one set for each of the years 1951 through 1969 in 16F5.0 format.

6. Attendance rates--one set for each of the years 1951-52 through 1970-71 in 12F5.0 format.

7. Pupil teacher ratios (teachers per thousand pupils)--one set for each of the years 1951-52 through 1970-71 in 12F5.0 format.

The output of the program was as follows:

1. enrolment by grade by sex by year.

2. teachers by specialty by year.

The calculations of the program were as follows:

1. The projections of the population from one year to the next were accomplsihed through:

(a) adjusting each age-sex cohort for deaths and migration.

(b) moving each age-sex cohort ahead by one-fifth.

(c) adding births to the first age cohort.

2. The migration rate was initialized to zero and then

calculated through twenty iterations of the following:

(a) project the population for 1956.

(b) compare the projected and actual 1956 population.

(c) approximate the age-sex-specific migration rate.

(d) repeat.

3. The matrix of school-aged population was calculated as follows:

(a) approximate the mid-year of the five-year age group as one-fifth of the five-year cohort.

(b) approximate each of the years between the mid-years by linear interpolation.

(c) correct each of the years of the five-year cohort to the total by adding a constant to each of the years.

4. The sex-grade matrix for each year was calculated through consideration of the matrix of school-aged population and attendance ratios for each grade by age and sex.

5. The teacher matrix for each year was calculated through consideration of the sex-grade matrix and the pupil-teacher ratio for each specialty.

```
      COMMON POP(16,2,25), BIRTH(7,2,24), DEATH(16,2,24), XMIG(16,2)
      DIMENSION ATEND(15,2,12,20),SCHOOL(21,2),TEACH(11,2,12,24)
     C,POP6(16,2),GRADES(12,2,20),STAFF(11,20),ITITLE(20)
      DATA IBLANK/'    '/
    1 FORMAT(16F5.0)
    2 FORMAT(7F5.2)
    3 FORMAT(16F5.2)
    4 FORMAT(' ',I2,'-',I2,'    MALE',12F7.0)
    5 FORMAT('          FEMALE',12F7.0)
    6 FORMAT(12F5.1)
    7 FORMAT(12F5.2)
    8 FORMAT('0 YEAR     ELEM.  JR. HIGH MATH-SCI. ENG-S.ST. LANGUAGES'
     C'  FINE ART  PHYS. ED     COMM.  IND.ARTS  HOME EC. TRADE-TEC')
    9 FORMAT(' ',I2,'-',I2,11F10.0)
   10 FORMAT('0 YEAR SEX ',12I7)
   11 FORMAT(20A4)
   12 FORMAT('1         ',20A4)
      READ(5,1)(POP(I,1,1),I=1,16)
      READ(5,1)(POP(I,2,1),I=1,16)
      READ(5,1)(POP6(I,1),I=1,16)
      READ(5,1)(POP6(I,2),I=1,16)
  366 READ(5,11)ITITLE
      IF(ITITLE(1).EQ.IBLANK) GO TO 365
      WRITE(6,12)ITITLE
      DO 111 M1=1,16
      DO 112 M2=1,2
      XMIG(M1,M2)=0
  112 CONTINUE
  111 CONTINUE
      DO 306 I=1,10
      READ(5,2)(BIRTH(J,1,I),J=1,7)
      READ(5,2)(BIRTH(J,2,I),J=1,7)
  306 CONTINUE
      DO 307 I=1,10
      READ(5,3)(DEATH(J,1,I),J=1,16)
      READ(5,3)(DEATH(J,2,I),J=1,16)
  307 CONTINUE
      DO 221 J=1,20
      DO 421 I=1,15
      READ(5,6)(ATEND(I,1,K,J),K=1,12)
      READ(5,6)(ATEND(I,2,K,J),K=1,12)
  421 CONTINUE
  221 CONTINUE
      DO 25  J=1,2
      DO 251 I=1,11
      READ(5,7)(TEACH(I,1,K,J),K=1,12)
      READ(5,7)(TEACH(I,2,K,J),K=1,12)
  251 CONTINUE
  25  CONTINUE
      WRITE(6,10)(I,I=1,12)
      DO 106 M=1,10
      DO 1   =1,
      CALL    (  )
  1   CONTINUE
      DO 1    =1,1
```

```
      X=POP6(I,1)-POP(I,1,6)
      XMIG(I,1)=(X/POP6(I,1)+X/POP(I,1,1))*100.+XMIG(I,1)
      X=POP6(I,2)-POP(I,2,6)
      XMIG(I,2)=(X/POP6(I,2)+X/POP(I,2,1))*100.+XMIG(I,2)
  106 CONTINUE
  401 CONTINUE
      DO 108 J=7,25
      CALL NEW(J)
  108 CONTINUE
      DO 415 I7=1,12
      DO 416 I8=1,2
      DO 417 I9=1,20
      GRADES(I7,I8,I9)=0.
  417 CONTINUE
  416 CONTINUE
  415 CONTINUE
      DO 202 I=1,20
      DO 203 J=1,21,5
      J1=(J+4)/5
      DO 204 K=1,2
      SCHOOL(J,K)=POP(J1,K,I)*.2
  204 CONTINUE
  203 CONTINUE
      DO 205 J=2,5
      DO 206 K=1,2
      X=J-1
      SCHOOL(J,K)=SCHOOL(1,K)+(SCHOOL(6,K)-SCHOOL(1,K))*.2*X
  206 CONTINUE
  205 CONTINUE
      DO 207 J=7,10
      DO 208 K=1,2
      X=J-6
      SCHOOL(J,K)=SCHOOL(6,K)+(SCHOOL(11,K)-SCHOOL(6,K))*.2*X
  208 CONTINUE
  207 CONTINUE
      DO 209 J=12,15
      DO 210 K=1,2
      X=J-11
      SCHOOL(J,K)=SCHOOL(11,K)+(SCHOOL(16,K)-SCHOOL(11,K))*.2*X
  210 CONTINUE
  209 CONTINUE
      DO 211 J=17,20
      DO 212 K=1,2
      X=J-16
      SCHOOL(J,K)=SCHOOL(16,K)+(SCHOOL(21,K)-SCHOOL(16,K))*.2*X
  212 CONTINUE
  211 CONTINUE
      DO 213 K=1,2
      X=(POP(2,K,I)-(SCHOOL(4,K)+SCHOOL(5,K)+SCHOOL(6,K)+SCHOOL(7,K)
     C+SCHOOL(8,K)))*.2
      DO 214 J=4,8
      SCHOOL(J,K)=SCHOOL(J,K)+X
  214 CONTINUE
  213 CONTINUE
      DO 215 K=1,2
```

```
      X=(POP(3,K,I)-(SCHOOL(9,K)+SCHOOL(10,K)+SCHOOL(11,K)+SCHOOL(12,K)
     C+SCHOOL(13,K)))*.2
      DO 216 J=9,13
      SCHOOL(J,K)=SCHOOL(J,K)+X
  216 CONTINUE
  215 CONTINUE
      DO 217 K=1,2
      X=(POP(4,K,I)-(SCHOOL(14,K)+SCHOOL(15,K)+SCHOOL(16,K)+SCHOOL(17,K)
     C+SCHOOL(18,K)))*.2
      DO 218 J=14,18
      SCHOOL(J,K)=SCHOOL(J,K)+X
  218 CONTINUE
  217 CONTINUE
      DO 231 J=4,13
      J2=J-3
      DO 232 J3=1,12
      DO 233 K=1,2
      GRADES(J3,K,I)=GRADES(J3,K,I)+SCHOOL(J,K)*ATEND(J2,K,J3,I)/100C.
  233 CONTINUE
  232 CONTINUE
  231 CONTINUE
  202 CONTINUE
      DO 260 I=1,20
      IY1=59+I
      IY2=IY1+1
      WRITE(6,4)IY1,IY2,(GRADES(J,1,I),J=1,12)
      WRITE(6,5)(GRADES(J,2,I),J=1,12)
  260 CONTINUE
      DO 261 I=1,11
      DO 262 J=1,20
      STAFF(I,J)=0.
  262 CONTINUE
  261 CONTINUE
      DO 266 J=1,20
      DO 265 I=1,11
      DO 264 L=1,12
      DO 263 K=1,2
      STAFF(I,J)=STAFF(I,J)+GRADES(L,K,J)*TEACH(I,K,L,J)/[illegible].
  263 CONTINUE
  264 CONTINUE
  265 CONTINUE
  266 CONTINUE
      WRITE(6,[illegible])
      DO 26[illegible] I=1,20
      IY1=59+I
      IY2=IY1+1
      WRITE(6,[illegible])IY1,IY2,(STAFF(J,I),J=1,11)
  2[illegible] CONTINUE
      GO TO 366
  365 CONTINUE
      STOP
      [illegible]
```

```
      SUBROUTINE NEW(N2)
      COMMON POP(16,2,25), BIRTH(7,2,24), DEATH(16,2,24), XMIG(16,2)
      N1=N2-1
      POP(1,1,N2)=0
      POP(1,2,N2)=0
      DO 102 I=1,7
      I2=I+2
      POP(1,1,N2)=POP(1,1,N2)+POP(I2,2,N1)*BIRTH(I,1,N1)/1000.
      POP(1,2,N2)=POP(1,2,N2)+POP(I2,2,N1)*BIRTH(I,2,N1)/1000.
  102 CONTINUE
      POP(1,1,N2)=(POP(1,1,N1)*.8+POP(1,1,N2))*(1000.+XMIG(1,1)
     C-DEATH(1,1,N1))/1000.
      POP(1,2,N2)=(POP(1,2,N1)*.8+POP(1,2,N2))*(1000.+XMIG(1,2)
     C-DEATH(1,2,N1))/1000.
      DO 104 I=2,15
      I2=I-1
      POP(I,1,N2)=(POP(I,1,N1)*.9+POP(I2,1,N1)*.2)
     C*(1000.+XMIG(I,1)-DEATH(I,1,N1))/1000.
      POP(I,2,N2)=(POP(I,2,N1)*.8+POP(I2,2,N1)*.2)
     C*(1000.+XMIG(I,2)-DEATH(I,2,N1))/1000.
  104 CONTINUE
      POP(16,1,N2)=(POP(16,1,N1)+POP(15,1,N1)*.2)
     C*(1000.+XMIG(16,1)-DEATH(16,1,N1))/1000.
      POP(16,2,N2)=(POP(16,2,N1)+POP(15,2,N1)*.2)
     C*(1000.+XMIG(16,2)-DEATH(16,2,N1))/1000.
      RETURN
      END
```

APPENDIX D

COMPUTER PROGRAM FOR DEMAND MODEL USING 1956 AND 1961 POPULATION DATA

The program for the teacher demand model used the following data in order:

1. Population in 1956 in 16F5.0 format--16 five year age groups of males followed by 16 five year age groups of females.

2. Population in 1961 as above.

3. Title in 20A4 format--must have one non-blank in any of the first four columns.

4. Age-specific birth rates--one set for each of the years 1956 through 1974 in 7F5.0 format.

5. Age-sex-specific death rates--one set for each of the years 1956 through 1974 in 16F5.0 format.

6. Attendance rates--one set for each of the years 1956-57 through 1975-76 in 12F5.0 format.

7. Pupil teacher ratios (teachers per thousand pupils)--one set for each of the years 1956-57 through 1975-76 in 12F5.0 format.

The output of the program was as follows:

1. enrolment by grade by sex by year.

2. teachers by specialty by year.

The calculations of the program were as follows:

1. The projections of the population from one year to the next were accomplished through:

(a) adjusting each age-sex cohort for deaths and migration.

(b) moving each age-sex cohort ahead by one-fifth.

(c) adding births to the first age cohort.

2. The migration rate was initialized to zero and then calculated through twenty iterations of the following:

(a) project the population for 1961.

(b) compare the projected and actual 1961 population.

(c) approximate the age-sex-specific migration rate.

(d) repeat.

3. The matrix of school aged population was calculated as follows:

(a) approximate the mid-year of the five-year age group as one-fifth of the five-year cohort.

(b) approximate each of the years between the mid-years by linear interpolation.

(c) correct each of the years of the five-year cohort to the total by adding a constant to each of the years.

4. The sex-grade matrix for each year was calculated through consideration of the matrix of school aged population and attendance ratios for each grade by age and sex.

5. The teacher matrix for each year was calculated through consideration of the sex-grade matrix and the pupil-teacher ratio for each specialty.

```
      COMMON POP(16,2,25), BIRTH(7,2,24), DEATH(16,2,24), XMIG(16,2)
      DIMENSION ATEND(15,2,12,24),SCHOOL(21,2),TEACH(11,2,12,2 )
     C,POPA(16,2),GRADES(12,2,24),STAFF(11,2 ),ITITLE(20)
      DATA IBLANK/'    '/
    1 FORMAT(16F5.0)
    2 FORMAT(7F5.2)
    3 FORMAT(16F5.2)
    4 FORMAT(' ',I2,'-',I2,'   MALE',12F7.0)
    5 FORMAT('        FEMALE',12F7.0)
    6 FORMAT(12F5.1)
    7 FORMAT(12F5.2)
    8 FORMAT('1 YEAR     ELEM.  JR. HIGH MATH-SCI. ENG-S.ST. LANGUAGES'
     C'  FINE ART  PHYS. ED   COMM.  IND. ARTS  HOME EC.  TRADE-TECH')
    9 FORMAT(' ',I2,'-',I2,11F10.0)
   10 FORMAT('1 YEAR SEX ',12I7)
   11 FORMAT(20A4)
   12 FORMAT('1       ',20A4)
      READ(5,1)(POP(I,1,1),I=1,16)
      READ(5,1)(POP(I,2,1),I=1,16)
      READ(5,1)(POPA(I,1),I=1,16)
      READ(5,1)(POPA(I,2),I=1,16)
  366 READ(5,11)ITITLE
      IF(ITITLE(1).EQ.IBLANK) GO TO 365
      WRITE(6,12)ITITLE
      DO 101 M1=1,16
      DO 112 M2=1,2
      XMIG(M1,M2)=0
  112 CONTINUE
  101 CONTINUE
      DO 306 I=1,24
      READ(5,2)(BIRTH(J,1,I),J=1,7)
      READ(5,2)(BIRTH(J,2,I),J=1,7)
  306 CONTINUE
      DO 307 I=1,24
      READ(5,3)(DEATH(J,1,I),J=1,16)
      READ(5,3)(DEATH(J,2,I),J=1,16)
  307 CONTINUE
      DO 221 J=1,2
      DO 421 I=1,15
      READ(5,6)(ATEND(I,1,K,J),K=1,12)
      READ(5,6)(ATEND(I,2,K,J),K=1,12)
  421 CONTINUE
  221 CONTINUE
      DO 25  J=1,2
      DO 251 I=1,11
      READ(5,7)(TEACH(I,1,K,J),K=1,12)
      READ(5,7)(TEACH(I,2,K,J),K=1,12)
  251 CONTINUE
  25  CONTINUE
      WRITE(6,10)(I,I=1,12)
      DO 4 1 [illegible]=1,[illegible]
      [illegible]
      CALL [illegible]
  1   CONTINUE
      DO 1[illegible] I=1,1[illegible]
```

```
      X=POPA(I,1)-POP(I,1,6)
      XMIG(I,1)=(X/POPA(I,1)+X/POP(I,1,1))*1[illegible].+XMIG(I,1)
      X=POPA(I,2)-POP(I,2,6)
      XMIG(I,2)=(X/POPA(I,2)+X/POP(I,2,1))*1[illegible].+XMIG(I,2)
 1?6  CONTINUE
 4?1  CONTINUE
      DO 1?8 J=7,25
      CALL ?P?(J)
 1?8  CONTINUE
      DO 415 I7=1,12
      DO 416 I8=1,2
      DO 417 I9=1,22
      GRADES(I7,I8,I9)=[illegible]
 417  CONTINUE
 416  CONTINUE
 415  CONTINUE
      DO 202 I=1,2?
      DO 203 J=1,21,5
      J1=(J+4)/5
      DO 204 K=1,2
      SCHOOL(J,K)=POP(J1,K,I)*.2
 204  CONTINUE
 203  CONTINUE
      DO 205 J=2,5
      DO 206 K=1,2
      X=J-1
      SCHOOL(J,K)=SCHOOL(1,K)+(SCHOOL(6,K)-SCHOOL(1,K))*.2*X
 206  CONTINUE
 205  CONTINUE
      DO 207 J=7,10
      DO 208 K=1,2
      X=J-6
      SCHOOL(J,K)=SCHOOL(6,K)+(SCHOOL(11,K)-SCHOOL(6,K))*.2*X
 2??  CONTINUE
 207  CONTINUE
      DO 2?? J=12,15
      DO 21? K=1,2
      X=J-11
      SCHOOL(J,K)=SCHOOL(11,K)+(SCHOOL(1?,K)-SCHOOL(11,K))*.2*X
 21?  CONTINUE
 2??  CONTINUE
      DO 211 J=17,2?
      DO 212 K=1,2
      X=J-1?
      SCHOOL(J,K)=SCHOOL(1?,K)+(SCHOOL(21,K)-SCHOOL(1?,K))*.2*X
 212  CONTINUE
 211  CONTINUE
      DO 21? K=1,2
      X=(P?P(2,K,I)-(SCHOOL(4,K)+SCHOOL(?,K)+SCHOOL(?,?)+SCHOOL(7,K)
     C+SCHOOL(?,K)))*.?
      DO 214 J=?,?
      [illegible](I,J)=[illegible](I,K)+X
 21?  [illegible]
 21?  [illegible]
      [illegible]
```

```
      X=(POP(3,K,I)-(SCHOOL(9,K)+SCHOOL(10,K)+SCHOOL(11,K)+SCHOOL(12,K)
     C+SCHOOL(13,K)))*.2
      DO 216 J=9,13
      SCHOOL(J,K)=SCHOOL(J,K)+X
  216 CONTINUE
  215 CONTINUE
      DO 217 K=1,2
      X=(POP(4,K,I)-(SCHOOL(14,K)+SCHOOL(15,K)+SCHOOL(16,K)+SCHOOL(17,K)
     C+SCHOOL(18,K)))*.2
      DO 218 J=14,18
      SCHOOL(J,K)=SCHOOL(J,K)+X
  218 CONTINUE
  217 CONTINUE
      DO 231 J=4,18
      J2=J-3
      DO 232 J3=1,12
      DO 233 K=1,2
      GRADES(J3,K,I)=GRADES(J3,K,I)+SCHOOL(J,K)*ATEND(J2,K,J3,I)/100.
  233 CONTINUE
  232 CONTINUE
  231 CONTINUE
  2[illegible] CONTINUE
      DO 260 I=1,20
      IY1=55+I
      IY2=IY1+1
      WRITE(6,4)IY1,IY2,(GRADES(J,1,I),J=1,12)
      WRITE(6,5)(GRADES(J,2,I),J=1,12)
  260 CONTINUE
      DO 261 I=1,11
      DO 262 J=1,2
      STAFF(I,J)=0.
  262 CONTINUE
  261 CONTINUE
      DO 266 J=1,2
      DO 265 I=1,11
      DO 264 L=1,12
      DO 263 K=1,2
      STAFF(I,J)=STAFF(I,J)+GRADES(L,K,J)*TEACH(I,K,L,J)/1[illegible].
  263 CONTINUE
  264 CONTINUE
  265 CONTINUE
  266 CONTINUE
      WRITE(6,[illegible])
      [illegible] I=1,[illegible]
      IY1=5[illegible]+I
      IY2=IY1+1
      [illegible]ITE([illegible])IY1,IY2,(STAFF(J,I),J=1,11)
  [illegible] CONTINUE
      [illegible]
  [illegible] CONTINUE
      END
```

```
SUBROUTINE NEW(N2)
COMMON POP(16,2,25), BIRTH(7,2,24), DEATH(16,2,24), XMIG(16,2)
N1=N2-1
POP(1,1,N2)=0.
POP(1,2,N2)=0.
DO 102 I=1,7
I2=I+2
POP(1,1,N2)=POP(1,1,N2)+POP(I2,2,N1)*BIRTH(I,1,N1)/1000.
POP(1,2,N2)=POP(1,2,N2)+POP(I2,2,N1)*BIRTH(I,2,N1)/1000.
102 CONTINUE
POP(1,1,N2)=(POP(1,1,N1)*.8+POP(1,1,N2))*(1000.+XMIG(1,1)
C-DEATH(1,1,N1))/1000.
POP(1,2,N2)=(POP(1,2,N1)*.8+POP(1,2,N2))*(1000.+XMIG(1,2)
C-DEATH(1,2,N1))/1000.
DO 104 I=2,15
I2=I-1
POP(I,1,N2)=(POP(I,1,N1)*.8+POP(I2,1,N1)*.2)
C*(1000.+XMIG(I,1)-DEATH(I,1,N1))/1000.
POP(I,2,N2)=(POP(I,2,N1)*.8+POP(I2,2,N1)*.2)
C*(1000.+XMIG(I,2)-DEATH(I,2,N1))/1000.
104 CONTINUE
POP(16,1,N2)=(POP(16,1,N1)+POP(15,1,N1)*.2)
C*(1000.+XMIG(16,1)-DEATH(16,1,N1))/1000.
POP(16,2,N2)=(POP(16,2,N1)+POP(15,2,N1)*.2)
C*(1000.+XMIG(16,2)-DEATH(16,2,N1))/1000.
RETURN
END
```

APPENDIX E

COMPUTER PROGRAM FOR DEMAND MODEL USING 1961 AND 1966 POPULATION DATA

The program for the teacher demand model used the following data in order:

1. Population in 1961 in 16F5.0 format--16 five-year age groups of males followed by 16 five-year age groups of females.

2. Population in 1966 as above.

3. Title in 20A4 format--must have one non-blank in any of the first four columns.

4. Age-specific birth rates--one set for each of the years 1961 through 1959 in 7F5.0 format.

5. Age-sex-specific death rates--one set for each of the years 1961 through 1979 in 16F5.0 format.

6. Attendance rates--one set for each of the years 1961-62 through 1980-81 in 12F5.0 format.

7. Pupil-teacher ratios (teachers per thousand pupils)--one set for each of the years 1961-62 through 1980-81 in 12F5.0 format.

The output of the program was as follows:

1. enrolment by grade by sex by year.

2. teachers by specialty by year.

The calculations of the program were as follows:

1. The projections of the population from one year to the next were accomplished through:

(a) adjusting each age-sex cohort for deaths and migration.

(b) moving each age-sex cohort ahead by one-fifth.

(c) adding births to the first age cohort.

2. The migration rate was initialized to zero and then calculated through twenty iterations of the following:

(a) project the population for 1966.

(b) compare the projected and actual 1966 population.

(c) approximate the age-sex-specific migration rate.

(d) repeat.

3. The matrix of school-aged population was calculated as follows:

(a) approximate the mid-year of the five-year age group as one-fifth of the five year cohort.

(b) approximate each of the years between the mid-years by linear interpolation.

(c) correct each of the years of the five-year cohort to the total by adding a constant to each of the years.

4. The sex-grade matrix for each year was calculated through consideration of the matrix of school aged population and attendance ratios for each grade by age and sex.

