A SYSTEMS APPROACH TO THE ANALYSIS OF THE TEACHER SUPPLY PROBLEM IN TURKISH SECONDARY EDUCATION

Dissertation for the Degree of Ph. D.

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KEMALETTIN AKALIN

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ABSTRACT

A SYSTEMS APPROACH TO THE ANALYSIS OF THE TEACHER SUPPLY PROBLEM IN TURKISH SECONDARY EDUCATION

By

Kemalettin Akalin

The Problem

In spite of the struggle and of the requirement of the national development plans to solve it, the problem of inadequate supply of secondary school core subject teachers (teachers for general education) has drastically grown in Turkey throughout the last score of years.

The Purpose

The purpose of this study was to examine the problem in order to search for an operational approach to solve it, and at the same time to demonstrate a new way of analyzing educational problems in general. The operational aim was to present a systems approach, useful in analyzing educational problems in general, and to perform an application of the technique to the particular teacher supply problem of the country.

Obviously, the need for scientifically processed data is essential to any effort to solve the problem through

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these kinds of studies. Hence another purpose of this study was to develop a tool, a mathematical model, as a means for obtaining information relevant to the problem.

Conclusions Drawn from the Analyses

A logical block diagram was developed in order to examine all events which either appeared to be involved in or to affect the teacher supply efforts and activities in the Turkish system. The overall conclusion drawn from the analytical examination was that the causal problem, which results in the shortage of secondary school core subject teachers, is essentially a resource utilization problem rather than a resource scarcity problem. In other words, the problem is caused basically by ineffective administrative decisions. In view of solid evidence that the administration has been supported and encouraged by the environment in its struggle for solution of the problem, the above mentioned ineffectiveness of decisions may be attributed to the inert state of the system, which cannot at present keep pace with the dynamic changes of the society.

In order to cope effectively with the problem, needed basic operational measures which may be derived from the analysis of the problem may be cited as follows:

1. To change the traditional conservative concept of administration toward the productive modern concept of management.

2. To establish a modern data processing system, which seems to be an especially urgent need, because the education system has become too large and too complex to be managed adequately by the central Ministry of Education through continuing today's practice, lacking adequate flows of essential information.

3. To redesignate the teacher supply system in terms not only of its organizational structure but also its training programs, so as to better answer the needs of the changing society.

The Tool Developed to Utilize Processed Data

To accomplish the purposes of this study, a mathematical model was developed to facilitate operational approaches for solution of the problem under consideration.

The model consists of two main parts. The first part was devoted to a simulation model in order to illustrate how alternative solutions are obtained and examined through manipulating parameters, and to illustrate what kind of data is needed in simulation for planning.

The second part was developed as a descriptive model in order to define the state of the system at a particular point in time. Obviously the purpose of the second part of the model was to facilitate obtaining realistic parameters to be used in a simulation model.

The model also facilitates cost analyses relevant to operational approaches for solution of the teacher supply problem.

Application of the Model

The model was applied to the province of Eskişehir, which was selected on a nonrandom basis. The criteria for selection of this province were: (a) to include all known variables, i.e., all kinds of secondary schools in Turkey, and (b) to facilitate data collection at minimum cost and effort.

Since expected performance of the model was obtained from its application for this particular province, one logically deduces that similar performances could be obtained for other provinces through simple looping in the computer program.

Although one should not generalize the findings in the Eskişehir application of the model for Turkey as a whole, implications of the results may be cited as follows:

1. Teacher supply and utilization problems exist in the province of Eskişehir, and the application demonstrates how the nature and dimensions of the problem may be apprehended.

2. Cost analyses indicate potential means for establishing criteria to facilitate improving the system

with respect both to quality and quantity of service, through both short-range and long-range measures.

It is hoped the success of this demonstration may encourage the Turkish National Ministry of Education to make greater use of systems approaches, to improve its flows of information, and to modernize its own administrative structures based on the outcomes of research and planning.

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By

Kemalettin Akalin

A DISSERTATION

Submitted to
Michigan State University
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DOCTOR OF PHILOSOPHY

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& Curriculum

1974

DEDICATED TO

My wife and children

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CHAPTER I

INTRODUCTION

> In this country, we suffer from the lack of the habit of thinking scientifically--all the way from the private life of citizens to the administration of the state.
>
> --Ismail Arar

Statement of the Problem

Insufficient supplies of general secondary school teachers has been a problem in Turkey since the early fifties. Following the Revolution of May 27, 1960, Turkey undertook to manage its national development by means of national five-year plans. The first planning period began in 1963. Education was considered to be a prime factor in the development of the economy and the society, and it was given high priority among other planned activities. However, in spite of the five-year plans and their yearly programs, implementation has remained insufficient throughout the last decade. In particular, the shortage of general secondary school teachers, which was fewer than 3,000[1] in

[1]Milli Egitim Bakanliği, Öğretirme Komitesi ve On Yillik Plan (Istanbul: Milli Eğitim Basimevi, 1961), p. 82.

the 1960-1961 school year, grew to more than 18,000[2] in the 1970-1971 school year.

This teacher shortage, which was readily apparent, manifested itself more and more year by year. The need to analyze the problem and to achieve effective control over it became increasingly urgent.

Over the last twenty-five years, the present writer has been intimately concerned with the problem: in his capacities as a teacher and administrator of teacher training schools, and since 1959 in his work in the central Ministry (a) as an administrator in the general directorate for teacher training and (b) as a researcher on the staff of the Ministry's planning office (which will be referred to in this study by its initials PAKD--see footnote 2, below).