5. The teacher matrix for each year was calculated through consideration of the sex-grade matrix and the pupil-teacher ratio for each specialty.

```
      COMMON POP(16,2,25), BIRTH(7,2,24), DEATH(16,2,24), XMIG(16,2)
      DIMENSION ATEND(15,2,12,20),SCHOOL(21,2),TEACH(11,2,12,20)
     C,POP6(16,2),GRADES(12,2,20),STAFF(11,20),ITITLE(20)
      DATA IBLANK/'    '/
    1 FORMAT(16F5.0)
    2 FORMAT(7F5.2)
    3 FORMAT(16F5.2)
    4 FORMAT(' ',I2,'-',I2,'     MALE',12F7.0)
    5 FORMAT('           FEMALE',12F7.0)
    6 FORMAT(12F5.1)
    7 FORMAT(12F5.2)
    8 FORMAT('0 YEAR      ELEM.   JR. HIGH MATH-SCI. ENG-S.ST. LANGUAGES'
     C'   FINE ART   PHYS. ED      COMM.   IND.ARTS  HOME EC. TRADE-TEC')
    9 FORMAT(' ',I2,'-',I2,11F10.0)
   10 FORMAT('0 YEAR SEX ',12I7)
   11 FORMAT(20A4)
   12 FORMAT('1       ',20A4)
      READ(5,1)(POP(I,1,1),I=1,16)
      READ(5,1)(POP(I,2,1),I=1,16)
      READ(5,1)(POP6(I,1),I=1,16)
      READ(5,1)(POP6(I,2),I=1,16)
  366 READ(5,11)ITITLE
      IF(ITITLE(1).EQ.IBLANK) GO TO 365
      WRITE(6,12)ITITLE
      DO 101 N1=1,16
      DO 112 N2=1,2
      XMIG(N1,N2)=0
  112 CONTINUE
  101 CONTINUE
      DO 306 I=1,19
      READ(5,2)(BIRTH(J,1,I),J=1,7)
      READ(5,2)(BIRTH(J,2,I),J=1,7)
  306 CONTINUE
      DO 307 I=1,19
      READ(5,3)(DEATH(J,1,I),J=1,16)
      READ(5,3)(DEATH(J,2,I),J=1,16)
  307 CONTINUE
      DO 221 J=1,20
      DO 421 I=1,15
      READ(5,6)(ATEND(I,1,K,J),K=1,12)
      READ(5,6)(ATEND(I,2,K,J),K=1,12)
  421 CONTINUE
  221 CONTINUE
      DO 250 J=1,20
      DO 251 I=1,11
      READ(5,7)(TEACH(I,1,K,J),K=1,12)
      READ(5,7)(TEACH(I,2,K,J),K=1,12)
  251 CONTINUE
  250 CONTINUE
      WRITE(6,10)(I,I=1,12)
      DO 401 N5=1,16
      DO 1.. ..=2,6
      CALL ....(..)
  1.. CONTINUE
      DO . I=1,16
```

```
      X=POP6(I,1)-POP(I,1,6)
      XMIG(I,1)=(X/POP6(I,1)+X/POP(I,1,1))*100.+XMIG(I,1)
      X=POP6(I,2)-POP(I,2,6)
      XMIG(I,2)=(X/POP6(I,2)+X/POP(I,2,1))*100.+XMIG(I,2)
106   CONTINUE
401   CONTINUE
      DO 108 J=7,25
      CALL NEW(J)
108   CONTINUE
      DO 415 I7=1,12
      DO 416 I8=1,2
      DO 417 I9=1,20
      GRADES(I7,I8,I9)=0.
417   CONTINUE
416   CONTINUE
415   CONTINUE
      DO 202 I=1,20
      DO 203 J=1,21,5
      J1=(J+4)/5
      DO 204 K=1,2
      SCHOOL(J,K)=POP(J1,K,I)*.2
204   CONTINUE
203   CONTINUE
      DO 205 J=2,5
      DO 206 K=1,2
      X=J-1
      SCHOOL(J,K)=SCHOOL(1,K)+(SCHOOL(6,K)-SCHOOL(1,K))*.2*X
206   CONTINUE
205   CONTINUE
      DO 207 J=7,10
      DO 208 K=1,2
      X=J-6
      SCHOOL(J,K)=SCHOOL(6,K)+(SCHOOL(11,K)-SCHOOL(6,K))*.2*X
208   CONTINUE
207   CONTINUE
      DO 209 J=12,15
      DO 210 K=1,2
      X=J-11
      SCHOOL(J,K)=SCHOOL(11,K)+(SCHOOL(16,K)-SCHOOL(11,K))*.2*X
210   CONTINUE
209   CONTINUE
      DO 211 J=17,20
      DO 212 K=1,2
      X=J-16
      SCHOOL(J,K)=SCHOOL(16,K)+(SCHOOL(21,K)-SCHOOL(16,K))*.2*X
212   CONTINUE
211   CONTINUE
      DO 213 K=1,2
      X=(POP(2,K,I)-(SCHOOL(4,K)+SCHOOL(5,K)+SCHOOL(6,K)+SCHOOL(7,K)
     C+SCHOOL(8,K)))*.2
      DO 214 J=4,8
      SCHOOL(J,K)=SCHOOL(J,K)+X
214   CONTINUE
213   CONTINUE
      DO 215 K=1,2
```

```
      X=(POP(3,K,I)-(SCHOOL(9,K)+SCHOOL(10,K)+SCHOOL(11,K)+SCHOOL(12,
     C+SCHOOL(13,K)))*.2
      DO 216 J=9,13
      SCHOOL(J,K)=SCHOOL(J,K)+X
  216 CONTINUE
  215 CONTINUE
      DO 217 K=1,2
      X=(POP(4,K,I)-(SCHOOL(14,K)+SCHOOL(15,K)+SCHOOL(16,K)+SCHOOL(17,
     C+SCHOOL(18,K)))*.2
      DO 218 J=14,18
      SCHOOL(J,K)=SCHOOL(J,K)+X
  218 CONTINUE
  217 CONTINUE
      DO 231 J=4,13
      J2=J-3
      DO 232 J3=1,12
      DO 233 K=1,2
      GRADES(J3,K,I)=GRADES(J3,K,I)+SCHOOL(J,K)*ATEND(J2,K,J3,I)/10[illegible].
  233 CONTINUE
  232 CONTINUE
  231 CONTINUE
  202 CONTINUE
      DO 260 I=1,20
      IY1=69+I
      IY2=IY1+1
      WRITE(6,4)IY1,IY2,(GRADES(J,1,I),J=1,12)
      WRITE(6,5)(GRADES(J,2,I),J=1,12)
  260 CONTINUE
      DO 261 I=1,11
      DO 262 J=1,20
      STAFF(I,J)=0.
  262 CONTINUE
  261 CONTINUE
      DO 266 J=1,20
      DO 265 I=1,11
      DO 264 L=1,12
      DO 263 K=1,2
      STAFF(I,J)=STAFF(I,J)+GRADES(L,K,J)*TEACH(I,K,L,J)/10[illegible].
  263 CONTINUE
  264 CONTINUE
  265 CONTINUE
  266 CONTINUE
      WRITE(6,2)
      DO 2[illegible] I=1,[illegible]
      IY[illegible]=[illegible]+I
      IY[illegible]=IY[illegible]+1
      [illegible]ITE([illegible])IY1,IY2,(STAFF(J,I),J=1,11)
  [illegible] CONTINUE
      [illegible]
  [illegible] CONTINUE
      STOP
      [illegible]
```

```
      SUBROUTINE NEW(N2)
      COMMON POP(16,2,25), BIRTH(7,2,24), DEATH(16,2,24), XMIG(16,2)
      N1=N2-1
      POP(1,1,N2)=0
      POP(1,2,N2)=0
      DO 102 I=1,7
      I2=I+2
      POP(1,1,N2)=POP(1,1,N2)+POP(I2,2,N1)*BIRTH(I,1,N1)/1000.
      POP(1,2,N2)=POP(1,2,N2)+POP(I2,2,N1)*BIRTH(I,2,N1)/1000.
  102 CONTINUE
      POP(1,1,N2)=(POP(1,1,N1)*.8+POP(1,1,N2))*(1000.+XMIG(1,1)
     C-DEATH(1,1,N1))/1000.
      POP(1,2,N2)=(POP(1,2,N1)*.8+POP(1,2,N2))*(1000.+XMIG(1,2)
     C-DEATH(1,2,N1))/1000.
      DO 104 I=2,15
      I2=I-1
      POP(I,1,N2)=(POP(I,1,N1)*.8+POP(I2,1,N1)*.2)
     C*(1000.+XMIG(I,1)-DEATH(I,1,N1))/1000.
      POP(I,2,N2)=(POP(I,2,N1)*.8+POP(I2,2,N1)*.2)
     C*(1000.+XMIG(I,2)-DEATH(I,2,N1))/1000.
  104 CONTINUE
      POP(16,1,N2)=(POP(16,1,N1)+POP(15,1,N1)*.2)
     C*(1000.+XMIG(16,1)-DEATH(16,1,N1))/1000.
      POP(15,2,N2)=(POP(16,2,N1)+POP(15,2,N1)*.2)
     C*(1000.+XMIG(16,2)-DEATH(16,2,N1))/1000.
      RETURN
      END
```

APPENDIX F

COMPUTER PROGRAM OF THE B.ED. MODEL

The program for the B.Ed. model used the following data:

1. The number of students in each year of the B.Ed. route, by specialty, in the year before the first year of the projections.

2. The number of students in grade twelve for each year starting with the year before the first projection and ending on the last year of the projections.

3. The proportion of grade twelve students entering the B.Ed. route for each year.

4. The distribution of first year students over specialty patterns each year.

5. The proportion of students progressing from first to second year each year.

6. The proportion of students progressing from second to third year each year.

7. The proportion of students progressing from third to fourth year each year.

The output of the program is a matrix of teachers by specialty for each year of the projections.

```
    ∇ TRAIN←PRODUC;S;F;BASE;SPEC;N;G12;P1;P2;P3;P4;D
[1]   'FIRST YEAR OF PROJ.'
[2]   S←⎕
[3]   'FINAL YEAR OF PROJ.'
[4]   F←⎕
[5]   TRAIN←((1+F-S),11)⍴11
[6]   SPEC←'EL, JH, M-S, E-S, L, FA, PE, C, IA, HF, T+T'
[7]   BASE←(4 11)⍴0
[8]   N←1
[9]   'NO. IN YEAR ';N;' IN ';S-1;' BY ';SPEC
[10]  BASE[N;]←⎕
[11]  →(4≥N←N+1)/9
[12]  N←1+F-S
[13]  'NO. GR. 12 IN ';F+1-N
[14]  G12←⎕
[15]  'PROP. GR. 12 TO FIRST YEAR ';1+F-N
[16]  P1←⎕
[17]  'DIST. IN ';1+F-N;' OVER ';SPEC
[18]  D←⎕
[19]  'PROP. 1 TO 2 ';1+F-N
[20]  P2←⎕
[21]  'PROP. 2 TO 3 ';1+F-N
[22]  P3←⎕
[23]  'PROP. 3 TO 4 ';1+F-N
[24]  P4←⎕
[25]  TRAIN[((2+F-S)-N);]←BASE[4;]
[26]  BASE[4;]←BASE[3;]×P4
[27]  BASE[3;]←BASE[2;]×P3
[28]  BASE[2;]←BASE[1;]×P2
[29]  BASE[1;]←D×P1×G12
[30]  TRAIN[((2+F-S)-N);]←TRAIN[((2+F-S)-N);]+BASE[3;]×1-P4
[31]  →(1≤N←N-1)/13
[32]  TRAIN←ROUND TRAIN
    ∇
```

APPENDIX G

COMPUTER PROGRAM OF THE TEACHER SUPPLY MODEL

The program of the teacher supply model used the following data:

1. A matrix of teachers by specialty and five-year age group in the year before the first year of the projections.

2. A matrix of exit rates from the teaching force, by age group and specialty, for each year of the projections.

3. A matrix of net migration by age group and specialty for each year of the projections.

4. A matrix of Alberta-trained teachers by specialty for each year of the projections.

The output of the program is a matrix of teachers by specialty for each year of the projections.

```
    ∇ PROJ;S;F;N;BASE;EXIT;IMMIG;Y;NEW;X
[1]   'PROJECT FROM'
[2]   S←⎕
[3]   'PROJECT TO'
[4]   F←⎕
[5]   BASE←EXIT←IMMIG←(9 11)⍴0
[6]   'TEACHERS BY AGE AND SPECIALTY IN ';S-1
[7]   BASE←⎕
[8]   N←S
[9]   'CHANGE ANY VARIABLES? (0=NO,1=YES)'
[10]  K←⎕
[11]  →(0=K)/24
[12]  'VARIABLE (0=EXIT AND RETIREMENT, 1=IMMIGRATION, 2=ALBERTA TRAINED)'
[13]  K←⎕
[14]  →15+3×K
[15]  'EXIT BY AGE AND SPECIALTY'
[16]  EXIT←⎕
[17]  →9
[18]  'IMMIGRATION BY AGE AND SPECIALTY'
[19]  IMMIG←⎕
[20]  →9
[21]  'ALBERTA TRAINED BY SPECIALTY'
[22]  NEW←⎕
[23]  →9
[24]  BASE←(BASE×(1-EXIT))+BASE×IMMIG
[25]  BASE[9;]←BASE[9;]+BASE[8;]÷5
[26]  K←8
[27]  BASE[K;]←(0.8×BASE[K;])+BASE[(K-1);]÷5
[28]  →(2≤Y←Y-1)/27
[29]  BASE[1;]←(0.8×BASE[1;])+NEW
[30]  'TEACHERS BY SPECIALTY IN ';N;'-';N+1
[31]  X←ROUND+/[1] BASE
[32]  X
[33]  'EL=';X[1];'  JP=';X[2];'  SP=';+/X[2+⍳9];'     TOTAL=';+/X
[34]  →(F≥N←N+1)/9
    ∇
```

APPENDIX H

AGE-SPECIFIC BIRTH RATES

<u>Births for females aged 15-19</u>. As illustrated in Figure 14, the birth rates for females aged 15-19 was at its lowest level, 56.3, in 1951. The highest level was at 85.4 in 1960. From this point, it declined steadily to 62.7 in 1967. The mean birth rate for this age category was 73.2.

An examination of the graph in Figure 14 would suggest that a continuing downward trend followed by a levelling off may be expected. However, this trend is not so clearly established as to appear a certainty. Even if the birth rate rises, its effect would not likely be any different from a birth rate of 73.2 (the mean) occurring over the period 1968 through 1980. It is unlikely but the highest level the birth rate might reach would be the high level over the years 1951 through 1967. Thus the very maximum level expected would be 84.4.

The alternate assumptions regarding the aged 15-19 birth rate are

(1) that the birth rate will decline to and remain at 56.3 over the period 1968 through 1980.

(2) that the birth rate will rise to and remain at 73.2 over the period 1968 through 1980.

(3) that the birth rare will rise to and remain at 84.4 over the period 1968 through 1980.

Of the assumptions, number one appears to be the most likely to be correct, number two would appear to be a relatively conservative estimate, and assumption three has a very remote chance of being correct.

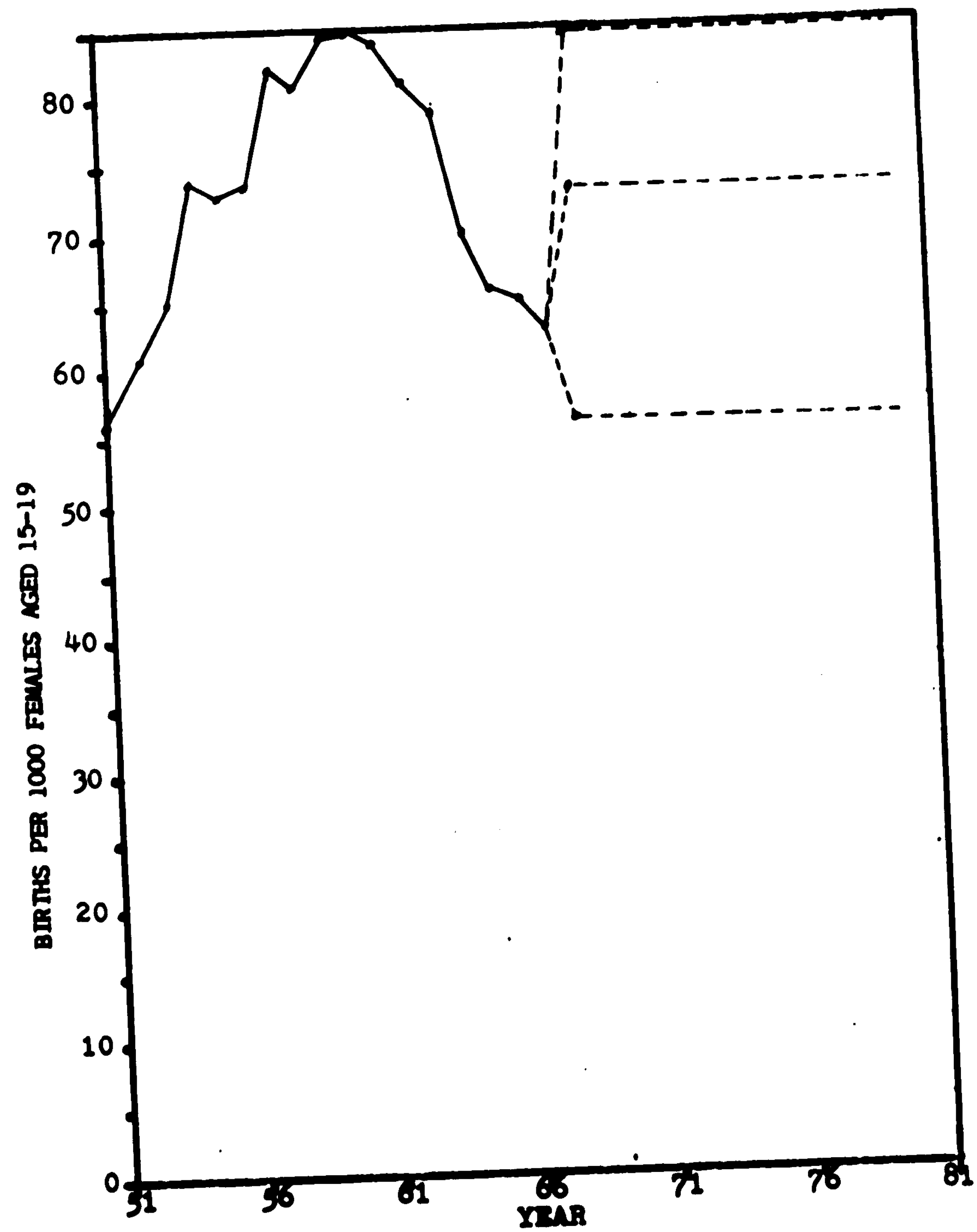

FIGURE 14

BIRTHS PER 1000 FEMALES AGED 15-19 IN ALBERTA

<u>Births for females aged 20-24</u>. The birth rates for females aged 20-24 ranged from a high of 281.2 in 1959 to a low of 196.7 in 1966. A steady increase between the years 1951 to 1955 was followed by a series of fluctuations between 1955 and 1961. From 1961 to 1966 the rate declined steadily but increased again in 1967.

The increase in 1967 suggests, but does not assure certainty, that the birth rate may be rising again. Should this rise occur, it is unlikely that the overall effect would be greater than a continued birth rate of 253.2 which is the mean value over the period under consideration. On the other hand, if the rise in 1967 is simply a minor fluctuation then the birth rate could decline to and stay at 196.7 which is the lowest value over the years 1951 through 1967. Although is is a remote possibility, the birth rate may rise to 281.2, as it did in 1959, and remain at that level over the next few years.

The alternate assumptions regarding the aged 20-24 birth rate are

(1) that the birth rate will decline to and remain at 196.7 over the period 1968 through 1980.

(2) that the birth rate will rise to and remain at 253.2 over the period 1968 through 1980.

(3) that the birth rate will rise to and remain at 281.2 over the period 1968 through 1980.

Of the assumptions, number two appears to be most nearly appropriate. Assumption number one will likely be too low. Assumption number three has a very remote chance of being accurate.

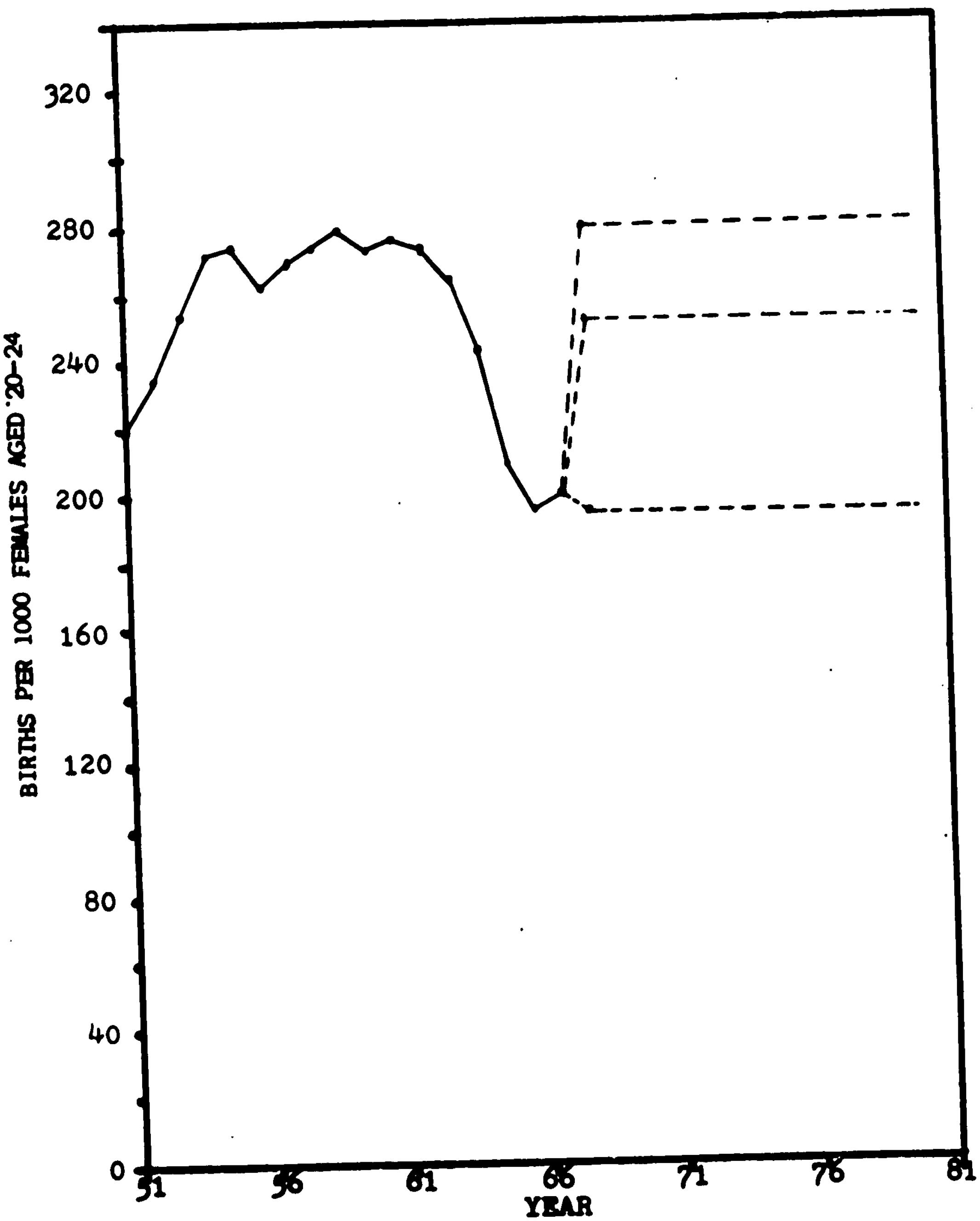

FIGURE 15

BIRTHS PER 1000 FEMALES AGED 20-24 IN ALBERTA

Births for females aged 25-29. As illustrated in Figure 16, the birth rates for females aged 25-29 increased to a high of 248.4 in 1959. Then they declined rapidly to a low of 168.6 in 1966. The birth rate of 168.6 also obtained in 1967.

The slope of the graph in Figure 16 would suggest that the birth rates may level off at 168.6 or slightly higher. If, in fact, the portion of the graph illustrated exhibits a cyclical trend, the birth rates may begin to rise and have an effect similar to a continuous birth rate of 220.5. The highest likely value, and the chance of reaching this seems remote, might be 248.4.

The alternate assumptions regarding the aged 25-29 birth rates are

(1) that the birth rate will continue at a level of 168.6 over the time period 1968 through 1980.

(2) that the birth rate will rise to and remain at 220.5 over the time period 1968 through 1980.

(3) that the birth rate will rise to and remain at 248.4 over the time period 1968 through 1980.

Of the assumptions, number one appears to be the most likely to be representative, number two would appear to provide a reasonable upper limit and number three would appear to be possible but highly improbable.

Births for females aged 30-34. The births for females ages 30-34 rises from a level of 143.6 in 1951 to a peak of 168.4 in 1954. From 1954 it declines, although not steadily, to a low of 99.9 in 1967. These data rea illustrated in Figure 17.

The slope of the graph in Figure 17 would lend support to the

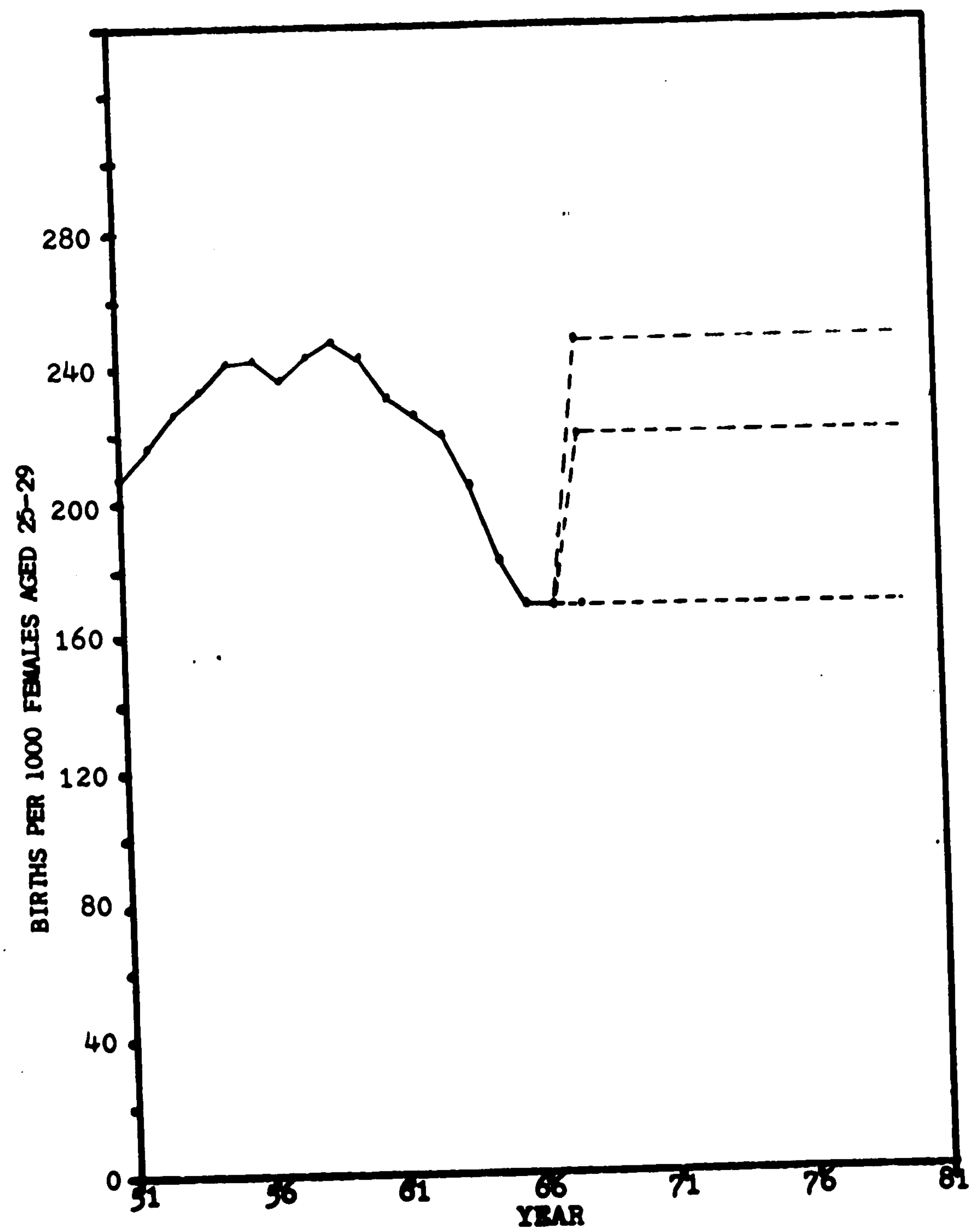

FIGURE 16

BIRTHS PER 1000 FEMALES AGED 25-29 IN ALBERTA

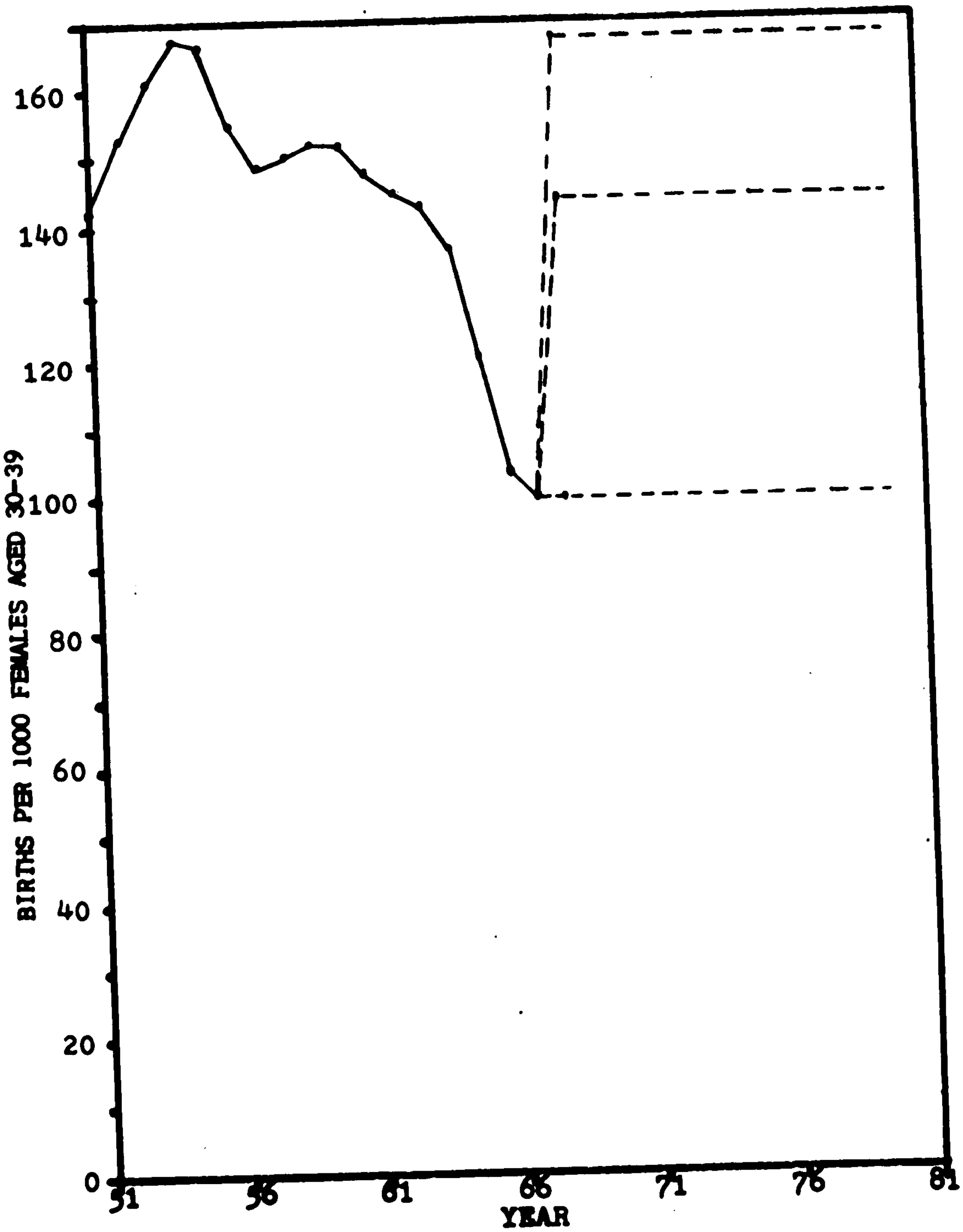

FIGURE 17

BIRTHS PER 1000 FEMALES AGED 30-39 IN ALBERTA

idea that the birth rate might remain at 99.9 in the years to come. If in fact, the new low is a temporary figure, the birth rate may rise. Even a substantial increase could hardly be expected to have a greater effect than a birth rate of 145.5. It is not likely but a level of 168.4 has been reached before and could obtain over the next few years.

The assumptions regarding the rate of births to females aged 30-34 are as follows:

(1) the birth rate will remain at a level of 99.9 over the time period 1968 through 1980.

(2) the birth rate will rise to and remain at a level of 144.5 over the time period 1968 through 1980.

(3) the birth rate will rise to and remain at a level of 168.4 over the time period 1968 through 1980.

Of the three assumptions, the first appears to be most reasonable, the second would appear to be a reasonable upper limit and the third, though only very remotely possible, tends to show what would happen under very unusual circumstances.

<u>Births for females aged 35-39</u>. The rate of births per 1000 females aged 35-39 increased slightly from 84.7 in 1951 to a high of 92.4 in 1955. After 1955, the rate declined sharply, but not steadily, to a low of 54.0 in 1967.

The slope of the graph in Figure 18 would suggest that the rate of births to females aged 35-39 may continue to decrease during the years following 1967. However, it was difficult to determine the extent to which it would decrease but it would appear to be safe to assume that 54.0 would be a reasonable upper limit. Also, considering

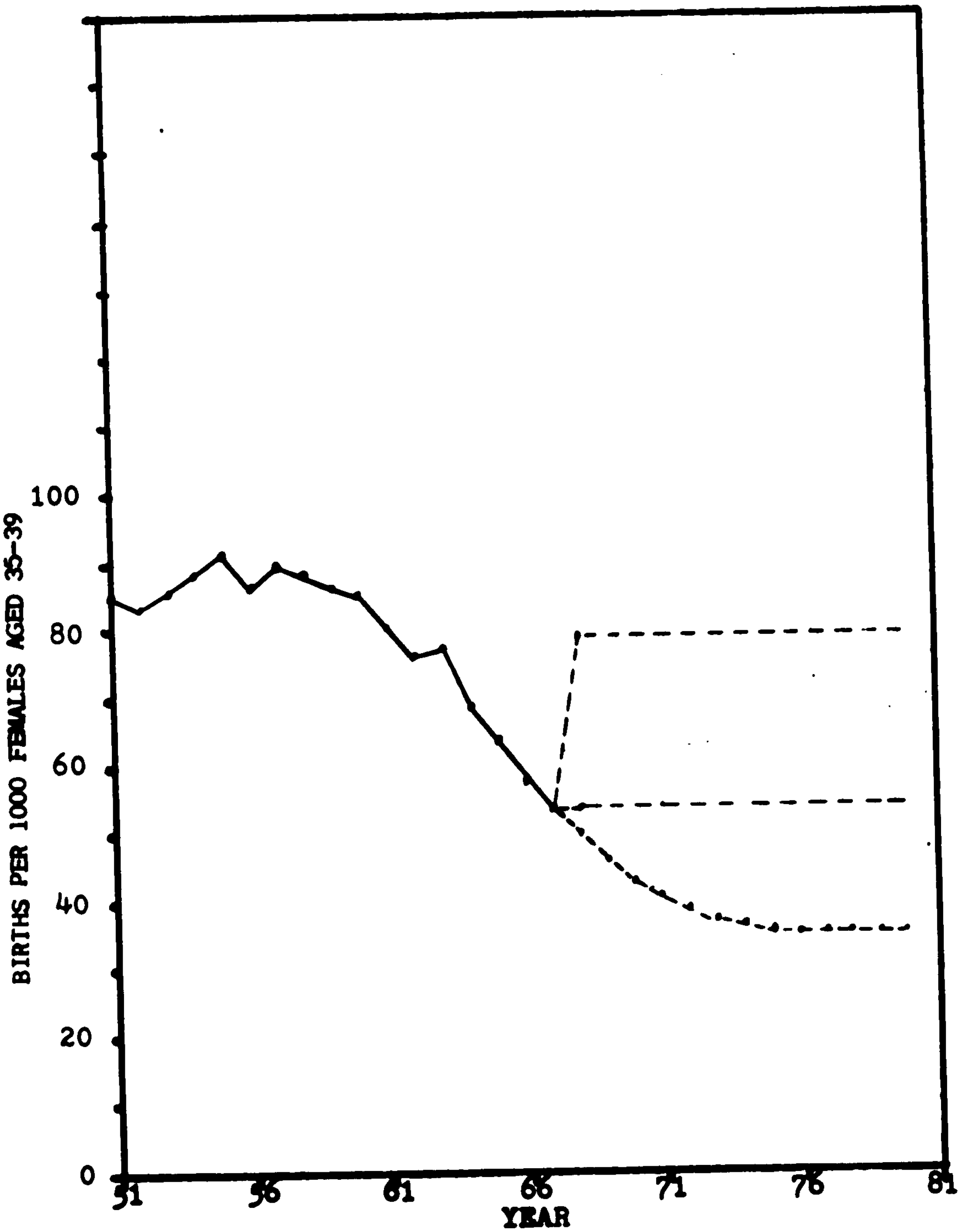

FIGURE 18

BIRTHS PER 1000 FEMALES AGED 35-39 IN ALBERTA

the years 1963 to 1967 as representative of a parabolic trend, the birth rates could fall to about 35.0 and level off at about 35.0 in 1975. If, on the other hand, the graph represents a part of a cycle such that it could be expected to rise, the effect would likely be the same as the overall effect over the earlier period.

The assumptions regarding the rate of births to females aged 35-39 were as follows:

(1) the birth rate will continue to decline through 50.0 in 1968, 46.0 in 1969, 42.5 in 1970, 40.5 in 1971, 38.5 in 1972, 37.0 in 1973, 36.0 in 1974 and remain at 35.0 over the period 1975 through 1980.

(2) the birth rate will remain at 54.0 over the time period 1968 through 1980.

(3) the birth rate will rise to and remain at 79.8 over the time period 1968 through 1980.

In reality, the rate of actual births may likely be expected to conform to something between assumptions one and two.

Births for females aged 40-44. The rate of births for females aged 40-44 increased from 28.8 in 1951 to a high of 33.3 in 1955. Then it decreased to a low of 16.1 in 1967. The mean value of the birth rate over the time period 1951 through 1967 was 27.2.

The slope of the graph in Figure 19 would suggest a continuing downward trend. However, birth rates generally level off after a period of time. Thus, it may be that the birth rates for this group can be approximated by considering the values for 1965, 1966, and 1967 as a part of a parabolic trend. On the other hand, it may be possible that

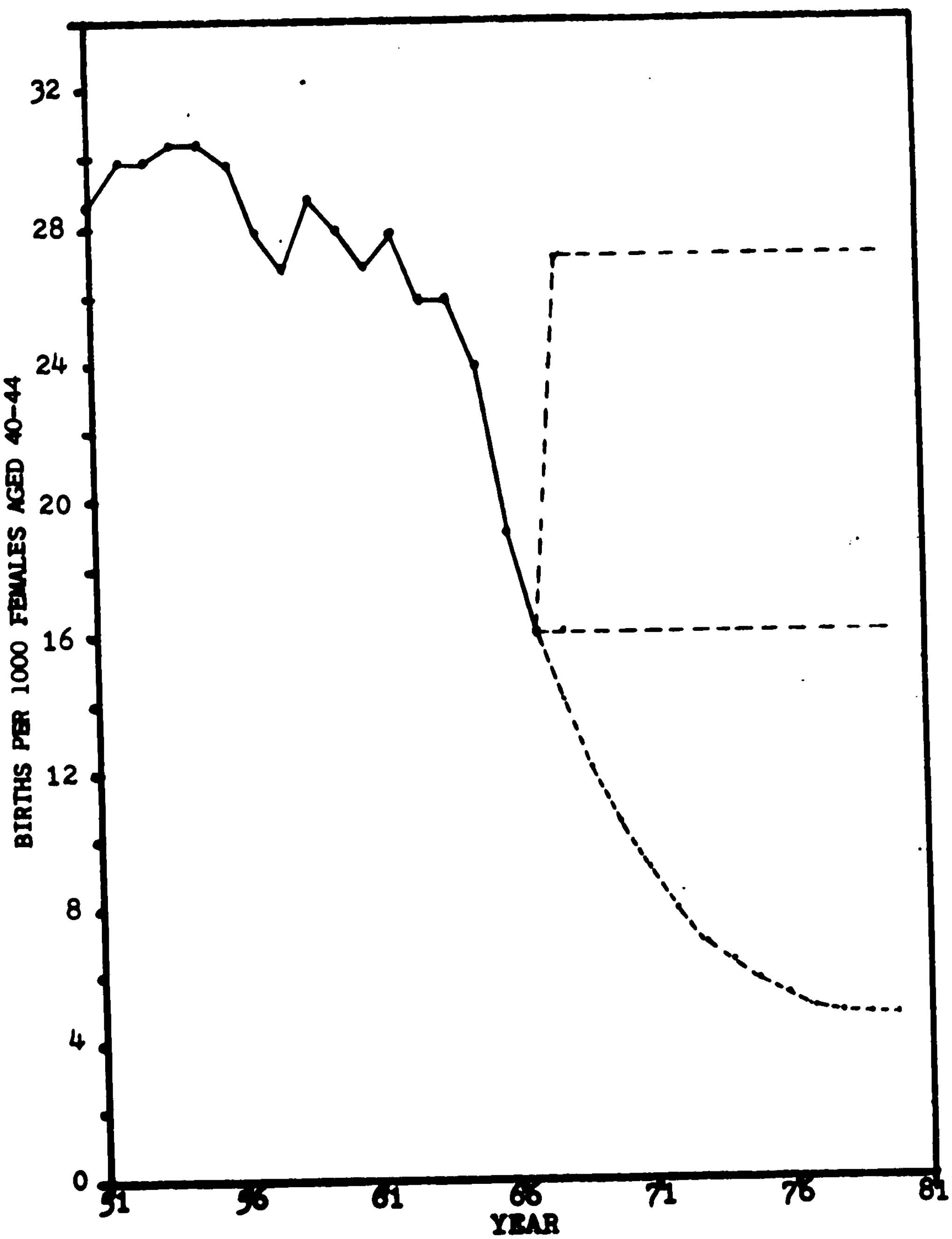

FIGURE 19

BIRTHS PER 1000 FEMALES AGED 40-44 IN ALBERTA

the birth rates have reached the low value and will remain nearly the same over the next few years. If the birth rates were to rise, the mean value over the last period may be a high estimate of the effect.

The assumptions regarding the rate of births to females aged 40-44 are as follows:

(1) the birth rate will continue to decline through 14.0 in 1968, 12.0 in 1969, 10.4 in 1970, 9.0 in 1971, 7.8 in 1972, 6.6 in 1973, 6.2 in 1974, 5.6 in 1975, 5.4 in 1976, 5.0 in 1977, 4.8 in 1978, 4.8 in 1979, and 4.8 in 1980.

(2) the birth rate will remain at 16.1 through the years 1968 through 1980.

(3) the birth rate will rise to and remain at 27.2 over the period 1968 through 1980.

In reality, the birth rate will likely conform to something between assumptions one and two. Assumption three serves as a maximum probable limit.

Births for females aged 45-49. The data of Table 65 illustrates the fact that there are no marked trends for these birth rates. In the absence of definite trends and in consideration of the fact that these rates are relatively low, the birth rates for the coming time period may be based on the high, mean, and low birth rates for this group.

The assumptions regarding the rate of births to females 45-49 years of age are as follows:

(1) that the birth rate will decline to and remain at 1.7 over the time period 1968 through 1980.

Table 65

Births per 1000 Females of Various Ages
in Alberta: 1951-1967

Year	Age of Mothers						
	15-19	20-24	25-29	30-34	35-39	40-44	45+
1951	56.3	220.5	208.0	143.6	84.7	28.8	3.1
1952	60.9	236.4	217.4	154.2	84.3	30.1	2.7
1953	64.8	256.5	227.3	162.7	86.0	30.2	3.8
1954	74.2	274.1	234.2	168.4	89.3	32.7	3.1
1955	72.7	275.8	242.4	167.0	92.4	33.3	3.1
1956	73.7	264.0	243.3	155.0	87.1	30.1	2.9
1957	82.4	270.7	236.9	149.2	89.7	27.6	2.2
1958	81.1	275.8	244.1	151.1	89.3	26.9	3.0
1959	84.8	281.2	248.4	153.0	86.9	28.5	2.8
1960	85.4	274.6	244.5	152.6	85.8	27.7	3.0
1961	84.4	278.4	231.6	148.3	81.2	27.4	2.2
1962	81.3	276.4	226.6	145.4	77.0	27.6	2.4
1963	78.6	265.7	220.0	143.8	77.7	26.3	2.1
1964	69.8	244.3	205.0	136.7	69.3	26.3	1.9
1965	65.9	210.1	172.1	121.0	64.3	23.5	2.4
1966	65.0	196.7	168.6	103.9	58.4	19.0	1.7
1967	62.7	202.6	168.6	99.9	54.0	16.1	1.9
Mean	73.17	253.16	220.52	144.45	79.84	27.18	2.60

Compiled from: Dominion Bureau of Statistics, Vital Statistics, Annual Reports, Ottawa: Queen's Printer, 1951-1967.

(2) that the birth rate will rise to and remain at 2.6 over the time period 1968 through 1980.

(3) that the birth rate will rise to and remain at 3.8 over the time period 1968 through 1980.

Of the assumptions, number two will most likely be representative of reality but number one and number three serve as probable lower and upper limits respectively.

APPENDIX I

AGE AND SEX-SPECIFIC DEATH RATES

<u>Death rates for males and females aged 0-4</u>. As illustrated in Figure 20, the number of deaths per thousand aged 0-4 was lower for females than for males in all years. Also, it should be noted that both sets of rates showed a general decrease from 1951 through 1967 and could be fitted reasonably well to a straight line regression model.

In order to test the effect of a continued decrease, both of the sets of death rates were fitted to a straight line. The regression equations were as follows:

(1) males $X = -.29Y + 10.1$

(2) females $X = -.27Y + 7.9$

where Y = Year - 1951

X = Deaths per 1000

Even though the death rates may not continue downward according to the past trend, these regression lines served as a minimum value.

If the death rates for these groups increase or remain the same, it is unlikely that their effect could be greater than a continuation of the mean values. The greatest value that seems at all likely is the maximum value shown.

The assumptions regarding the death rates for males aged 0-4 were as follows:

(1) that the death rate will increase to 5.1 in 1968 and decrease through 4.9 in 1969, 4.6 in 1970, 4.2 in 1971, 4.0 in 1972, 3.7 in 1973, 3.4 in 1974, 3.1 in 1975, 2.8 in 1976, 2.5 in 1977, 2.2 in 1978, 1.9 in 1979, and 1.7 in 1980.

(2) that the death rate will increase to and remain at 7.5

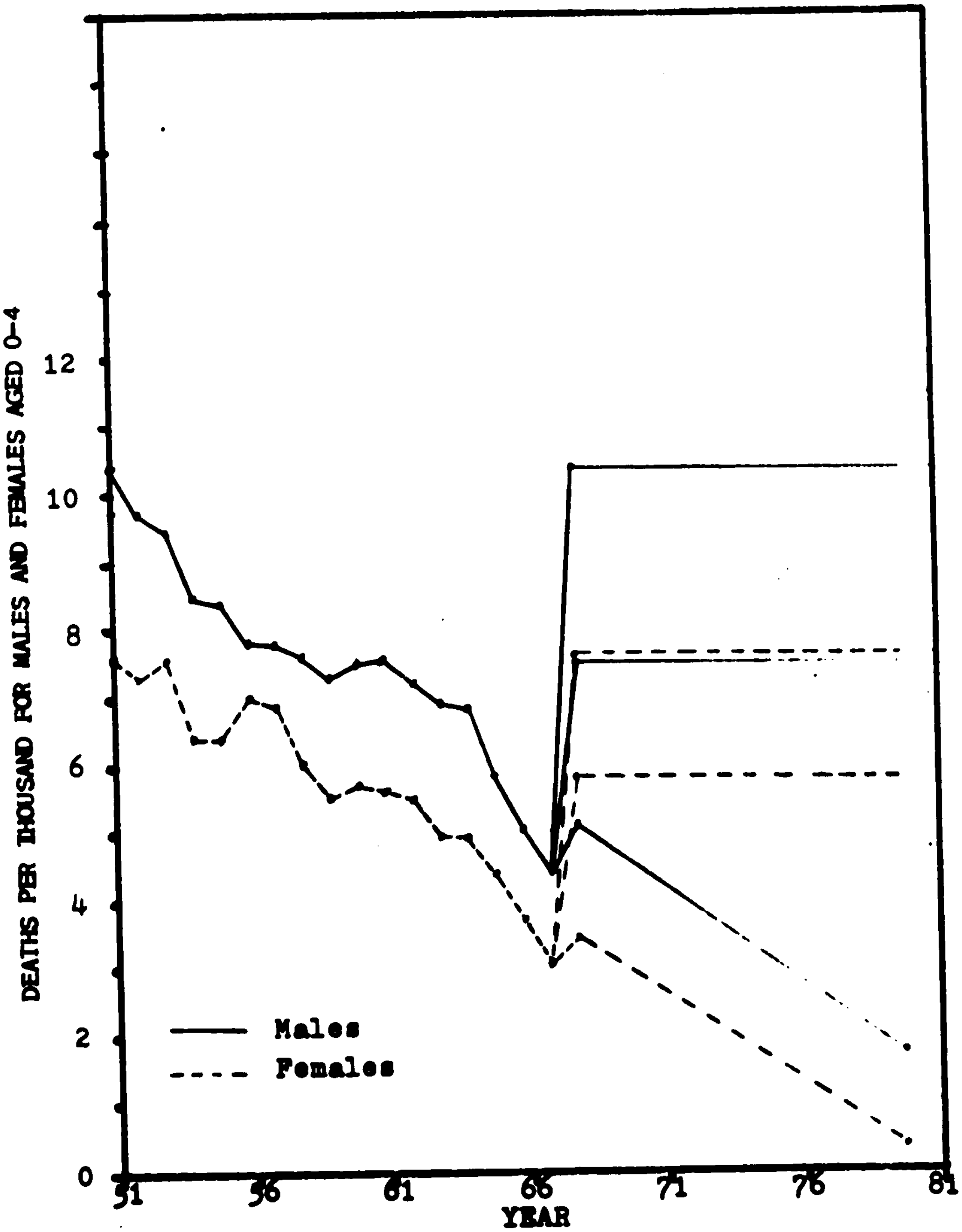

FIGURE 20

DEATH RATES FOR MALES AND FEMALES AGED 0-4 IN ALBERTA

Table 66

Death Rates for Males of Various Ages in Alberta: 1951-1967

Year	Age 0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75+
1951	10.44	0.76	0.77	1.48	1.85	1.53	2.39	2.29	3.07	6.01	8.48	13.28	21.51	29.65	32.85	112.99
1952	9.76	0.88	0.90	1.30	2.02	2.05	2.27	2.21	3.53	5.58	10.09	13.80	21.34	33.32	47.09	103.18
1953	9.53	1.33	1.09	1.51	2.56	1.65	2.22	3.09	3.87	6.05	8.70	12.91	21.72	30.19	52.25	106.52
1954	8.51	0.64	0.75	1.01	2.33	1.64	1.94	2.30	3.71	5.41	9.51	12.92	22.48	31.95	50.38	103.80
1955	8.38	0.52	0.88	1.14	1.80	1.76	2.24	2.08	3.82	5.25	8.78	13.10	22.37	35.95	51.08	113.57
1956	7.82	0.56	0.48	1.32	1.73	1.68	1.51	2.19	3.43	5.10	8.10	12.67	20.34	32.00	47.83	107.94
1957	7.79	0.60	0.58	1.24	1.87	1.78	1.78	2.03	3.33	4.70	8.27	13.20	19.79	31.72	49.76	104.73
1958	7.60	0.46	0.42	1.57	1.64	1.88	1.74	1.99	3.63	5.91	8.67	13.41	19.47	33.95	49.07	100.76
1959	7.30	0.41	0.63	1.05	1.83	1.72	2.12	2.01	3.02	4.97	8.25	13.44	20.70	32.22	49.26	103.11
1960	7.49	0.38	0.62	1.38	1.70	1.57	1.49	2.51	3.26	4.63	8.01	12.67	20.42	31.99	51.75	105.31
1961	7.57	0.45	0.48	1.27	1.82	1.86	1.72	2.05	3.29	4.98	8.65	12.17	20.44	29.83	46.19	106.23
1962	7.16	0.39	0.49	1.01	1.98	1.47	1.87	1.90	2.69	5.36	7.76	13.44	20.76	32.29	50.98	107.15
1963	6.91	0.57	0.52	0.87	2.04	1.66	1.80	2.07	3.56	5.16	8.73	13.07	19.73	29.31	48.43	109.14
1964	6.83	0.51	0.40	1.22	2.16	1.50	1.68	2.30	3.14	5.73	7.81	12.51	22.43	32.84	46.82	106.92
1965	5.84	0.32	0.46	1.15	1.88	1.81	1.87	2.19	3.07	4.74	9.01	13.26	20.19	31.63	46.39	108.36
1966	4.95	0.29	0.48	1.50	1.98	1.79	1.58	2.21	3.15	5.07	8.21	12.85	21.30	31.33	46.46	107.33
1967	4.36	0.45	0.57	1.45	2.33	1.71	1.72	1.80	3.57	4.51	7.73	13.44	19.92	30.77	44.63	101.11
Mean	7.54	0.56	0.62	1.26	1.96	1.71	1.87	2.19	3.36	5.24	8.52	13.07	20.88	31.79	47.72	106.36

Compiled from: Government of Alberta, Department of Public Health, Vital Statistics Division, Annual Report, Edmonton: Queen's Printer, 1951-1967.

Table 67

Death Rates for Females of Various Ages in Alberta: 1951-1967

Year	Age															
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75+
1951	7.56	0.72	0.55	1.00	1.26	0.80	1.36	1.76	2.33	3.83	6.28	8.06	15.18	22.68	42.86	98.88
1952	7.28	0.53	0.63	0.90	1.00	0.62	1.23	1.54	2.75	3.66	5.95	8.87	15.59	20.03	42.12	94.27
1953	7.57	0.58	0.48	0.61	0.60	1.17	1.05	1.59	2.48	3.25	5.90	8.83	13.99	23.57	40.92	90.58
1954	6.44	0.62	0.27	0.52	0.69	0.71	1.83	1.57	2.02	3.31	5.47	7.69	12.13	20.56	34.28	94.46
1955	6.44	0.48	0.44	0.46	0.40	0.77	1.07	1.50	2.15	3.29	3.57	8.12	12.39	20.73	32.48	93.40
1956	7.02	0.73	0.58	0.49	0.59	0.68	0.73	1.55	2.03	4.45	5.42	8.16	14.91	26.72	34.31	89.82
1957	6.87	0.40	0.35	0.65	0.58	0.70	0.97	1.25	1.81	2.85	5.85	7.68	13.58	18.84	32.15	90.42
1958	6.00	0.39	0.67	0.59	0.59	0.48	1.11	1.14	1.59	2.56	4.96	5.87	11.50	19.28	31.70	86.47
1959	5.46	0.35	0.38	0.53	0.56	0.79	0.72	0.96	1.56	3.12	4.83	7.23	11.82	16.89	35.12	86.61
1960	5.68	0.42	0.41	0.87	0.57	0.75	0.70	1.20	1.87	2.85	5.13	7.50	11.89	19.16	30.80	87.30
1961	5.58	0.31	0.22	0.70	0.51	0.52	0.72	1.30	1.72	3.04	3.90	6.33	10.71	16.97	29.13	82.01
1962	5.54	0.40	0.30	0.48	0.76	0.59	0.85	1.10	2.14	2.81	3.89	8.05	9.57	17.58	31.11	85.69
1963	4.85	0.29	0.19	0.58	0.80	0.54	0.63	1.20	2.12	2.69	4.93	6.77	11.29	18.35	32.32	86.77
1964	4.92	0.29	0.27	0.48	0.65	0.76	0.72	1.44	1.91	2.70	4.63	6.52	10.87	16.89	26.35	82.03
1965	4.43	0.38	0.35	0.49	0.49	0.73	0.83	1.13	1.77	3.52	4.22	7.34	9.99	16.29	29.26	83.02
1966	3.73	0.37	0.33	0.55	0.61	0.67	0.85	1.32	1.69	2.50	4.17	7.15	11.00	18.29	28.95	84.47
1967	3.02	0.33	0.30	0.49	0.64	0.56	0.90	1.38	2.12	2.95	4.65	7.82	9.82	17.17	27.55	77.62
Mean	5.79	0.45	0.38	0.62	0.66	0.70	0.90	1.35	2.00	3.14	4.93	7.53	12.13	19.41	33.02	87.87

Compiled from: Government of Alberta, Department of Public Health, Vital Statistics Division, Annual Report. Edmonton: Queen's Printer, 1951-1967.

in the years 1968 through 1980.

(3) that the death rate will increase to and remain at 10.4 during the years 1968 through 1980.

The assumptions regarding the death rates for females aged 0-4 were as follows:

(1) that the death rate will increase to 3.4 in 1968 and decrease through 3.2 in 1969, 2.9 in 1970, 2.6 in 1971, 2.4 in 1972, 2.1 in 1973, 1.8 in 1974, 1.6 in 1975, 1.3 in 1976, 1.0 in 1977, 0.8 in 1978, 0.5 in 1979, 0.3 in 1980.

(2) that the death rate will increase to and remain at 5.8 during the years 1968 through 1980.

(3) that the death rate will increase to and remain at 7.6 during the years 1968 through 1970.

Of the assumptions, reality will likely prove to be between assumptions one and two for both males and females. Assumption three in both cases serves to set a maximum probable rate.

<u>Death rates for males and females age 5-9</u>. As illustrated in Figure 21, the death rates for males and females aged 5-9 both exhibit a slight downward trend but the fluctuations from these trends are so wide as to make them meaningless.

For the above reason, the death rates for these groups were accounted for merely by considering the high, mean, and low values of each set of rates. This procedure resulted in alternate assumptions for the male death rates as follows:

(1) that the death rate will decline to and remain at 0.3 during the time period 1968 through 1980.

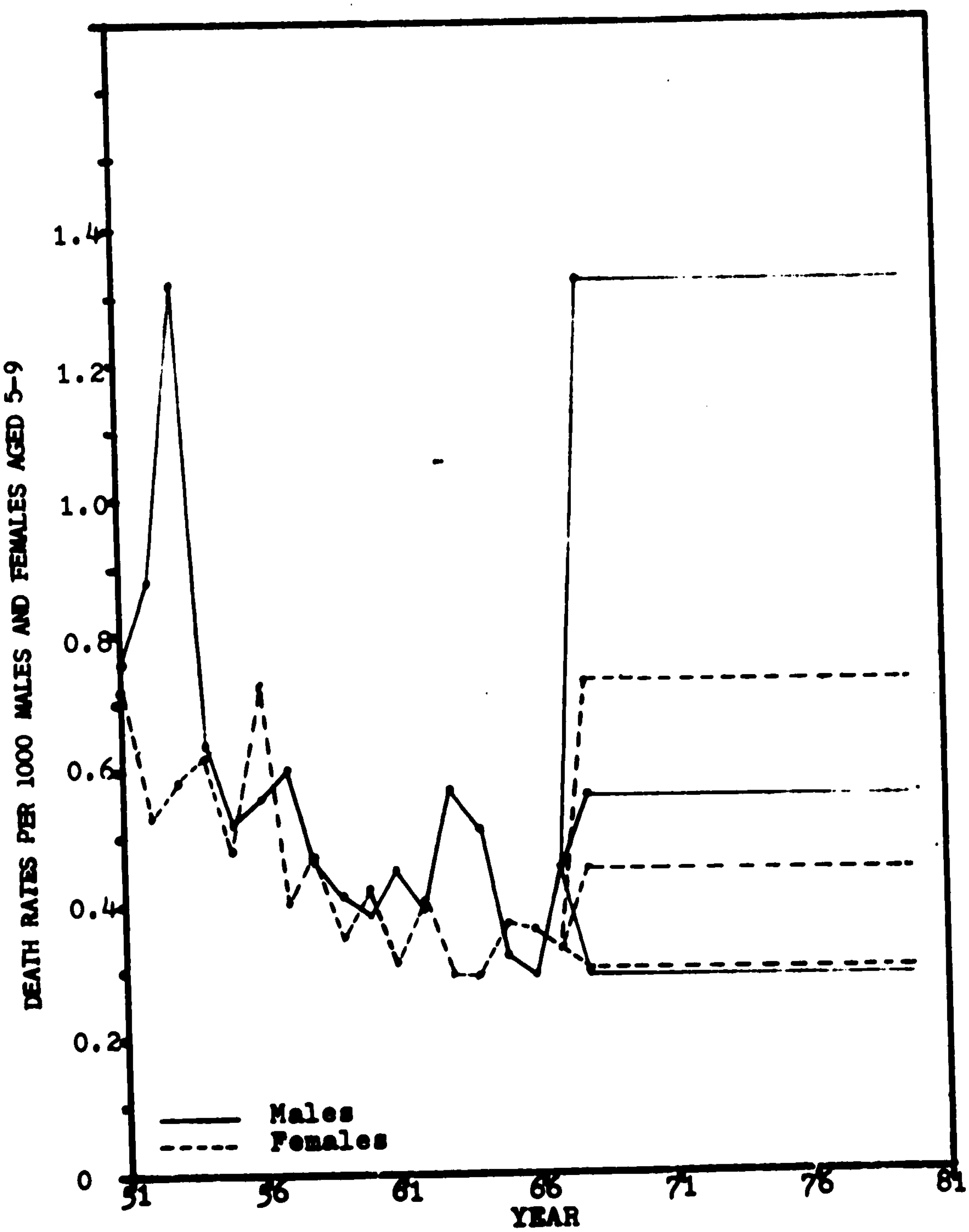

FIGURE 21

DEATH RATES FOR MALES AND FEMALES AGED 5-9 IN ALBERTA

(2) that the death rate will rise to and remain at 0.5 during the time period 1968 through 1980.

(3) that the death rate will rise to and remain at 1.3 during the time period 1968 through 1980.

The alternate assumptions for the female death rates were as follows:

(1) that the death rate will decline to and remain at 0.3 during the time period 1968 through 1980.

(2) that the death rate will rise to and remain at 0.5 during the time period 1968 through 1980.

(3) that the death rate will rise to and remain at 0.7 during the time period 1968 through 1980.

Considering the assumptions, in each case assumptions one and two will likely be the limits of the effect of the real death rates. However, assumption number three serves as a conservative estimate of the upper limit.

Death rates for males and females aged 10-14. As illustrated in Figure 22 the death rates for both males and females aged 10-14 decreased to some extent in the 1950's. However no overall trend appears to be manifest in either the male or female death rates. Thus the alternate assumptions regarding these rates were based on a consideration of the high mean, and low rates over the time period under consideration.

The alternate assumptions regarding the death rates for males aged 10-14 over the time period 1968 through 1980 were that the death rate would

(1) decrease to and remain at 0.4.

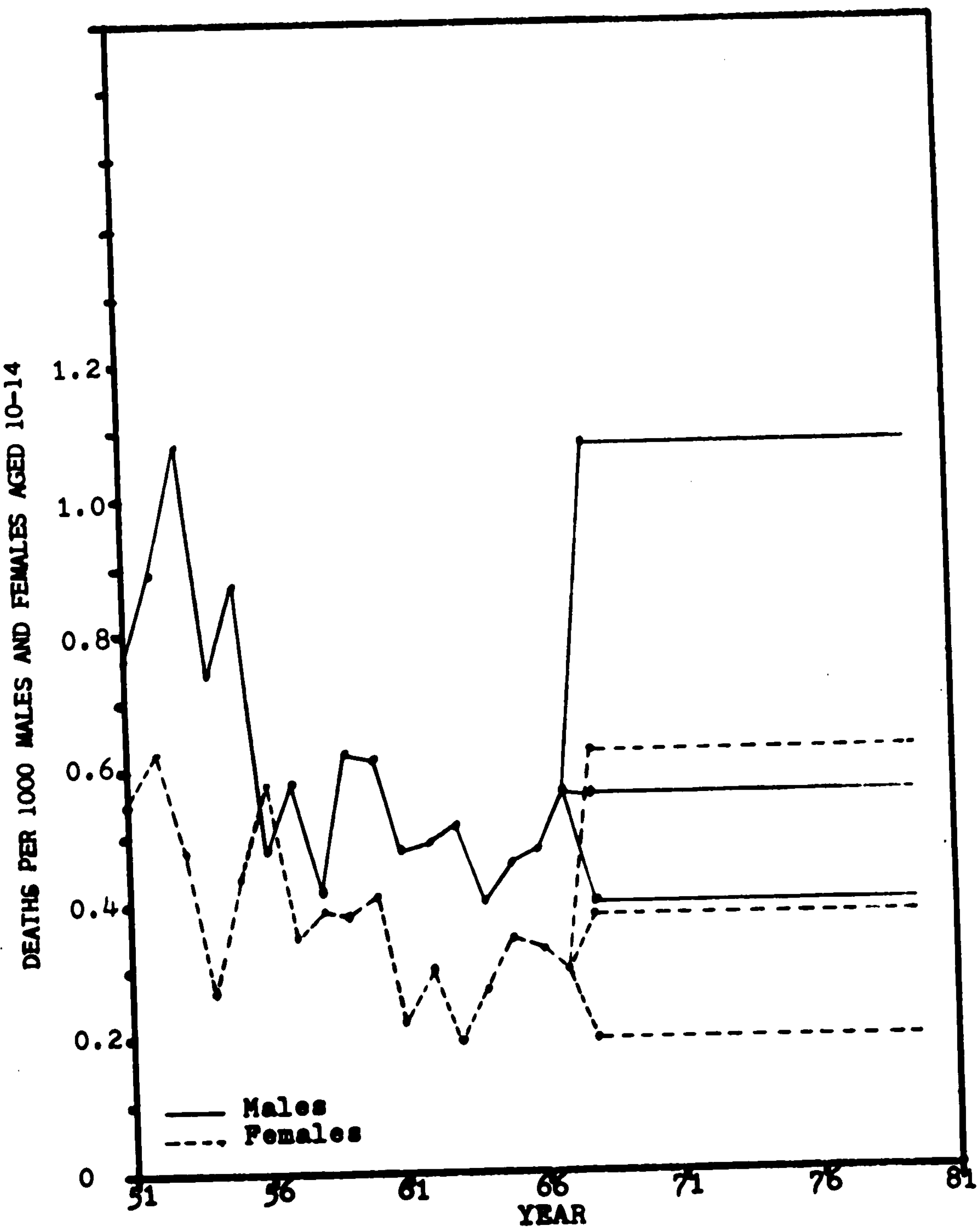

FIGURE 22

DEATH RATES FOR MALES AND FEMALES AGED 10-14 IN ALBERTA

(2) increase to and remain at 0.6.

(3) increase to and remain at 1.1.

It should be noted that rates illustrated in Figure 22 make assumption three appear very unlikely while assumptions one and two would appear to include the range of the real death rates. The alternate assumptions regarding the death rates for females aged 10-14 over the time period 1968 through 1980 were that the death rate would

(1) decrease to and remain at 0.2.

(2) increase and remain at 0.4.

(3) increase to and remain at 0.6.

The third assumption would appear, from the nature of the graph in Figure 22, to ve very unlikely to be true, but the real death rates would probably be between assumptions one and two.

Death rates for males and females aged 15-19. The death rates for both males and females aged 15-19 do not show any clear-cut trends but do fluctuate widely. This is illustrated in Figure 23. To account for this wide fluctuation, it was assumed that any death rate that had occurred could occur again but the fluctuation could also continue.

The assumptions regarding the death rate for males aged 15-19, over the period 1968-1980, were that the death rate would

(1) decrease to and remain at 0.9.

(2) decrease to and remain at 1.3.

(3) increase to and remain at 1.6.

Although the death rate for any one year could be equal to those of assumption one and three, continued fluctuations could have an effect

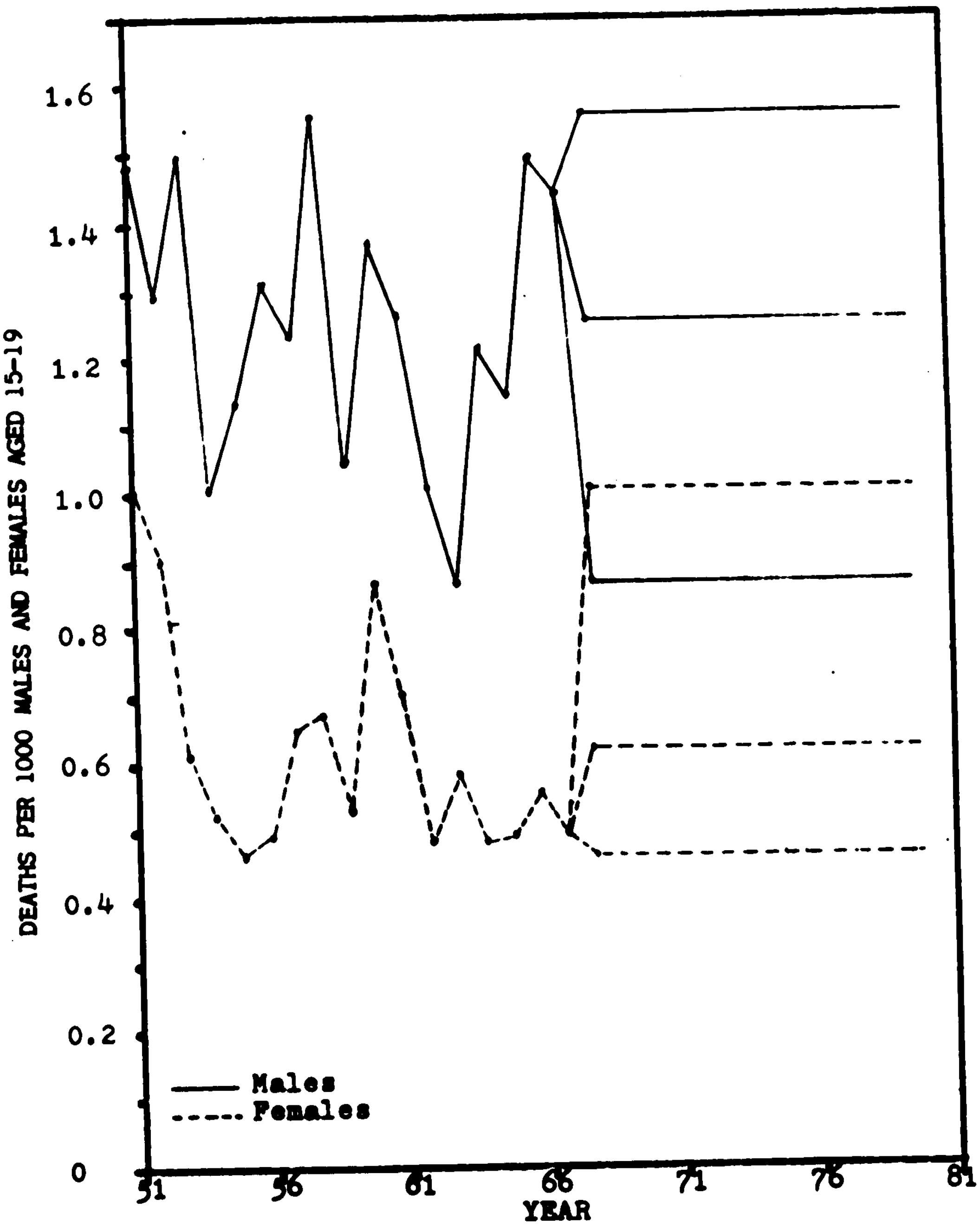

FIGURE 23

DEATH RATES FOR MALES AND FEMALES AGED 15-19 IN ALBERTA

more like those of assumption two. The assumptions regarding the death rate for females aged 15-19, over the period 1968-1980, were that the death rate would

(1) decline to and remain at 0.4.

(2) increase to and remain at 0.6.

(3) increase to and remain at 0.9.

In this case, the real death rates would be most likely to fall between assumptions one and two with assumption three having little chance of being true.

<u>Death rates for males and females aged 20-24</u>. As illustrated in Figure 24, both the male and female death rates for persons aged 20-24 declined in the early 1950's. However, the male death rate has recently shown a tendency toward an increase. Thus, while the assumptions for both male and female death rates were based on the high, mean, and low values, the likelihood of the accuracy of particular assumptions is different for males and females.

The assumptions regarding the death rates for males aged 20-24 over the time period 1968 through 1980 were that the rates would

(1) decrease to and remain at 1.6.

(2) decrease to and remain at 2.0.

(3) increase to and remain at 2.5.

The nature of the graph in Figure 24 suggests that the real death rates would be expected to comply with the range established by assumptions two and three. The assumptions regarding the death rates for females aged 20-24 over the time period 1968 through 1980 were that

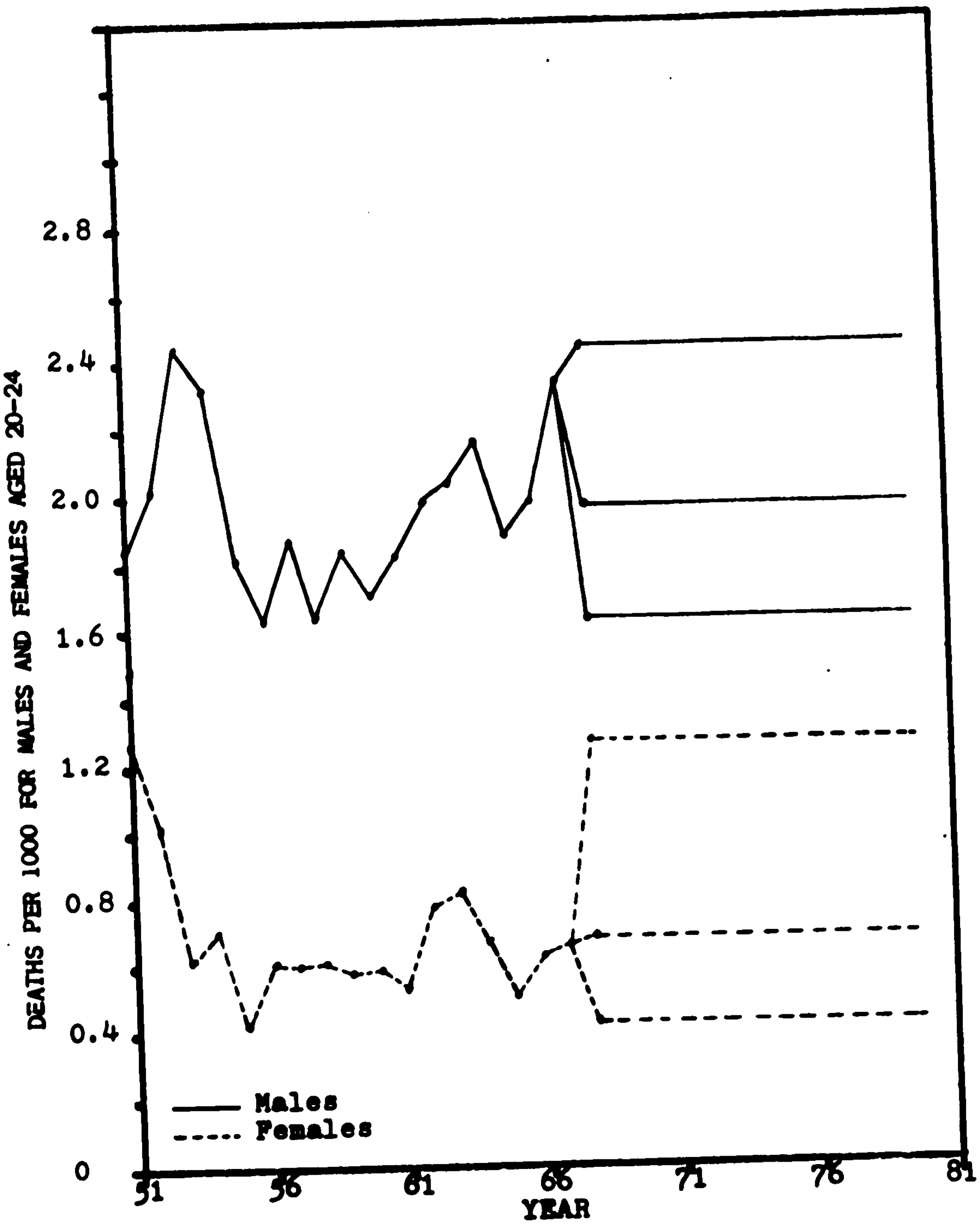

FIGURE 24

DEATH RATES FOR MALES AND FEMALES AGED 20-24 IN ALBERTA

the rates would

(1) decrease to and remain at 0.4.

(2) increase to and remain at 0.7.

(3) increase to and remain at 1.3.

For females of this age group, the data suggests that the real death rates might have an effect most closely related to assumption two.

Death rates for males and females aged 25-29. Both the male and female death rates for this age group are characterized by wide fluctuations and the lack of definite trends. As illustrated in Figure 25, the female death rates reached a peak in 1953 which was far higher than it ever reached in the subsequent years. Because of the lack of trends and in spite of the inconsistency in the female death rates, the alternate assumptions were based on the high, mean, and low rates.

The alternate assumptions regarding the death rates for males aged 25-29 over the time period 1968 through 1980 were that the death rate would

(1) decline to and remain at 1.5.

(2) decline to and remain at 1.7.

(3) increase to and remain at 2.1.

In any given year, the assumptions appear to have equiprobability of being true. If, however, the fluctuations continue, the effect will most likely be like the effect of assumption two. The alternate assumptions regarding the death rates for females aged 25-29 over the time period 1968 through 1980 were that the death rate would

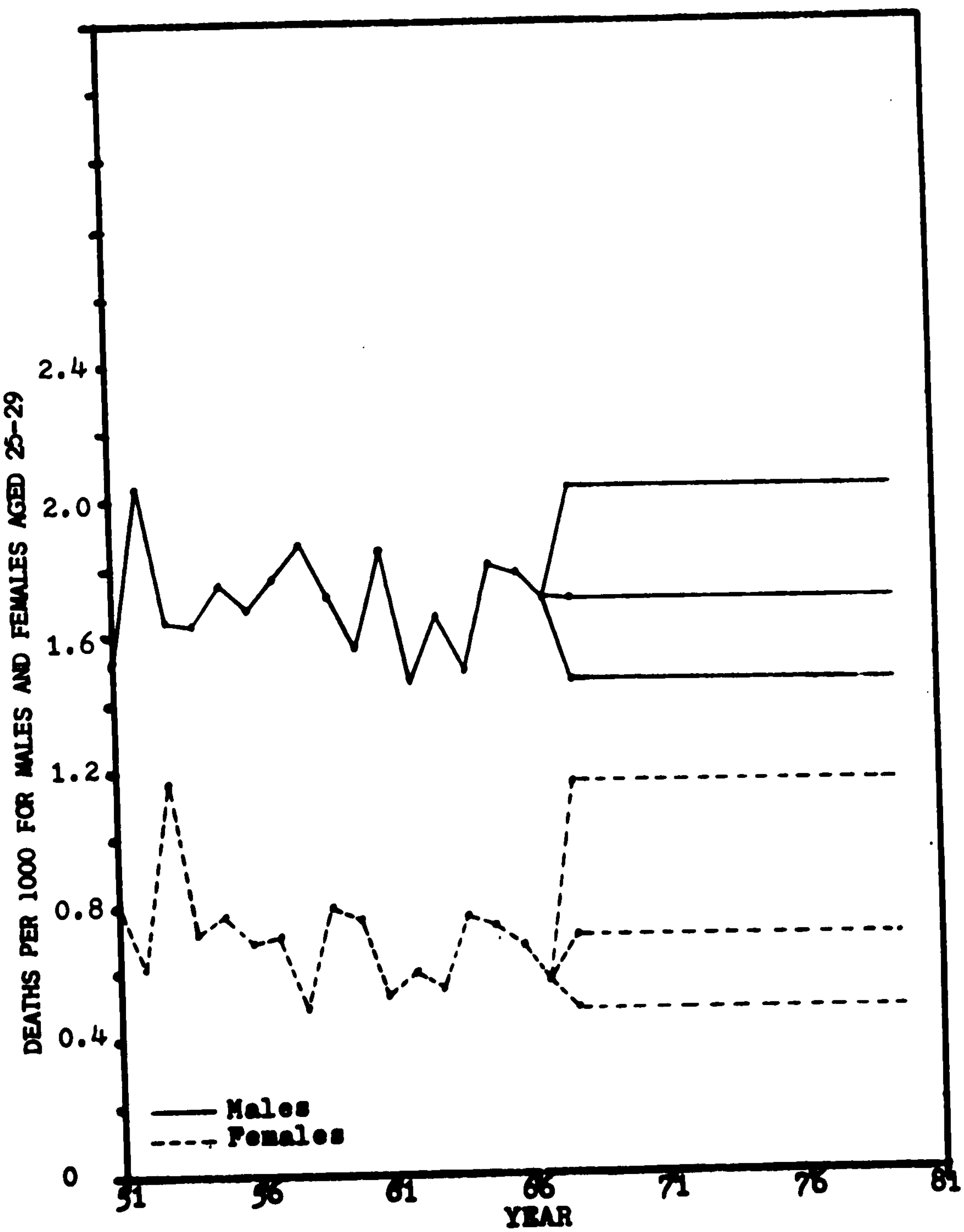

FIGURE 25

DEATH RATES FOR MALES AND FEMALES AGED 25-29 IN ALBERTA

(1) decline to and remain at 0.5.

(2) increase to and remain at 0.7.

(3) increase to and remain at 1.2.

Assumption three appears to have little probability of being accurate in any given year. Assumptions one and two are the likely limits of the real death rate.

Death rates for males and females aged 30-34. Both the male and female death rates for this age group showed their highest value in 1951 and fluctuated widely below this value in subsequent years. As illustrated in Figure 26, the decrease after 1951 gives the rates the appearance of a slight downward trend. Thus the alternate assumptions were based on the high, mean, and low values with the recognition that the assumptions would not be of equiprobability.

The alternate assumptions regarding the death rates of males aged 30-34 over the time period 1968 through 1980 were that the death rate would

(1) decline to and remain at 1.5.

(2) increase to and remain at 1.9.

(3) increase to and remain at 2.4.

Assumptions one and two would appear to be realistic upper and lower values of the expected death rates. The alternate assumptions regarding the death rates of females aged 30-34 over the time period 1968 through 1980 were that the death rate would

(1) decline to and remain at 0.6.

(2) increase to and remain at 0.9.

(3) increase to and remain at 1.4.

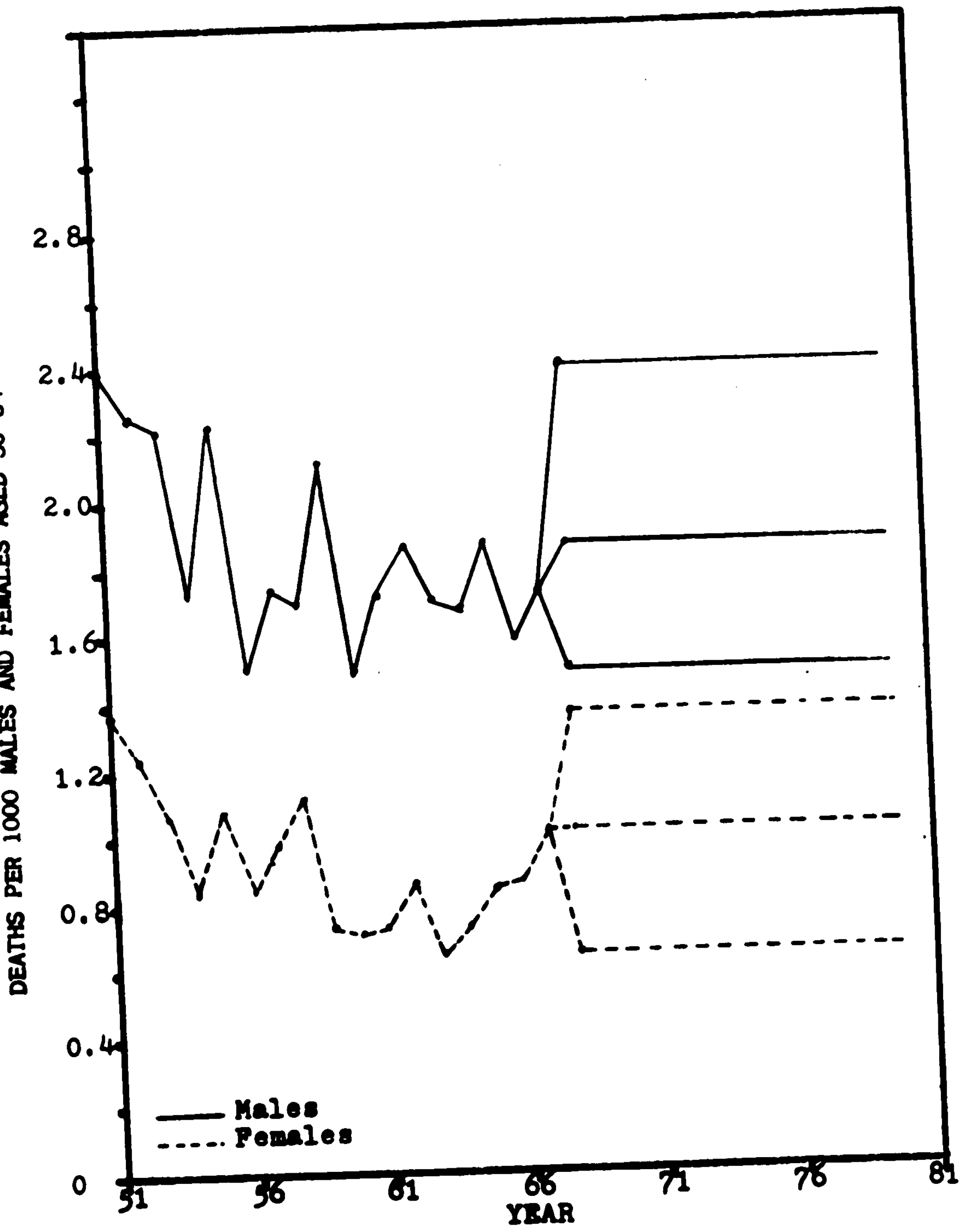

FIGURE 26

DEATH RATES FOR MALES AND FEMALES AGED 30-34 IN ALBERTA

Of the assumptions, the third appears to be far too high to be realistic. Assumptions one and two can be considered to be the upper and lower limits of the expected value.

Death rates for males and females aged 35-39. As illustrated in Figure 27, both the male and female death rates for this group have shown some tendency to decline. This decline has implications regarding the probability of the assumptions.

The alternate assumptions regarding the death rate for males aged 35 to 39 over the time period 1968 through 1980 were that the death rate would

(1) remain at 1.8.

(2) increase to and remain at 2.2.

(3) increase to and remain at 3.1.

The decline in these death rates since 1951 implies that assumptions one and two are the most viable and assumption three is quite improbable. The alternate assumptions regarding the death rate for females aged 35 to 39 over the time period 1968 through 1980 were that the death rate would

(1) decline to and remain at 1.0.

(2) decline to and remain at 1.3.

(3) increase to and remain at 1.8.

In this case, assumption two will likely have an effect similar to the actual death rates.

Death rates for males and females aged 40-44. Figure 28 illustrates the fact that the death rates for both males and females for

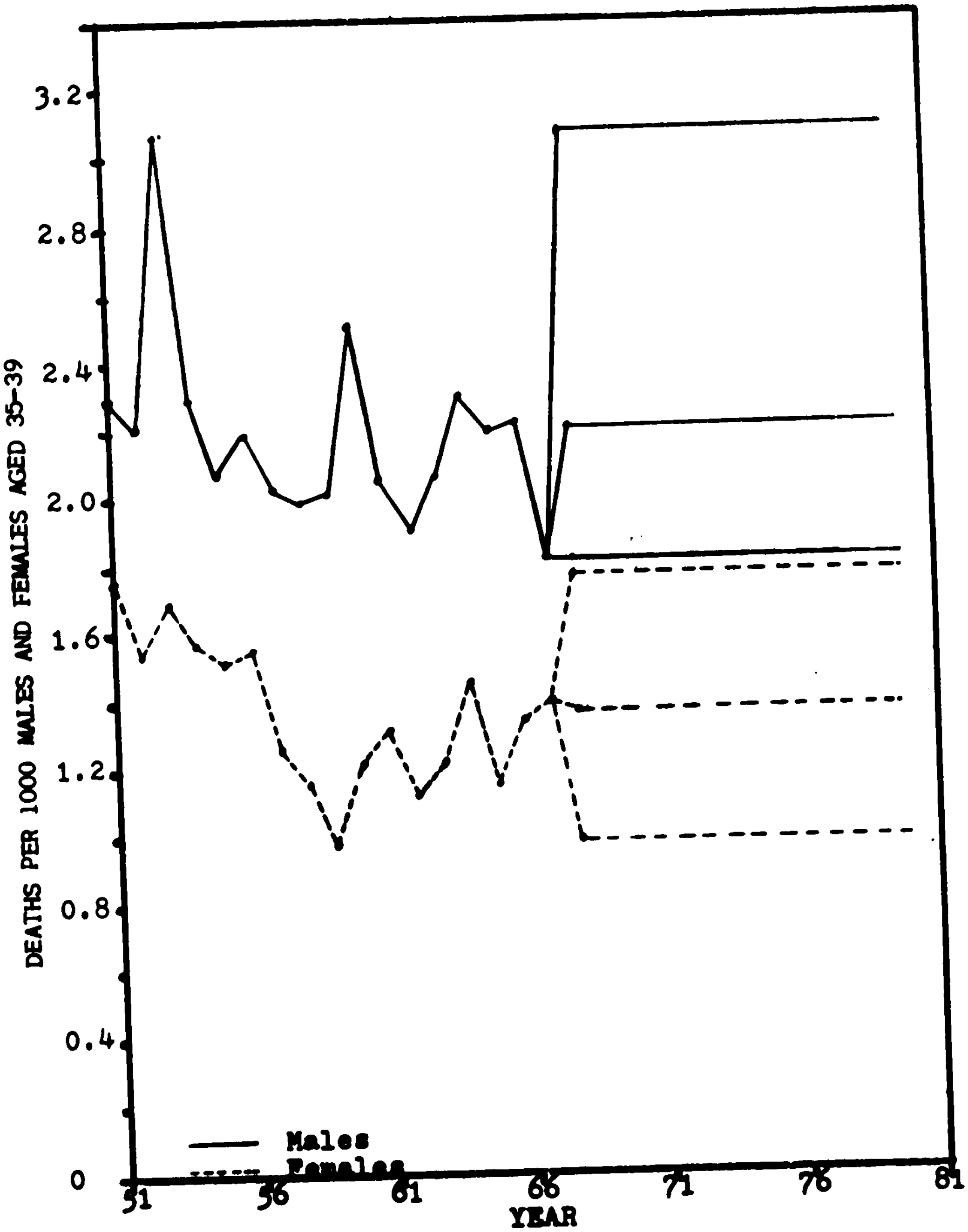

FIGURE 27

DEATH RATES FOR MALES AND FEMALES AGED 35-39 IN ALBERTA

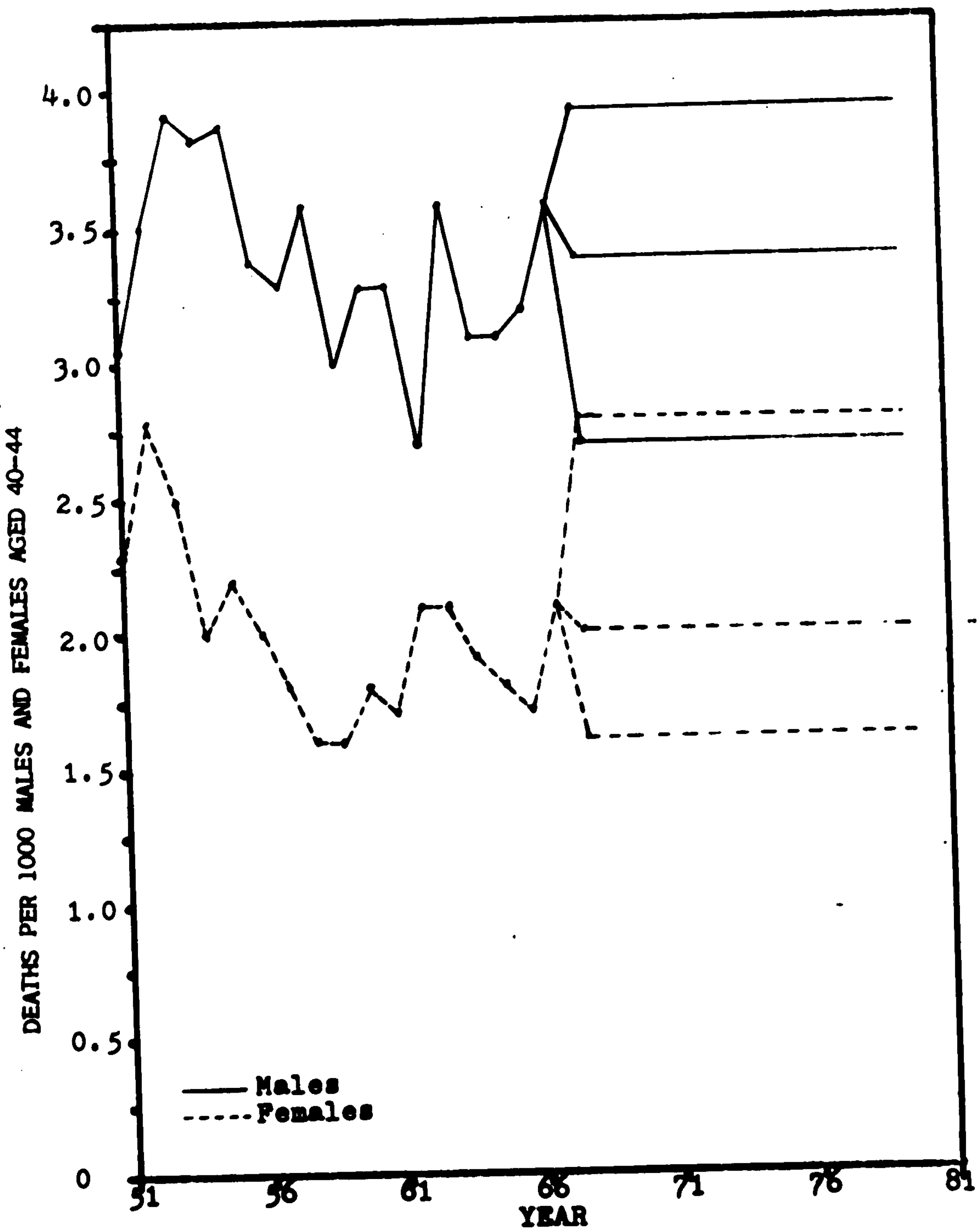

FIGURE 28

DEATH RATES FOR MALES AND FEMALES AGED 40-44 IN ALBERTA

this age group exhibits wide fluctuations and no real trends. Thus in each case assumptions one and three set the lower and upper bounds of the probable death rates while assumption two approximates the overall effect of continued fluctuations.

The alternate assumptions regarding the death rates for males aged 40 to 44 over the time period 1968 through 1980 were that the death rates would

(1) decline to and remain at 2.7.

(2) decline to and remain at 3.4.

(3) increase to and remain at 3.7.

The alternate assumptions regarding the death rates for females aged 40 to 44 over the time period 1968 through 1980 were that the death rates would

(1) decline to and remain at 1.5.

(2) decline to and remain at 2.0.

(3) increase to and remain at 2.8.

Death rates for males and females aged 45 and over. It was thought that the death rates for this age group would have little, if any impact, in terms of the model, on the demand for teachers. For this reason, the alternate assumptions, about the death rates for each age category of this group were stated without explanation.

As illustrated in Figure 29, the alternate assumptions regarding the death rates for males aged 45 to 49, over the time period 1968 through 1980 were that the death rates would

(1) remain at 4.5.

(2) increase to and remain at 5.2.

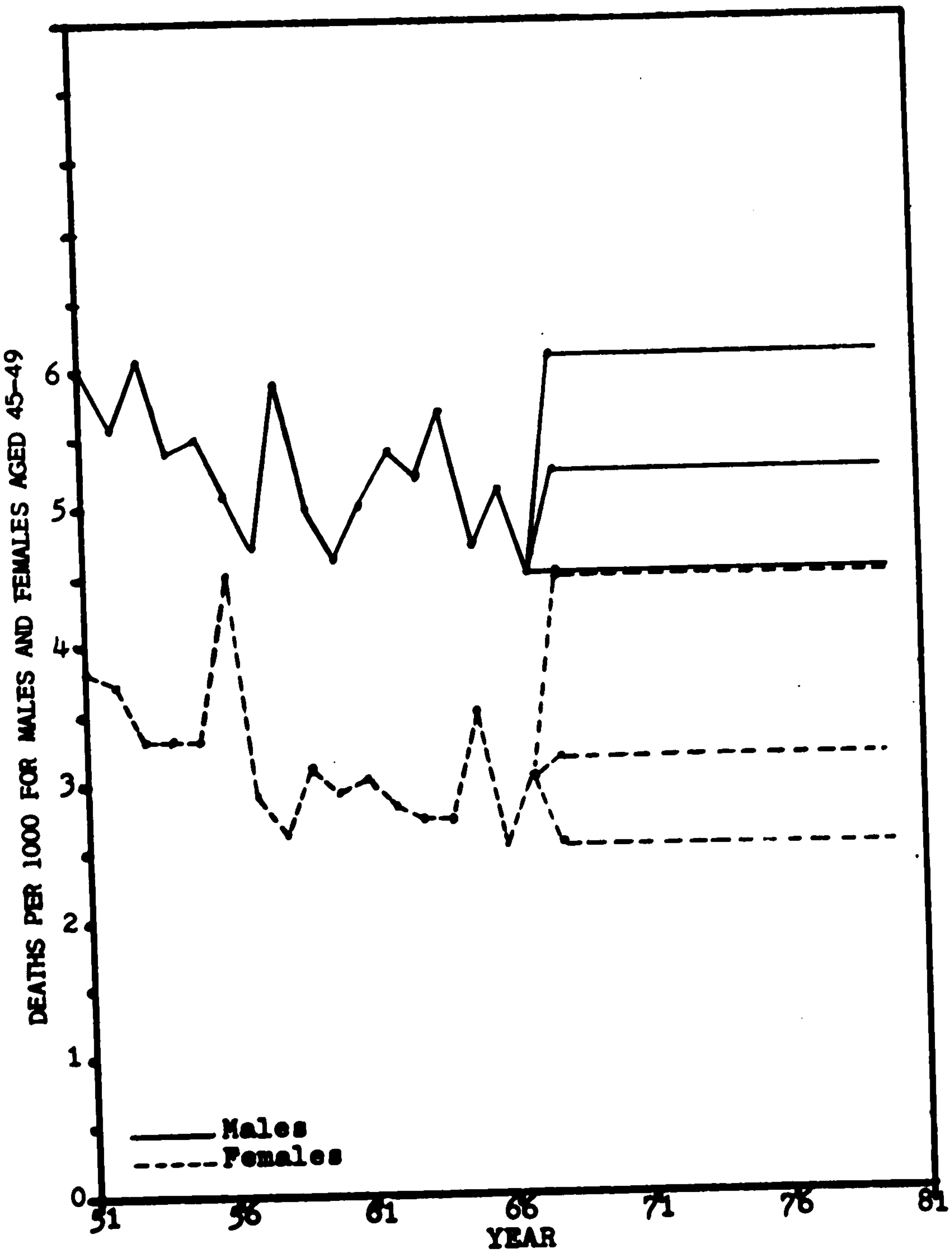

FIGURE 29

DEATH RATES FOR MALES AND FEMALES AGED 45-49 IN ALBERTA

(3) increase to and remain at 6.0.

The alternate assumptions regarding the death rates of females aged 45 to 49, over the time period 1968 through 1980 were that the death rates would

(1) decline to and remain at 2.5.

(2) increase to and remain at 3.1.

(3) increase to and remain at 4.5.

As illustrated in Figure 30, the alternate assumptions regarding the death rates for males aged 50 to 54, over the time period 1968 through 1980, were that the death rate would

(1) remain at 7.7.

(2) increase to and remain at 8.5.

(3) increase to and remain at 10.1.

The alternate assumptions regarding the death rates for females aged 50 to 54, over the time period 1968 through 1980, were that the death rates would

(1) decline to and remain at 3.6.

(2) increase to and remain at 4.9.

(3) increase to and remain at 6.3.

As illustrated in Figure 31, the alternate assumptions regarding the death rates for males aged 55 to 59, over the time period 1968 through 1980, were that the death rate would

(1) decrease to and remain at 12.2.

(2) decrease to and remain at 13.1.

(3) increase to and remain at 13.8.

The alternate assumptions regarding the death rates for females aged

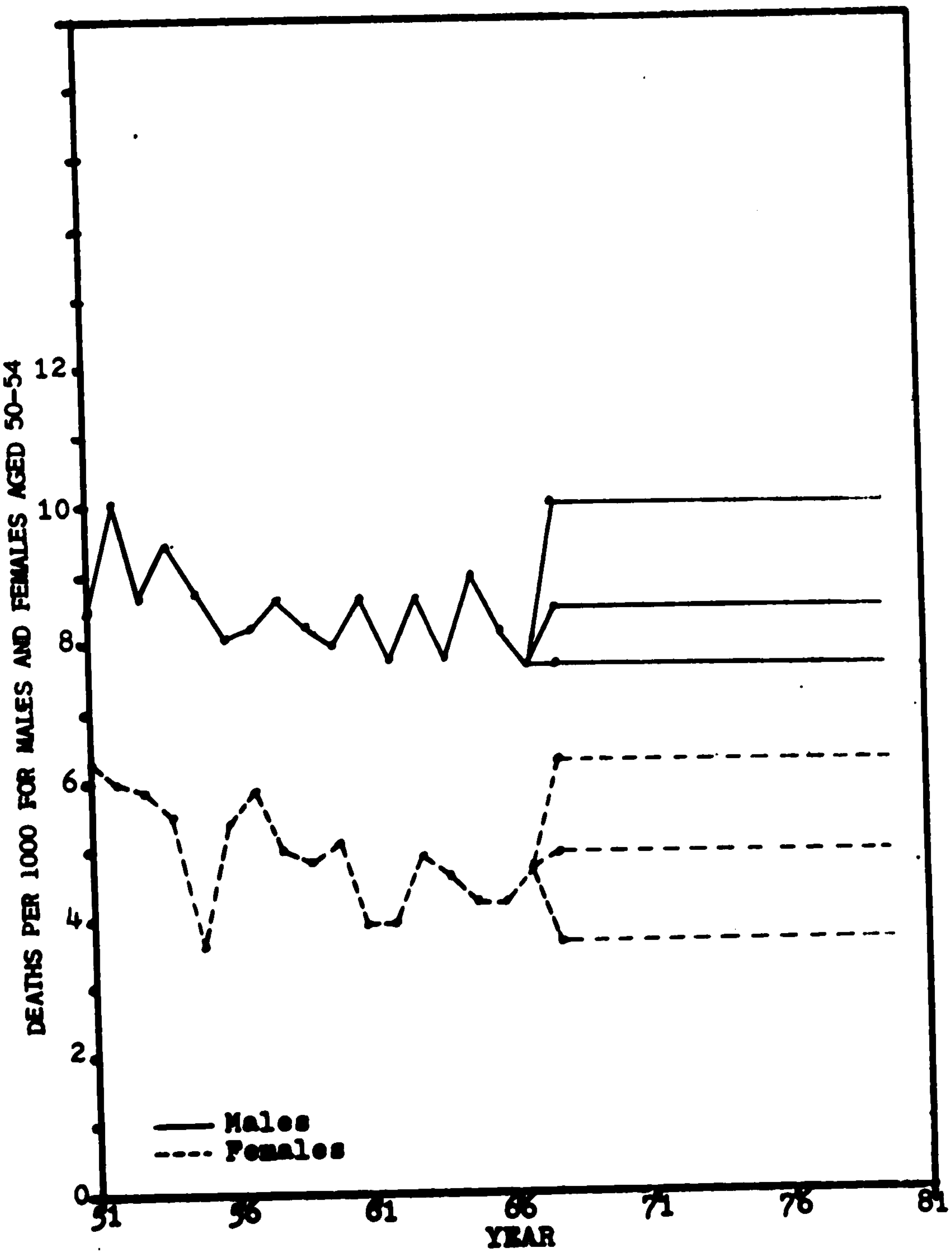

FIGURE 30

DEATH RATES FOR MALES AND FEMALES AGED 50-54 IN ALBERTA

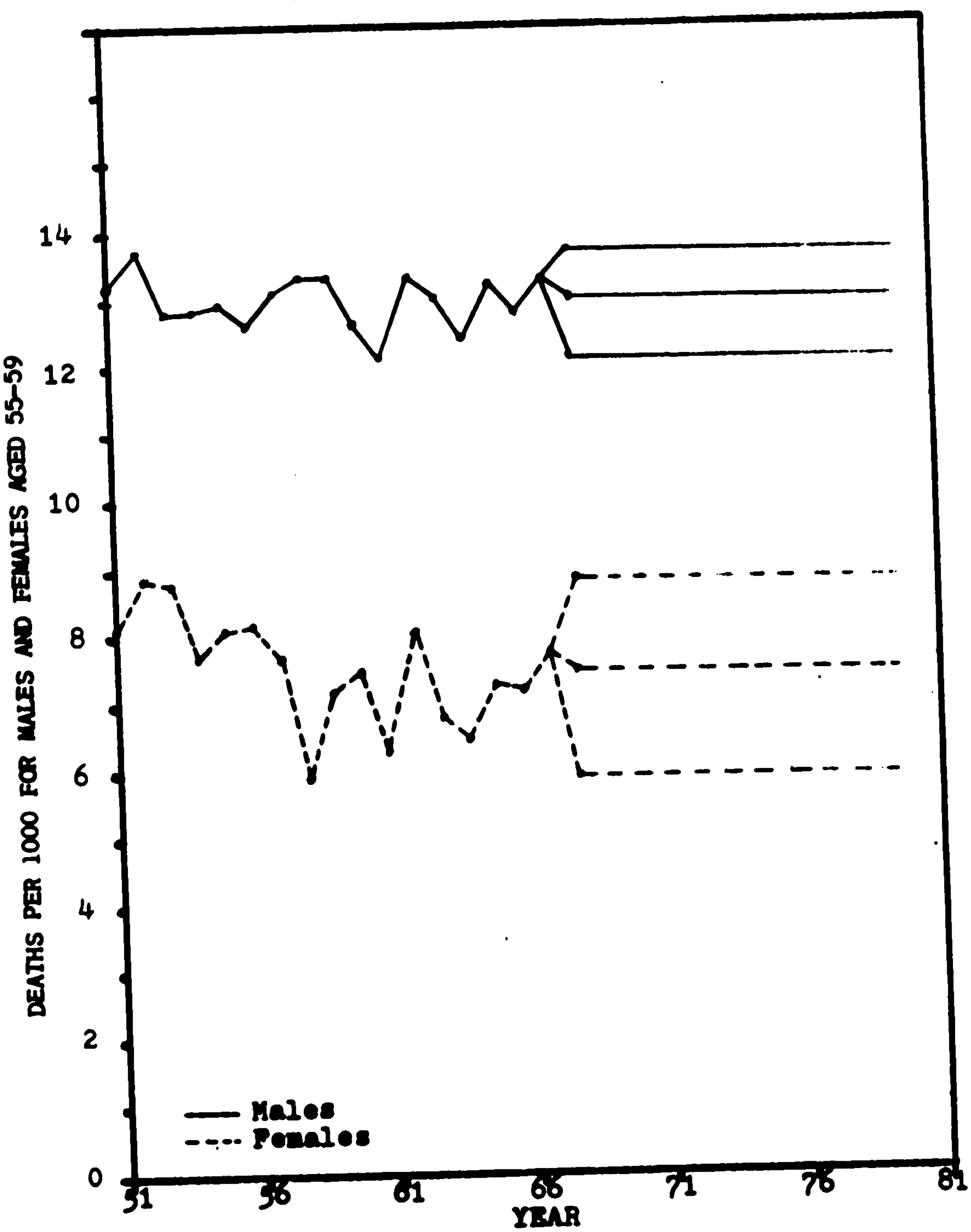

FIGURE 31

DEATH RATES FOR MALES AND FEMALES AGED 55-59 IN ALBERTA

55 to 59, over the time period 1968 through 1980, were that the death rate would

(1) decrease to and remain at 5.9.

(2) decrease to and remain at 7.5.

(3) increase to and remain at 8.9.

As illustrated in Figure 32, the alternate assumptions regarding the death rate for males aged 60 to 64, over the time period 1968 through 1980, were that the death rates would

(1) decrease to and remain at 19.5.

(2) increase to and remain at 20.9.

(3) increase to and remain at 22.4.

The alternate assumptions regarding the death rate for females aged 60 to 64, over the time period 1968 through 1980, were that the death rate would

(1) decrease to and remain at 9.6.

(2) increase to and remain at 12.1.

(3) increase to and remain at 15.5.

As illustrated in Figure 33, the alternate assumptions regarding the death rate for males aged 65 to 69, over the time period 1968 through 1980, were that the death rate would

(1) decrease to and remain at 29.3.

(2) increase to and remain at 31.8.

(3) increase to and remain at 36.0.

The alternate assumptions regarding the death rate for females aged 65 to 69, over the time period 1968 through 1980, were that the death rate would

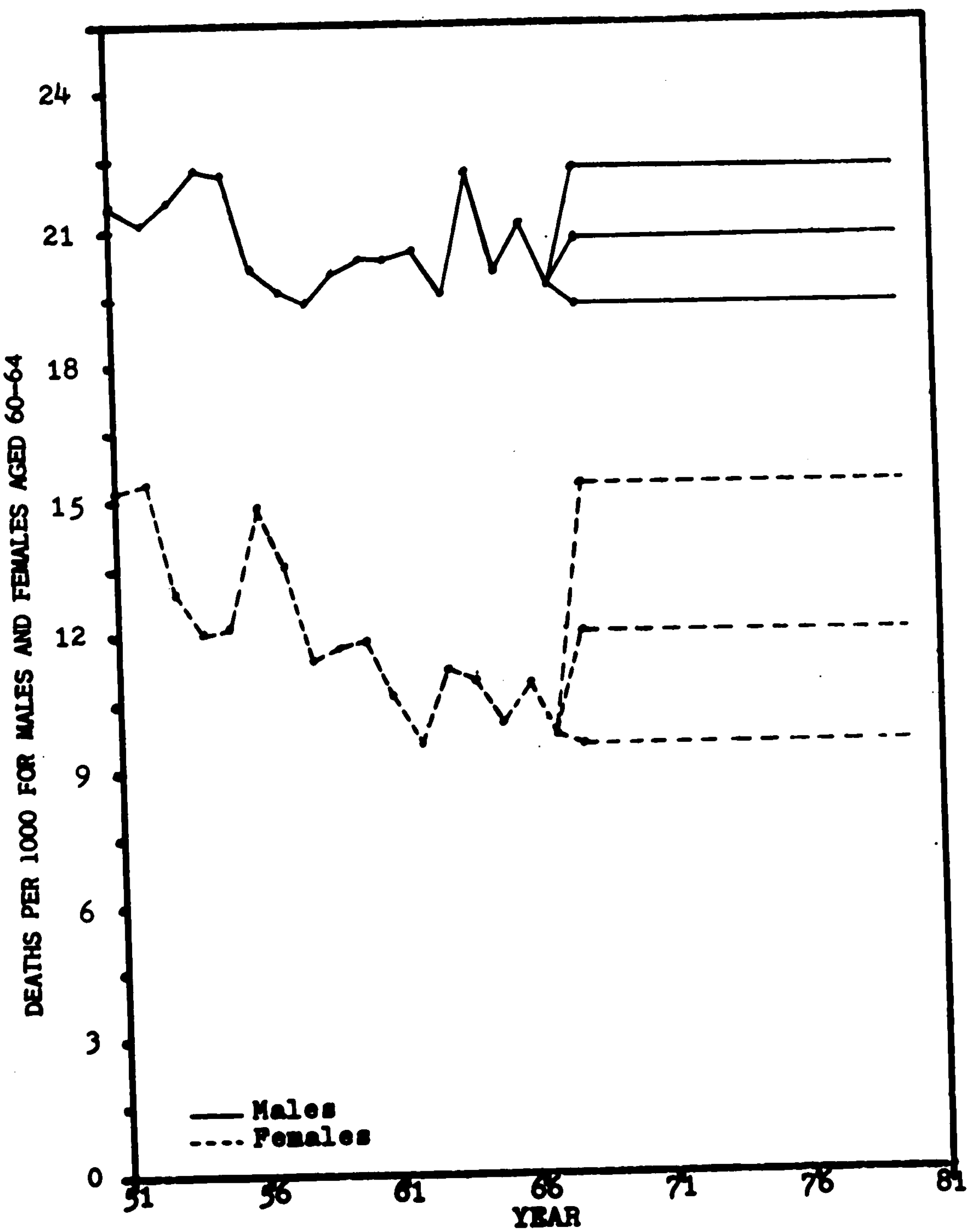

FIGURE 32

DEATH RATES FOR MALES AND FEMALES AGED 60-64 IN ALBERTA

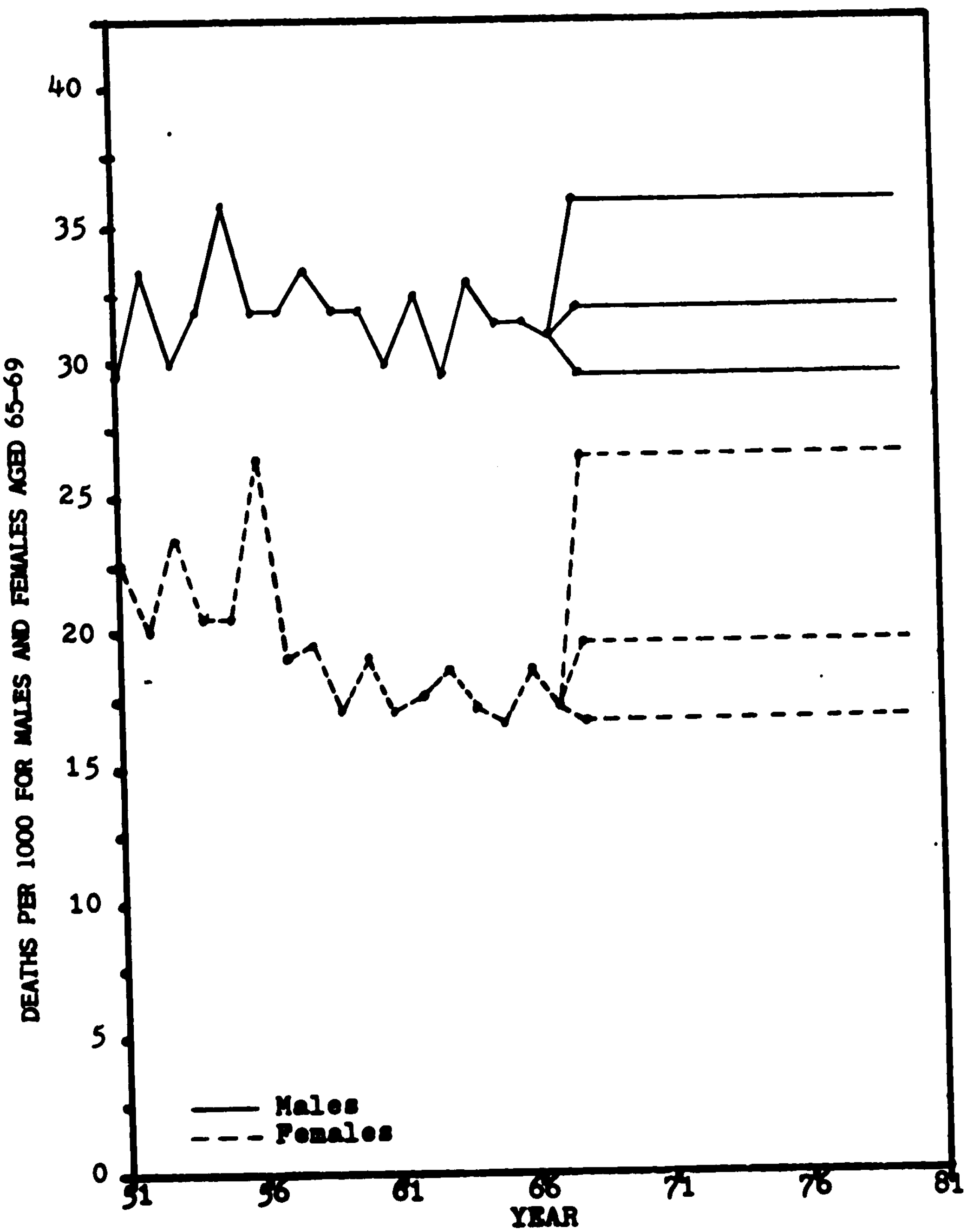

FIGURE 33

DEATH RATES FOR MALES AND FEMALES AGED 65-69 IN ALBERTA

(1) decrease to and remain at 16.3.

(2) increase to and remain at 19.4.

(3) increase to and remain at 26.7.

As illustrated in Figure 34, the alternate assumptions regarding the death rate for males aged 70 to 74, over the time period 1968 through 1980, were that the death rate would

(1) decrease to and remain at 32.9.

(2) increase to and remain at 47.7.

(3) increase to and remain at 52.2.

The alternate assumptions regarding the death rates for females aged 70 to 74, over the time period 1968 through 1980, were that the death rate would

(1) decrease to and remain at 26.4.

(2) increase to and remain at 33.0.

(3) increase to and remain at 42.9.

As illustrated in Figure 35, the alternate assumptions regarding the death rate for males aged 75 and over, during the time period 1968 through 1980, were that the death rate would

(1) decrease to and remain at 100.8.

(2) increase to and remain at 106.4.

(3) increase to and remain at 113.6.

The alternate assumptions regarding the death rate for females aged 75 and over, during the time period 1968 through 1980, were that the death rate would

(1) remain at 77.6.

(2) increase to and remain at 87.9.

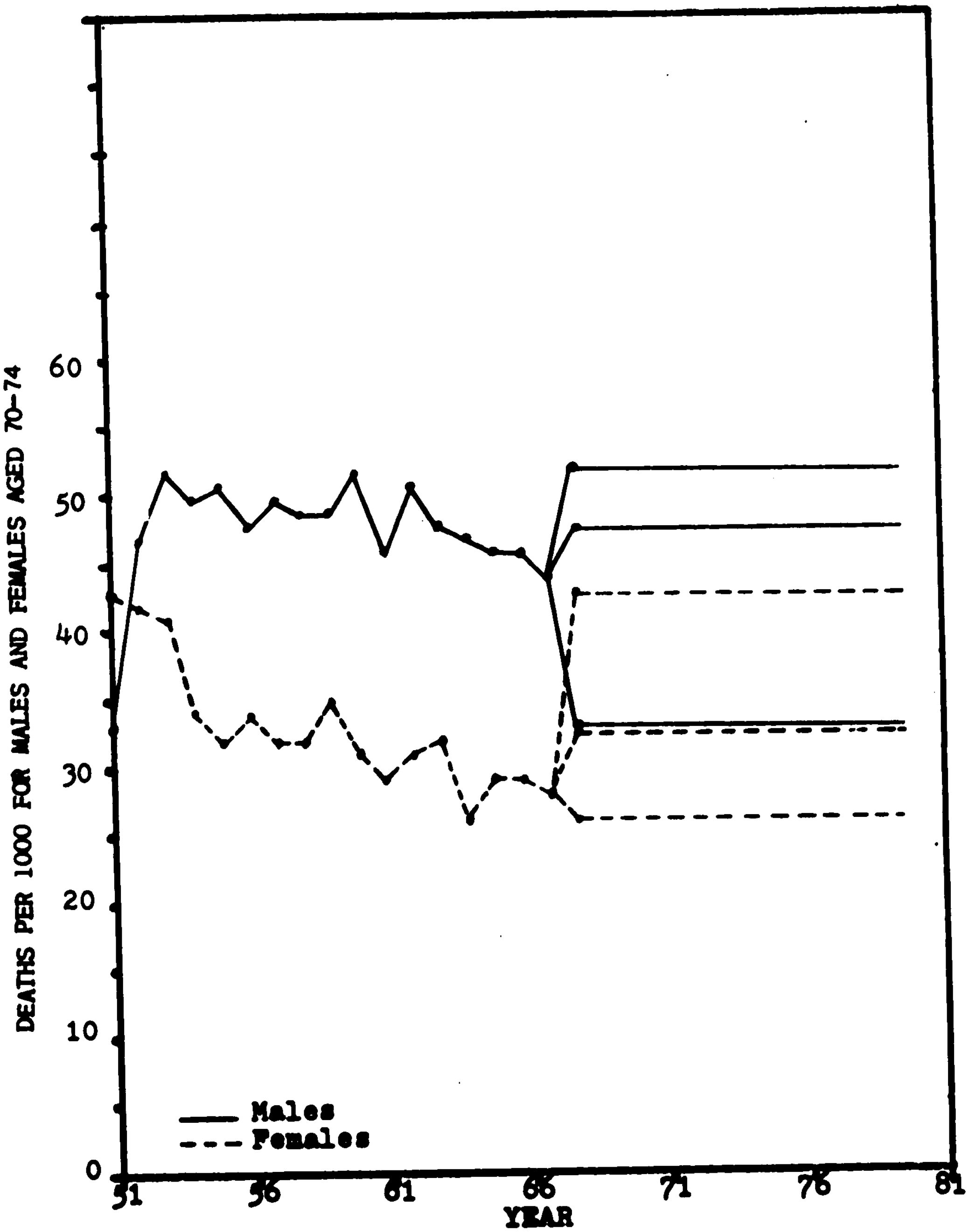

FIGURE 34

DEATH RATES FOR MALES AND FEMALES AGED 70-74 IN ALBERTA

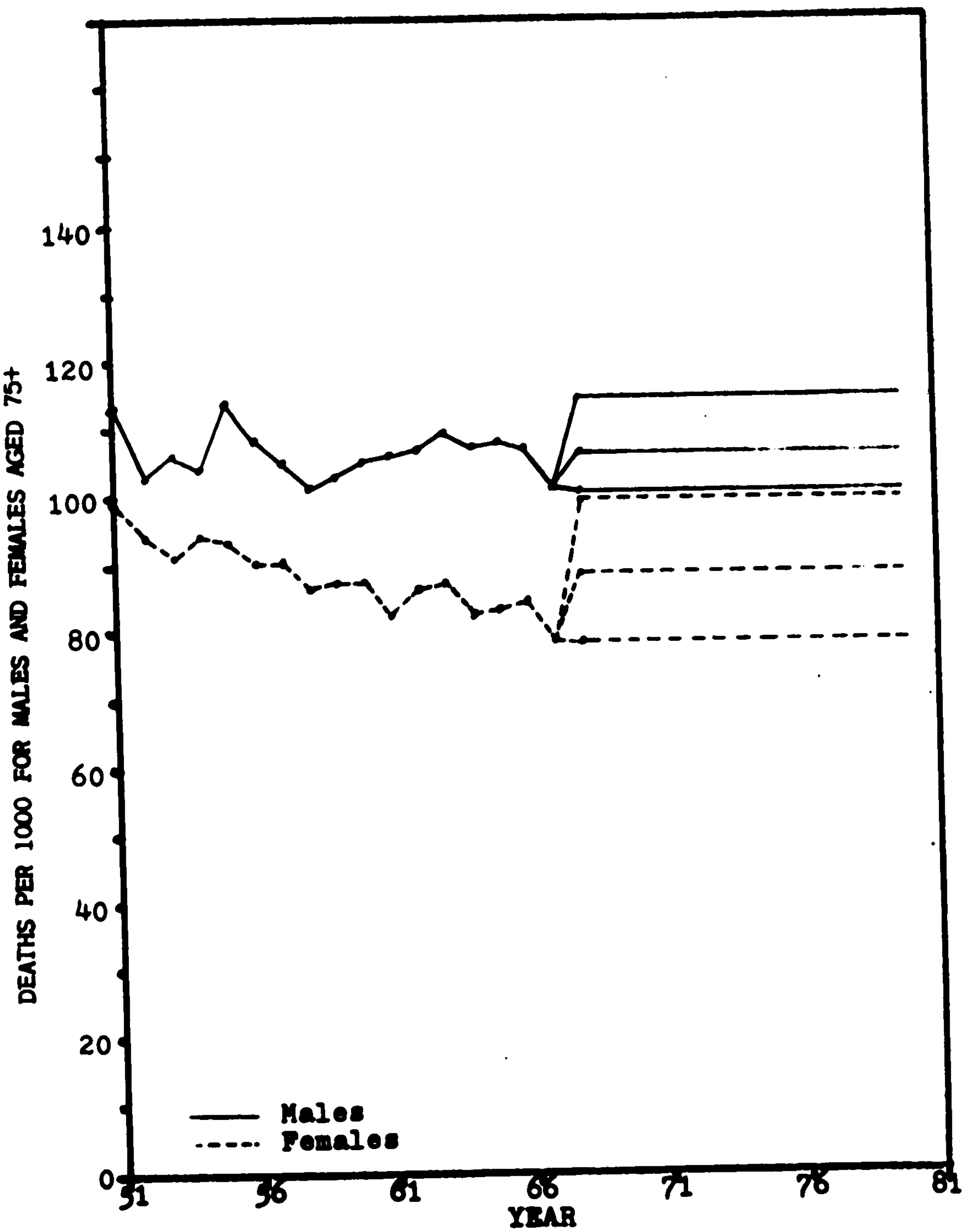

FIGURE 35

DEATH RATES FOR MALES AND FEMALES AGED 75+ IN ALBERTA

(3) increase to and remain at 98.9.

The population data and the projections of birth rates and death rates were used to make population projections. However, since the demand for teachers was the major problem further data were required.

APPENDIX J

ENROLMENT BY AGE AND GRADE

Five years old. As illustrated in Table 68, the major portion of five year old children attending school were in grade one. The rates varied from a high of 381.3 per thousand for five year old girls in 1951 to a low of 266.2 per thousand for five year old boys in 1966. The data also show a consistent decline in the attendance rate of five year olds. It should be noted that this was not the result of deliberate legislation by the Province of Alberta but rather the result of policies of local school authorities.

In order to test the model and to complete the projection it was decided to assume three sets of possible attendance rates for five year old children. The low rates were based on a continuation of trends established between 1961 and 1966. The middle rates were based on a continuation of the 1966 attendance rates. The high rates were based on the initiation of full attendance of five year old children beginning in the 1971-72 school year.

The alternate assumptions regarding the attendance rates for five year old males over the period 1967-68 through 1980-81 were that the attendance rates would

(1) decrease to 262.8 in 1967-68, 259.3 in 1968-69, 255.9 in 1969-70, 252.4 in 1970-71, 249.0 in 1971-72, 245.6 in 1972-72, 242.1 in 1973-84, 238.7 in 1974-75, 235.2 in 1975-76, 231.8 in 1976-77, 228.4 in 1977-78, 224.9 in 1978-79, 221.5 in 1979-80, and 218.0 in 1980-81.

(2) remain at 266.2.

(3) remain at 266.2 through 1967-68 to 1970-71 and increase to and remain at 1000.0 through 1971-72 to 1980-81.

Table 68

Five Year Old Children in Various Grades per One Thousand Population of Five Year Olds in Alberta

Grade	1951		1956		1961		1966	
	Male	Female	Male	Female	Male	Female	Male	Female
1	366.1	381.3	348.9	359.8	382.4	288.6	266.2	267.9

The alternate assumptions regarding the attendance rates for five year old females over the period 1967-68 through 1980-81 were that the attendance rates would

(1) decrease to 265.8 in 1967-68, 263.6 in 1968-69, 261.5 in 1969-70, 259.3 in 1970-71, 257.2 in 1971-72, 255.1 in 1972-73, 252.9 in 1973-74, 250.8 in 1974-75, 248.6 in 1975-76, 246.5 in 1976-77, 244.4 in 1977-78, 242.2 in 1978-79, 240.1 in 1979-80, and 237.9 in 1980-81.

(2) remain at 267.9.

(3) remain at 267.9 through 1967-68 to 1970-71 and increase to and remain at 1000.0 through 1971-72 to 1980-81.

Of the alternate assumptions the first is likely low, the second was a conservative realistic assumption, and the third represents the maximum possible effect.

Six years old. As illustrated in Table 69, the major portion of the six year old children were in grades one and two. Attendance rate for six year olds in grade one varied from a low of 472.6 for females in 1956 to a high of 731.4 for males in 1961 while the attendance rate for six year olds in grade two varied from a low of 241.3 for males in 1961 to a high of 351.7 for females in 1956. There appeared to be an interdependency which is illustrated in the above statement. It should also be noted that the total proportion of six year olds attending school has increased from about 830 per thousand in 1951 to 950 per thousand in 1966. In order to test the model, it was decided to assume linear changes over the periods between the years shown on Table 69.

Table 69

Six Year Old Children in Various Grades per One Thousand Population of Six Year Olds in Alberta

Grade	1951		1956		1961		1966	
	Male	Female	Male	Female	Male	Female	Male	Female
1	540.2	512.3	503.9	472.6	731.4	704.3	712.6	699.2
2	285.3	325.4	321.7	351.7	244.4	254.4	241.3	253.5

To complete the projections, three sets of attendance rates were compiled. The first set was based on the present rates. The second set was based on attendance rate that is projected to increase to 975 per thousand, distributed over grade one and two in the same proportion as obtained in 1966. The third set was based on the total attendance of all six year olds, also distributed over grades one and two in the same proportion as obtained in 1966.

The alternate assumptions regarding the attendance rates for six year old males over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) remain at 712.6 in grade one
   (b) remain at 241.3 in grade two.
2. (a) increase to and remain at 728.4 in grade one.
   (b) increase to and remain at 246.6 in grade two.
3. (a) increase to and remain at 747.0 in grade one.
   (b) increase to and remain at 253.0 in grade two.

The alternate assumptions regarding the attendance rates for six year old females over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) remain at 699.2 in grade one.
   (b) remain at 253.5 in grade two.
2. (a) increase to and remain at 715.6 in grade one.
   (b) increase to and remain at 259.4 in grade two.
3. (a) increase to and remain at 733.9 in grade one.
   (b) increase to and remain at 266.1 in grade two.

Seven years old. As illustrated in Table 70, the seven year old children are mainly in attendance in grades one, two, and three with the largest proportion in grade two. Also, as illustrated in Table 70, the attendance rates in total are about 950 per 1000. Although the proportion in each grade varies from year to year, this would have little impact on total demand for teachers. In order to test the model, linear changes between the years provided in Table 70 were assumed.

To complete the projections three sets of assumptions were made. The first was based on a continuation of 950 per thousand. The second was based on 975 per thousand. The thirs was based on 1000 per thousand. In each case the distribution over the various grades was based on the distribution that obtained in 1966. The alternate assumptions regarding the attendance rates for seven year old males over the period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 64.1 for grade one.
   (b) decrease to and remain at 664.4 for grade two.
   (c) decrease to and remain at 221.5 for grade three.
2. (a) decrease to and remain at 65.8 for grade one.
   (b) decrease to and remain at 681.9 for grade two.
   (c) decrease to and remain at 227.3 for grade three.
3. (a) increase to and remain at 67.5 for grade one.
   (b) increase to and remain at 699.4 for grade two.
   (c) increase to and remain at 233.1 for grade three.

The alternate assumptions regarding the attendance rates for females seven years old over the time period 1967-68 through 1980-81 were that the attendance rates would

Table 70

Seven Year Old Children in Various Grades per One Thousand Population of Seven Year Olds in Alberta

Grade	1951		1956		1961		1966	
	Male	Female	Male	Female	Male	Female	Male	Female
1	218.0	181.5	176.0	148.4	73.4	43.4	66.5	44.4
2	509.0	486.9	490.4	461.6	694.6	696.1	689.4	660.4
3	274.0	329.9	288.1	345.9	211.9	244.4	229.8	245.9

1. (a) remain at 44.4 for grade one.

   (b) decrease to and remain at 659.9 for grade two.

   (c) decrease to and remain at 245.7 for grade three.

2. (a) increase to and remain at 45.5 for grade one.

   (b) increase to and remain at 677.3 for grade two.

   (c) increase to and remain at 252.2 for grade three.

3. (a) increase to and remain at 46.7 for grade one.

   (b) increase to and remain at 694.6 for grade two.

   (c) increase to and remain at 258.7 for grade three.

Eight years old. As illustrated in Table 71, the total attendance rate of eight year old children tends to be equal to or above 950 per thousand. The distribution among various grades varies but this can be expected to have little impact on the demand for teachers. To test the model, an assumption of linear changes in the intervening years was used.

To complete the projections three sets of attendance rates were used. The first set based on a total attendance of 950 per thousand, the second set based on a total attendance of 975 per thousand and the third based on an attendance of 1000 per thousand. The eight year old students were assumed distributed over the grades in the proportion that obtained in 1966. The alternate assumptions regarding attendance rates for eight year old males over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) increase to and remain at 11.0 for grade one.

   (b) increase to and remain at 101.7 for grade two.

   (c) increase to and remain at 621.6 for grade three.

Table 71

Eight Year Old Children in Various Grades per One Thousand Population of Eight Year Olds in Alberta

Grade	1951		1956		1961		1966	
	Male	Female	Male	Female	Male	Female	Male	Female
1	38.2	24.3	23.1	11.6	9.0	6.4	11.0	6.7
2	239.7	187.7	201.1	154.0	106.1	62.4	101.6	70.4
3	515.7	501.8	493.7	477.3	632.5	640.1	621.1	639.8
4	248.7	312.0	289.0	349.3	209.3	254.7	215.5	255.2

(d) increase to and remain at 215.7 for grade four.

2. (a) increase to and remain at 11.3 for grade one.

(b) increase to and remain at 104.4 for grade two.

(c) increase to and remain at 638.0 for grade three.

(d) increase to and remain at 221.4 for grade four.

3. (a) increase to and remain at 11.6 for grade one.

(b) increase to and remain at 107.0 for grade two.

(c) increase to and remain at 654.3 for grade three.

(d) increase to and remain at 227.0 for grade four.

The alternate assumptions regarding attendance rates for eight year old females over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 6.5 for grade one.

(b) decrease to and remain at 68.8 for grade two.

(c) decrease to and remain at 607.0 for grade three.

(d) decrease to and remain at 249.4 for grade four.

2. (a) increase to and remain at 6.7 for grade one.

(b) increase to and remain at 70.6 for grade two.

(c) increase to and remain at 623.0 for grade three.

(d) increase to and remain at 256.0 for grade four.

3. (a) increase to and remain at 6.9 for grade one.

(b) increase to and remain at 72.4 for grade two.

(c) increase to and remain at 638.9 for grade three.

(d) increase to and remain at 262.5 for grade four.

Nine years old. As illustrated in Table 72, the total attendance rates for nine year old children tends to be equal to or above

Table 72

Nine Year Old Children in Various Grades per One Thousand Population of Nine Year Olds in Alberta

Grade	1951		1956		1961		1966	
	Male	Female	Male	Female	Male	Female	Male	Female
1	9.4	6.1	5.8	4.8	2.9	2.4	4.0	3.1
2	56.0	30.5	38.2	20.0	17.9	9.5	16.3	9.2
3	266.7	212.3	238.3	179.2	138.2	76.4	127.6	81.7
4	449.9	473.7	511.5	525.4	593.3	618.3	626.0	631.5
5	224.0	285.2	274.8	336.2	189.7	224.2	207.0	230.8

930 per thousand. Although the distribution of these students among various grades has changed this can be expected to have had little impact on the total demand for teachers. The assumption of linear changes over intervening years was used to test the model.

To complete the projections alternate attendance rates based on 930, 965, and 1000 students per thousand in attendance were used. Also, the attendance of children in grade one was pooled with grade two. The distribution that obtained in 1966 was used in the projections. The alternate assumptions regarding the attendance rates for males aged nine years old, over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 19.4 for grade two.
   (b) decrease to and remain at 121.0 for grade three.
   (c) decrease to and remain at 593.5 for grade four.
   (d) decrease to and remain at 196.3 for grade five.
2. (a) decrease to and remain at 20.0 for grade two.
   (b) decrease to and remain at 125.5 for grade three.
   (c) decrease to and remain at 615.9 for grade four.
   (d) decrease to and remain at 203.6 for grade five.
3. (a) increase to and remain at 20.7 for grade two.
   (b) increase to and remain at 120.1 for grade three.
   (c) increase to and remain at 638.2 for grade four.
   (d) increase to and remain at 211.0 for grade five.

The alternate assumptions regarding the attendance rates for females aged nine years old, over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 12.0 for grade two.
   (b) decrease to and remain at 79.9 for grade three.
   (c) decrease to and remain at 617.4 for grade four.
   (d) decrease to and remain at 225.7 for grade five.
2. (a) increase to and remain at 12.4 for grade two.
   (b) increase to and remain at 82.4 for grade three.
   (c) increase to and remain at 637.2 for grade four.
   (d) increase to and remain at 241.3 for grade five.

Ten years old. As illustrated in Table 73, the attendance rates for ten year old children tend to be equal to or greater than 930 per thousand. Some changes have occurred in the distribution of the students among grades, however this could not be expected to have any major impact on the total demand for teachers. To test the model, it was assumed that changes in the attendance changed in a linear fashion over the years between the ones reported in Table 73.

To complete the projection, three sets of attendance rates were completed on the bases of total attendance of 930, 965, and 1000 per thousand. It should also be noted that students in grades one and two were treated as being in grade three. The alternate assumptions regarding the attendance rates for males aged ten years, over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 30.2 for grade three.
   (b) decrease to and remain at 123.1 for grade four.
   (c) decrease to and remain at 536.1 for grade five.
   (d) decrease to and remain at 209.2 for grade six.

Table 73

Ten Year Old Children in Various Grades per One Thousand Population of Ten Year Olds in Alberta

Grade	1951 Male	1951 Female	1956 Male	1956 Female	1961 Male	1961 Female	1966 Male	1966 Female
1	3.4	2.7	1.5	1.8	1.5	0.6	2.1	1.2
2	14.1	8.0	8.1	5.0	5.1	2.9	5.1	2.6
3	77.2	45.0	56.5	28.5	27.5	15.2	23.1	12.7
4	267.0	217.1	254.6	204.2	152.5	93.3	136.0	87.9
5	441.4	455.0	440.3	458.9	548.5	594.4	557.8	585.3
6	222.2	284.1	212.6	269.2	184.8	231.1	210.1	254.5

2. (a) increase to and remain at 31.3 for grade three.
   (b) increase to and remain at 123.9 for grade four.
   (c) increase to and remain at 540.5 for grade five.
   (d) increase to and remain at 217.0 for grade six.
3. (a) increase to and remain at 32.4 for grade three.
   (b) increase to and remain at 124.7 for grade four.
   (c) increase to and remain at 545.6 for grade five.
   (d) increase to and remain at 224.9 for grade six.

The alternate assumptions regarding the attendance rates for females aged ten years, over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 16.2 for grade three.
   (b) decrease to and remain at 86.1 for grade four.
   (c) decrease to and remain at 573.5 for grade five.
   (d) decrease to and remain at 249.4 for grade six.
2. (a) increase to and remain at 16.8 for grade three.
   (b) increase to and remain at 89.4 for grade four.
   (c) increase to and remain at 595.0 for grade five.
   (d) increase to and remain at 258.7 for grade six.
3. (a) increase to and remain at 17.4 for grade three.
   (b) increase to and remain at 92.6 for grade four.
   (c) increase to and remain at 616.6 for grade five.
   (d) increase to and remain at 268.1 for grade six.

Eleven years old. As illustrated in Table 74, the total attendance rate for eleven year old students tends to be equal to or above 930 per thousand. Although there are variations in the proportion

Table 74

Eleven Year Old Children in Various Grades per One Thousand Population of Eleven Year Olds in Alberta

Grade	1951 Male	1951 Female	1956 Male	1956 Female	1961 Male	1961 Female	1966 Male	1966 Female
1	2.5	2.3	1.5	1.0	1.1	0.7	0.6	0.3
2	2.4	3.2	2.8	1.8	2.5	1.7	2.5	1.2
3	25.0	11.9	15.0	7.8	8.5	5.4	8.4	4.8
4	97.3	54.3	69.2	37.2	39.2	19.0	32.6	17.3
5	275.1	218.0	236.9	193.4	172.9	113.3	155.6	99.5
6	407.1	433.9	411.8	429.2	521.7	559.3	574.3	592.0
7	201.9	264.8	218.7	283.5	193.5	233.0	207.1	255.7

of eleven year old students in grade seven, which would have an impact on the demand for junior high school teachers as opposed to elementary teachers, the variations do not show any specific trends. Since the proportions in grade seven in 1966 are not extreme in relation to other years, 1966 can be considered a representative year. The assumption of linear change over the years between the ones reported in Table 74 was used to test the model.

To complete the projections, the distribution among grades that obtained in 1966 was used with grades one, two, and three pooled with grade four. The total attendance was based on 930, 965, and 1000 per thousand respectively. The alternate assumptions regarding the attendance rate of males aged eleven years, over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 41.8 for grade four.
   (b) decrease to and remain at 147.9 for grade five.
   (c) decrease to and remain at 544.4 for grade six.
   (d) decrease to and remain at 196.3 for grade seven.
2. (a) decrease to and remain at 43.4 for grade four.
   (b) decrease to and remain at 153.0 for grade five.
   (c) decrease to and remain at 564.9 for grade six.
   (d) decrease to and remain at 203.7 for grade seven.
3. (a) increase to and remain at 44.9 for grade four.
   (b) increase to and remain at 158.6 for grade five.
   (c) increase to and remain at 585.4 for grade six.
   (d) increase to and remain at 211.1 for grade seven.

The alternate assumptions regarding the attendance rate for females aged eleven years, over the time period 1967-68 through 1980-81 were that the attendance rate would

1. (a) decrease to and remain at 22.6 for grade four.
   (b) decrease to and remain at 95.4 for grade five.
   (c) decrease to and remain at 567.5 for grade six.
   (d) decrease to and remain at 245.1 in grade seven.
2. (a) decrease to and remain at 23.5 for grade four.
   (b) decrease to and remain at 99.0 for grade five.
   (c) decrease to and remain at 588.9 for grade six.
   (d) decrease to and remain at 254.4 for grade seven.
3. (a) increase to and remain at 24.3 for grade four.
   (b) increase to and remain at 102.6 for grade five.
   (c) increase to and remain at 610.2 for grade six.
   (d) increase to and remain at 263.6 for grade seven.

Twelve year olds. As illustrated in Table 75, the attendance rate for children twelve years old has been above 940 per thousand. It should also be noted that the proportion of this age group in junior high schook, which would have an impact on the demand for junior high school teachers, has shown changes but has not shown any particular trend. Thus, the distribution that obtained in 1966 would appear to be valid as a basis for the projections.

While the assumption of linear change over the intervening years was used to test the model, total attendance rates of 940, 970, and 1000 were used to complete the projections. Also, the attendance of twelve year olds in grades one, two, three, and four were pooled with those in grade five. The alternate assumptions regarding the

Table 75

Twelve Year Old Children in Various Grades per One Thousand Population of Twelve Year Olds in Alberta

Grade	1951		1956		1961		1966	
	Male	Female	Male	Female	Male	Female	Male	Female
1	2.2	1.5	0.4	0.6	0.6	0.5	0.4	0.3
2	3.4	1.5	1.3	1.5	1.6	0.9	1.8	1.1
3	8.6	4.7	5.7	3.2	4.2	2.4	4.6	3.0
4	35.2	16.8	20.2	9.5	10.7	5.7	9.0	5.7
5	111.9	61.3	77.1	43.2	57.1	26.5	43.4	25.1
6	269.0	223.4	249.7	199.7	177.8	120.7	185.5	107.2
7	274.7	412.9	411.7	436.5	511.7	558.5	552.2	596.5
8	192.9	254.4	211.5	280.9	182.0	239.5	183.6	243.3

attendance rate for males aged twelve, over the time period 1967-68 through 1980-81 were that the attendance rate would

1. (a) decrease to and remain at 58.5 for grade five.
   (b) decrease to and remain at 153.8 for grade six.
   (c) decrease to and remain at 546.1 for grade seven.
   (d) decrease to and remain at 181.6 for grade eight.
2. (a) increase to and remain at 60.4 for grade five.
   (b) increase to and remain at 158.7 for grade six.
   (c) increase to and remain at 563.5 for grade seven.
   (d) increase to and remain at 187.4 for grade eight.
3. (a) increase to and remain at 62.3 for grade five.
   (b) increase to and remain at 163.6 for grade six.
   (c) increase to and remain at 581.0 for grade seven.
   (d) increase to and remain at 193.2 for grade eight.

The alternate assumptions regarding the attendance rate of females aged twelve, over the time period 1967-68 through 1980-81 were that the attendance rate would

1. (a) decrease to and remain at 33.7 for grade five.
   (b) decrease to and remain at 102.6 for grade six.
   (c) decrease to and remain at 570.9 for grade seven.
   (d) decrease to and remain at 232.8 for grade eight.
2. (a) decrease to and remain at 34.8 for grade five.
   (b) decrease to and remain at 105.9 for grade six.
   (c) decrease to and remain at 589.1 for grade seven.
   (d) decrease to and remain at 240.3 for grade eight.
3. (a) increase to and remain at 35.8 for grade five.

(b) increase to and remain at 109.1 for grade six.

(c) increase to and remain at 607.3 for grade seven.

(d) increase to and remain at 247.7 for grade eight.

Thirteen year olds. As illustrated in Table 76, the total attendance rate of thirteen year old children has been above 960 per thousand. The data also indicates that the proportion of thirteen year old children in junior high school increased through the period 1951 to 1961 but remained stable between 1961 and 1966. Thus 1966 appeared to be a representative year to use to calculate the projected attendance rates.

Although the assumption of linear change over the intervening years was used, the projections were based on total attendance rates of 960 980, and 1000 per thousand. Grades below grade six were poo ed with grade six. The alternate assumptions regarding the attendance rates for males aged thirteen, over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 66.6 for grade six.

   (b) decrease to and remain at 182.2 for grade seven.

   (c) decrease to and remain at 527.6 for grade eight.

   (d) decrease to and remain at 183.6 for grade nine.

2. (a) decrease to and remain at 67.9 for grade six.

   (b) decrease to and remain at 186.0 for grade seven.

   (c) decrease to and remain at 538.6 for grade eight.

   (d) decrease to and remain at 187.4 for grade nine.

3. (a) increase to and remain at 69.3 for grade six.

   (b) increase to and remain at 189.8 for grade seven.

Table 76

Thirteen Year Old Children in Various Grades per One Thousand Population of Thirteen Year Olds in Alberta

Grade	1951 Male	1951 Female	1956 Male	1956 Female	1961 Male	1961 Female	1966 Male	1966 Female
1	1.7	1.1	0.4	0.7	0.5	0.3	0.4	0.3
2	2.0	1.0	0.5	0.7	0.8	0.4	0.9	0.4
3	4.0	2.3	2.9	1.4	3.2	1.2	2.5	1.4
4	15.2	7.6	7.7	4.8	4.8	2.8	4.0	3.4
5	45.9	20.2	24.8	12.5	14.4	8.9	11.2	5.7
6	120.5	72.8	92.2	54.6	65.4	34.8	49.3	24.6
7	276.2	232.1	270.5	210.0	210.8	138.8	187.0	118.1
8	344.4	389.8	415.6	444.9	514.7	564.2	541.4	581.8
9	172.0	244.4	202.1	265.9	164.2	213.4	188.4	246.4

(c) increase to and remain at 549.6 for grade eight.

(d) increase to and remain at 191.2 for grade nine.

The alternate assumptions regarding the attendance rates for females aged thirteen, over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 34.4 for grade six.
   (b) decrease to and remain at 113.4 for grade seven.
   (c) decrease to and remain at 558.5 for grade eight.
   (d) decrease to and remain at 236.5 for grade nine.
2. (a) decrease to and remain at 35.1 for grade six.
   (b) decrease to and remain at 115.7 for grade seven.
   (c) decrease to and remain at 570.2 for grade eight.
   (d) decrease to and remain at 241.5 for grade nine.
3. (a) increase to and remain at 35.8 for grade six.
   (b) increase to and remain at 118.1 for grade seven.
   (c) increase to and remain at 581.8 for grade eight.
   (d) increase to and remain at 246.4 for grade nine.

Fourteen years old. As illustrated in Table 77, the total attendance rate of fourteen year old children tended to be above 870 per thousand. Also, although the proportion in elementary, junior high school, and high school varied there were no definite trends. Thus, 1966 appears to be a representative year in the calculation of projections.

By pooling grades one to six, assuming linear changes over the intervening years, and a total enrolment rate of 870, 935, and 1000, the model was tested and the projections completed. The alternate

Table 77

Fourteen Year Old Children in Various Grades per One Thousand Population of Fourteen Year Olds in Alberta

	1951		1956		1961		1966	
Grade	Male	Female	Male	Female	Male	Female	Male	Female
1	1.7	0.7	0.1	0.7	0.2	0.0	0.2	0.0
2	1.6	0.7	0.8	0.2	0.5	0.4	0.4	1.0
3	2.7	0.8	1.0	0.8	1.3	1.1	1.1	1.6
4	6.8	3.0	3.0	2.0	2.1	2.0	1.5	2.2
5	17.9	8.2	7.7	3.9	6.6	3.2	4.5	2.6
6	46.5	26.1	30.9	15.8	18.0	9.2	12.9	6.7
7	127.7	80.5	109.9	60.2	97.2	43.4	71.8	35.3
8	244.6	219.3	262.8	215.0	231.8	157.1	185.7	125.9
9	296.8	360.9	359.8	412.6	523.9	620.1	539.1	590.6
10	123.8	205.2	170.1	226.1	152.9	196.0	163.8	203.0

assumptions regarding the attendance rates of males fourteen years old over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 81.9 for grade seven.
   (b) decrease to and remain at 164.7 for grade eight.
   (c) decrease to and remain at 478.1 for grade nine.
   (d) decrease to and remain at 145.3 for grade ten.
2. (a) decrease to and remain at 88.1 for grade seven.
   (b) decrease to and remain at 177.0 for grade eight.
   (c) decrease to and remain at 513.8 for grade nine.
   (d) decrease to and remain at 156.1 for grade ten.
3. (a) increase to and remain at 94.2 for grade seven.
   (b) increase to and remain at 189.3 for grade eight.
   (c) increase to and remain at 549.5 for grade nine.
   (d) increase to and remain at 167.0 for grade ten.

The alternate assumptions regarding the attendance rates for females aged fourteen, over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 44.4 for grade seven.
   (b) decrease to and remain at 113.0 for grade eight.
   (c) decrease to and remain at 530.3 for grade nine.
   (d) decrease to and remain at 182.3 for grade ten.
2. (a) decrease to and remain at 47.7 for grade seven.
   (b) decrease to and remain at 121.5 for grade eight.
   (c) decrease to and remain at 569.9 for grade nine.
   (d) decrease to and remain at 167.0 for grade ten.

3. (a) increase to and remain at 51.0 for grade seven.
   (b) increase to and remain at 129.9 for grade eight.
   (c) increase to and remain at 608.6 for grade nine.
   (d) increase to and remain at 209.5 for grade ten.

Fifteen years old. According to the data that are summarized in Table 78, there appear to be two important trends in the attendance of fifteen year old children. First, the number of fifteen year olds attending school as a proportion of fifteen year olds in the population increased. For males, the proportion attending school per thousand was 718.6, 818.1, 866.9, and 924.8 for 1951, 1956, 1961, and 1977 respectively. For females, the proportion attending school per thousand was 794.9, 833.7, 892.6, and 933.8 for 1951, 1956, 1961, and 1977 respectively. Secondly, the number attending high school as a proportion of those in school has shown an increase. For males, the proportion in high school was 0.49, 0.56, 0.61, and 0.68 in 1951, 1956, 1961, and 1966 respectively. For females the proportion in high school was 0.60, 0.66, 0.74, and 0.79 in 1951, 1956, 1961, and 1966 respectively.

By pooling all grades below grade eight, assuming linear changes over the intervening years, and taking account of the previously mentioned trends, the model was tested and the projections completed. The projections were based on total attendance rates of 900, 950, and 1000 per thousand. The distribution over the grades were estimated at 0.084, 0.166 0.570, and 0.180 for males in grades eight, nine, ten, and eleven respectively and 0.063, 0.187, 0.549, and 0.201 for females in grades eight, nine, ten, and eleven respectively. The alternate assumptions regarding the attendance rates for males aged fifteen, over

Table 78

Fifteen Year Old Children in Various Grades per One Thousand Population of Fifteen Year Olds in Alberta

Grade	1951		1956		1961		1966	
	Male	Female	Male	Female	Male	Female	Male	Female
2	0.8	0.3	0.2	0.1	0.3	0.0	0.3	0.2
3	1.2	0.3	0.6	0.2	0.5	0.9	0.4	0.4
4	3.6	1.2	0.9	0.5	1.5	0.6	1.2	0.6
5	5.4	2.2	1.9	1.7	2.9	1.5	3.4	0.8
6	12.2	8.7	8.0	4.6	4.5	3.1	3.4	1.6
7	40.3	22.2	20.8	15.9	26.2	11.2	20.4	9.7
8	103.6	69.8	91.7	54.8	90.9	45.7	69.1	36.4
9	202.2	211.5	232.6	208.0	207.9	166.0	193.9	148.9
10	234.7	294.3	314.1	344.7	415.2	502.0	480.5	538.5
11	114.6	184.4	147.2	203.2	117.0	161.6	152.2	196.7

the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 75.6 for grade eight.
   (b) decrease to and remain at 149.4 for grade nine.
   (c) increase to and remain at 513.0 for grade ten.
   (d) increase to and remain at 162.0 for grade eleven.
2. (a) decrease to and remain at 79.8 for grade eight.
   (b) decrease to and remain at 157.7 for grade nine.
   (c) increase to and remain at 541.5 for grade ten.
   (d) increase to and remain at 171.0 for grade eleven.
3. (a) decrease to and remain at 84.0 for grade eight.
   (b) decrease to and remain at 166.0 for grade nine.
   (c) increase to and remain at 570.0 for grade ten.
   (d) increase to and remain at 180.0 for grade eleven.

The alternate assumptions regarding the attendance rates for females aged fifteen, over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 56.7 for grade eight.
   (b) decrease to and remain at 168.3 for grade nine.
   (c) increase to and remain at 494.1 for grade ten.
   (d) increase to and remain at 180.9 for grade eleven.
2. (a) increase to and remain at 59.9 for grade eight.
   (b) increase to and remain at 177.7 for grade nine.
   (c) increase to and remain at 521.6 for grade ten.
   (d) increase to and remain at 171.0 for grade eleven.
3. (a) increase to and remain at 63.0 for grade eight.

(b) increase to and remain at 187.0 for grade nine.

(c) increase to and remain at 549.0 for grade ten.

(d) increase to and remain at 201.0 for grade eleven.

Sixteen years old. Two important trends appear in the data summarized in Table 79. As a proportion of the total population, the number of sixteen year olds attending school has been increasing. For example, for males the attendance rates have been 563.0, 642.0, 757.2, and 859.2 per thousand for 1951, 1956, 1961, and 1966 respectively. For females the attendance rates have been 587.8, 639.1, 753.4, and 860.5 per thousand for 1951, 1956, 1961, and 1966 respectively. While it is not probable, it is possible that this trend could continue to what might essentially be full attendance of sixteen year olds. The second trend has to do with the proportion of sixteen year olds attending high school. For example, for males the proportion in high school has been 0.72, 0.84, 0.85, and 0.88 for 1951, 1956,1961, and 1966 respectively. For females the proportion in high school has been 0.85, 0.89, 0.92, and 0.93 for 1951, 1956 1961, and 1966 respectively.

To test the model, an assumption of linear changes between the years reported in Table 79 was made. Also, grades below grade nine were pooled with grade nine. To complete the projections, total attendance rates of 850, 925, and 1000 were used. The proportions in each grade were 0.100, 0.216, 0.514, and 0.170 for males in grades nine ten, eleven, and twelve respectively and 0.050, 0.163, 0.569, and 0.218 for females in grades nine, ten, eleven, and twelve respectively. The alternate assumptions regarding the attendance rates for males aged sixteen over the time period 1967-68 through 1980-81 were that the

Table 79

Sixteen Year Old Children in Various Grades per One Thousand Population of Sixteen Year Olds in Alberta

Grade	1951 Male	1951 Female	1956 Male	1956 Female	1961 Male	1961 Female	1966 Male	1966 Female
3	0.4	0.3	0.2	0.0	0.1	0.1	0.3	0.1
4	1.7	0.4	0.5	0.1	0.6	0.4	0.2	0.6
5	2.2	1.0	0.2	0.4	0.9	0.5	0.5	0.9
6	4.2	2.6	1.5	0.9	1.0	0.5	1.4	1.1
7	9.3	4.3	5.7	3.4	4.1	2.9	5.2	3.5
8	26.1	14.3	20.9	11.0	22.2	8.1	15.8	8.4
9	116.2	65.1	78.2	53.3	88.4	51.1	81.8	46.1
10	140.1	139.7	170.0	146.9	157.4	111.1	181.3	137.2
11	174.8	224.1	241.0	276.8	368.9	425.6	430.5	478.8
12	88.0	136.0	123.9	146.3	113.6	153.1	142.2	183.8

attendance rates would

1. (a) decrease to and remain at 85.0 for grade nine.
   (b) decrease to and remain at 183.6 for grade ten.
   (c) decrease to and remain at 436.9 for grade eleven.
   (d) decrease to and remain at 144.5 for grade twelve.
2. (a) increase to and remain at 92.5 for grade nine.
   (b) increase to and remain at 199.8 for grade ten.
   (c) increase to and remain at 475.5 for grade eleven.
   (d) increase to and remain at 157.3 for grade twelve.
3. (a) increase to and remain at 100.0 for grade nine.
   (b) increase to and remain at 216.0 for grade ten.
   (c) increase to and remain at 514.0 for grade eleven.
   (d) increase to and remain at 170.0 for grade twelve.

The alternate assumptions regarding the attendance rates for females aged sixteen, over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 42.5 for grade nine.
   (b) decrease to and remain at 138.6 for grade ten.
   (c) decrease to and remain at 483.7 for grade eleven.
   (d) decrease to and remain at 185.3 for grade twelve.
2. (a) increase to and remain at 46.3 for grade nine.
   (b) increase to and remain at 150.8 for grade ten.
   (c) increase to and remain at 526.3 for grade eleven.
   (d) increase to and remain at 201.7 for grade twelve.
3. (a) increase to and remain at 50.0 for grade nine.
   (b) increase to and remain at 163.0 for grade ten.

(c) increase to and remain at 569.0 for grade eleven.

(d) increase to and remain at 218.0 for grade twelve.

Seventeen years old. Trends towards an increased proportion of all seventeen years old in school attendance and a larger part of these in high school appeared in the data in Table 80. As to the proportion of seventeen year olds in school attendance for males this has been 312.0, 394.9, 572.4, and 653.2 per thousand in 1951, 1956, 1961, and 1966 respectively. For females the rate has been 322.5, 329.6, 497.0, and 591.7 per thousand for 1951, 1956, 1961, and 1966 respectively. As to the proportion in high school the fraction has been between 0.95 and 0.98 for both males and females in 1961 and 1966.

To test the model, linear change over the intervening years was assumed. Also, students in grades one to eight were pooled with grade nine. To complete the projections, total attendance rates of 600, 725, and 850 per thousand for males and 550, 675, and 800 per thousand for females. It should be noted that the maximum rates of 850 per thousand for males and 800 for females were based on the attendance rates of sixteen year olds in grade twelve. The proportions in each grade that were used were the proportions that obtained in 1966. The alternate assumptions regarding the attendance rates for males aged seventeen, over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 20.8 for grade nine.

   (b) decrease to and remain at 60.0 for grade ten.

   (c) decrease to and remain at 138.1 for grade eleven.

   (d) decrease to and remain at 381.2 for grade twelve.

(c) increase to and remain at 569.0 for grade eleven.

(d) increase to and remain at 218.0 for grade twelve.

Seventeen years old. Trends towards an increased proportion of all seventeen years old in school attendance and a larger part of these in high school appeared in the data in Table 80. As to the proportion of seventeen year olds in school attendance for males this has been 312.0, 394.9, 572.4, and 653.2 per thousand in 1951, 1956, 1961, and 1966 respectively. For females the rate has been 322.5, 329.6, 497.0, and 591.7 per thousand for 1951, 1956, 1961, and 1966 respectively. As to the proportion in high school the fraction has been between 0.95 and 0.98 for both males and females in 1961 and 1966.

To test the model, linear change over the intervening years was assumed. Also, students in grades one to eight were pooled with grade nine. To complete the projections, total attendance rates of 600, 725, and 850 per thousand for males and 550, 675, and 800 per thousand for females. It should be noted that the maximum rates of 850 per thousand for males and 800 for females were based on the attendance rates of sixteen year olds in grade twelve. The proportions in each grade that were used were the proportions that obtained in 1966. The alternate assumptions regarding the attendance rates for males aged seventeen, over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 20.8 for grade nine.

   (b) decrease to and remain at 60.0 for grade ten.

   (c) decrease to and remain at 138.1 for grade eleven.

   (d) decrease to and remain at 381.2 for grade twelve.

Table 80

Seventeen Year Old Children in Various Grades per One Thousand Population of Seventeen Year Olds in Alberta

Grade	1951		1956		1961		1966	
	Male	Female	Male	Female	Male	Female	Male	Female
4	1.2	0.1	0.0	0.0	0.1	0.0	0.2	0.1
5	1.3	0.6	0.1	0.3	0.2	0.2	0.1	0.5
6	2.4	0.7	0.1	0.3	0.3	0.3	0.5	0.4
7	2.4	0.7	1.4	0.8	1.0	0.6	2.0	1.2
8	4.4	2.4	4.8	1.8	2.7	1.8	3.0	2.0
9	15.7	11.8	16.5	10.5	22.6	10.0	16.8	9.8
10	40.9	30.6	47.8	26.4	50.9	21.5	65.3	36.2
11	96.0	106.0	121.9	103.3	141.1	93.1	150.3	100.3
12	145.7	169.6	202.3	186.3	353.5	369.5	415.0	441.2

2. (a) increase to and remain at 25.1 for grade nine.
   (b) increase to and remain at 72.5 for grade ten.
   (c) increase to and remain at 166.8 for grade eleven.
   (d) increase to and remain at 460.6 for grade twelve.
3. (a) increase to and remain at 29.4 for grade nine.
   (b) increase to and remain at 85.0 for grade ten.
   (c) increase to and remain at 195.6 for grade eleven.
   (d) increase to and remain at 540.0 for grade twelve.

The alternate assumptions regarding the attendance rates for females aged seventeen, over the time period 1967-68 through 1980-81, were that the attendance rates would

1. (a) decrease to and remain at 13.0 for grade nine.
   (b) decrease to and remain at 33.6 for grade ten.
   (c) decrease to and remain at 93.2 for grade eleven.
   (d) decrease to and remain at 410.1 for grade twelve.
2. (a) increase to and remain at 16.0 for grade nine.
   (b) increase to and remain at 41.3 for grade ten.
   (c) increase to and remain at 114.4 for grade eleven.
   (d) increase to and remain at 503.3 for grade twelve.
3. (a) increase to and remain at 18.9 for grade nine.
   (b) increase to and remain at 48.9 for grade ten.
   (c) increase to and remain at 135.6 for grade eleven.
   (d) increase to and remain at 596.5 for grade twelve.

Eighteen years old. As illustrated in Table 81, a small but relatively constant proportion of eighteen year olds have been in attendance in grade nine or below. Also, the total attendance rate for

Table 81

Eighteen Year Old Children in Various Grades per One Thousand Population of Eighteen Year Olds in Alberta

	1951		1956		1961		1966	
Grade	Male	Female	Male	Female	Male	Female	Male	Female
5	0.5	0.0	0.0	0.1	0.0	0.1	0.0	0.1
6	1.6	0.3	0.1	0.0	0.2	0.0	0.0	0.0
7	0.8	0.1	0.8	0.3	0.1	0.0	0.5	0.3
8	1.3	0.6	1.4	0.4	0.1	0.2	0.6	0.2
9	1.7	1.4	2.3	1.7	4.3	1.3	3.3	1.3
10	7.1	4.3	9.8	3.7	13.7	3.0	18.4	7.9
11	26.0	23.9	30.6	14.2	43.6	15.0	49.0	19.6
12	111.7	95.6	127.1	73.7	230.7	102.7	242.4	139.3

both boys and girls has been increasing to some extent.

The assumption of linear change in the intervening years was used to test the model. Also, all students in grades one to eight were pooled with grade nine. To complete the projections, total attendance rates of 300, 350, and 400 per thousand were used for males. For females, total attendance rates of 150, 225, and 300 per thousand were used. It should be noted that the highest figure for both males and females was based on attendance rates in grade twelve for sixteen and seventeen year olds. The distribution over the grades used in the projections was the distribution that obtained in 1966. The alternate assumptions regarding the attendance rates for males aged eighteen over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 4.2 for grade nine.
   (b) decrease to and remain at 17.6 for grade ten.
   (c) decrease to and remain at 46.8 for grade eleven.
   (d) decrease to and remain at 231.4 for grade twelve.
2. (a) increase to and remain at 4.9 for grade nine.
   (b) increase to and remain at 20.5 for grade ten.
   (c) increase to and remain at 54.6 for grade eleven.
   (d) increase to and remain at 270.0 for grade twelve.
3. (a) increase to and remain at 5.6 for grade nine.
   (b) increase to and remain at 23.4 for grade ten.
   (c) increase to and remain at 63.4 for grade eleven.
   (d) increase to and remain at 308.6 for grade twelve.

The alternate assumptions regarding the attendance rates for females aged eighteen, over the time period 1967-68 through 1980-81, were that the attendance rates would

1. (a) decrease to and remain at 1.7 for grade nine.
   (b) decrease to and remain at 7.0 for grade ten.
   (c) decrease to and remain at 17.4 for grade eleven.
   (d) decrease to and remain at 123.9 for grade twelve.
2. (a) increase to and remain at 2.5 for grade nine.
   (b) increase to and remain at 10.5 for grade ten.
   (c) increase to and remain at 26.1 for grade eleven.
   (d) increase to and remain at 185.8 for grade twelve.
3. (a) increase to and remain at 3.4 for grade nine.
   (b) increase to and remain at 14.0 for grade ten.
   (c) increase to and remain at 34.8 for grade eleven.
   (d) increase to and remain at 247.7 for grade twelve.

Nineteen years old. As illustrated in Table 82, the total attendance rate for males aged nineteen has increased from about 50 per thousand in 1951 and 1956 to nearly 100 per thousand in 1961 and 1966. At the same time, the total attendance rate for females has fluctuated between 18 and 30 per thousand without showing any real trends. On the basis of the attendance rates in grade twelve of younger groups the maximum attendance rate for nineteen year olds would be about 100 per thousand males and about 50 per thousand females.

The pooling of grades one to ten and an assumption of linear change were used to test the model. To complete the projections, the 1966 distribution over grades was used. Total attendance rates of 90, 95, and 100 per thousand males and 20, 35 and 50 per thousand females

Table 82

Nineteen Year Old Children in Various Grades per One Thousand Population of Nineteen Year Olds in Alberta

Grade	1951 Male	1951 Female	1956 Male	1956 Female	1961 Male	1961 Female	1966 Male	1966 Female
6	1.2	0.3	0.2	0.0	0.0	0.0	0.0	0.0
7	0.4	0.1	0.2	0.1	0.1	0.0	0.2	0.2
8	0.4	0.1	0.9	0.0	0.1	0.1	0.1	0.1
9	0.8	0.6	0.5	0.4	1.1	0.3	0.7	0.2
10	0.7	0.4	1.5	1.4	3.9	0.1	4.0	1.7
11	4.9	3.3	6.0	2.3	12.3	1.5	11.7	2.6
12	48.5	26.6	42.6	15.7	73.6	17.2	81.8	20.6

were used. The alternate assumptions regarding the attendance rates for males aged nineteen, over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 4.6 for grade ten.
   (b) decrease to and remain at 10.7 for grade eleven.
   (c) decrease to and remain at 74.7 for grade twelve.
2. (a) decrease to and remain at 4.8 for grade ten.
   (b) decrease to and remain at 11.3 for grade eleven.
   (c) decrease to and remain at 78.9 for grade twelve.
3. (a) increase to and remain at 5.1 for grade ten.
   (b) increase to and remain at 11.9 for grade eleven.
   (c) increase to and remain at 83.0 for grade twelve.

The alternate assumptions regarding the attendance rates for females aged nineteen, over the time period 1967-68 through 1980-81 were that the attendance rates would

1. (a) decrease to and remain at 1.7 for grade ten.
   (b) decrease to and remain at 2.0 for grade eleven.
   (c) decrease to and remain at 16.2 for grade twelve.
2. (a) increase to and remain at 3.0 for grade ten.
   (b) increase to and remain at 3.6 for grade eleven.
   (c) increase to and remain at 28.4 for grade twelve.
3. (a) increase to and remain at 4.3 for grade ten.
   (b) increase to and remain at 5.1 for grade eleven.
   (c) increase to and remain at 40.6 for grade twelve.