In 1960 and 1961, this researcher was in charge of preparing a ten-year plan for meeting the need for elementary and secondary school teachers. On the basis of his experiences and his first-hand observations of implementation during the planned period, he developed the working hypothesis that a key to the problem might lie in the decision-making processes by which the system of preparing and supplying teachers was administered. The

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[2]Source: Data supplied by the Planlama, Arastirma, ve Koordinasyon Daıresi (PAKD--the Planning, Research, and Coordination office of the National Ministry of Education in Turkey).

rising demand and aspiration in society for more general secondary educational opportunities exceeded the targets specified in the national plans. At the same time, the supply of teachers fell below the targets. The problem appeared to be more dynamic than the ability to cope with it in the present administrative system.

The researcher pursued this problem further in graduate study at Michigan State University. There he took up a study of systems analysis with a view to the light which might be shed by employing a systems approach to the problems of teacher supply in Turkey.

Working Hypothesis Upon Which This Study Is Based

This became the working hypothesis upon which the present research is based: that a systems approach to analyzing the processes of teacher supply in Turkey (a) might help administrators understand better the nature of the teacher shortage problem, (b) might better identify the points at which better decisions need to be made and the variables which need to be considered, and (c) might indicate new and better kinds of data needed.

What the researcher learned was that a systems approach represents a new and general method of thinking. It recognizes that the operations of a particular part of a system are normally interrelated in complex ways with the simultaneous operations of other parts of the system. A systems approach is a comprehensive way of enabling the analyst to include in his thinking--in ways he might not otherwise be able to do--those other pertinent variables which also bear on the particular problem at hand.

The present study therefore is a study in applied methodology. It attempts to demonstrate how a systems approach may be usefully applied--in this case, to the particular problem of teacher supply in Turkey. In addition to the particular problem, the researcher hopes that the general usefulness of the approach also will become apparent. The problem of teacher supply is urgent and for that reason it was selected as the topic for application in this study. But the problem of teacher supply is only one part of the total complex of processes making up the whole Turkish educational system. Application of the approach to other problems may promise also to offer useful results similar to the outcomes of the present study of teacher supply.

Objectives

There would appear to be a great opportunity for helping Turkish educational administrators by providing them with better analyses and better data. In this way their decisions may be more effectively based on scientific analyses and national understandings. In present practice, however, such help customarily is neither asked nor provided. Decisions are made depending on personal, empirical

estimations or on interpretations of aggregate statistical data which are frequently outdated, and inaccurate, or insufficiently analyzed. Any attempt to help administrators, therefore, should first of all attempt to facilitate the provision of sufficient data which has been scientifically analyzed. As indicated above, the primary aim of this study is to demonstrate one promising new way in which this might be done in terms of applying a systems approach to the problem of need and supply of secondary school teachers.

The overall objective is to accomplish this aim through facilitating a more compehensive identification of the problem and its relevant variables. The following main objectives may be specified:

1. To utilize a systems approach in analyzing the education system under consideration in order to identify the relevant variables involved in causing an inadequate supply of general secondary school teachers, and to explore the interrelationship among these variables.

2. To develop a mathematical model for approximating the state of the system related to demand and supply of secondary school core subject teachers at a given particular point in time.

To be more specific, one may break down the above primary objectives into secondary ones, as follows:

1. In terms of identification of the problem:

    a. Isolate and identify the problem in terms of its internal structural and functional nature and its external environment.

    b. Illuminate possible interrelationships of variables which may be causing the problem.

2. In terms of the system as it relates to need and supply of secondary school teachers, identify the following:

    a. Anatomy of structural elements in the existing situation in terms of need and supply of teachers.

    b. Existing functional relationships among variables related to need and supply of teachers.

    c. Assessments of actual observed utilization of teachers in an existing situation.

    d. Opportunities for better utilization of teachers under existing circumstances.

    e. Assessments of the utilization of funds with respect to the observed utilization of teachers.

    f. Estimates of cash expenditures.

    g. Estimates of investment and prorated costs.

    h. Estimates of unit costs of educational services.

Delimitation of the Study

The scope of this study includes only identification of quantitative elements in The Turkish secondary school system which relate to need and supply of secondary school core subject teachers. Qualitative aspects of teachers and all aspects relating to vocational and technical subjects in the secondary schools are not in the scope of this study. One may, however, use the mathematical model in the quantitative aspects of vocational and technical education which relates to need and supply of teachers through extending the indices of teachers' fields to vocational and technical subjects.

Operational Procedure of the Study

Procedures followed in completion of this study were as follows:

A logical block diagram of the structure of the system under consideration was developed to set forth through a systems approach the possible location of key decision points in the operation of the system.

Sets of possible functional relationships were developed among variables of the system and stated in the form of mathematical functions so as to generate a model.

To demonstrate how the model might illuminate circumstances in a real situation, the province of Eskişehir was selected for study. The criteria used in the selection of this province were as follows:

The model was built to facilitate identification of operations at either micro or macro levels, i.e., from individual schools to national levels. Turkey is divided into 67 provinces, each of which functions as a self-sufficient administrative unit subordinated to the central government.

Therefore, a given province may serve both as the smallest unit in a model of the entire country where less detail is needed, and as the largest aggregate in a model of the province. In any case it will serve as an adequate unit for testing the model. However, every province does not at present have every kind of secondary school contained in the system. A province was needed which might more nearly represent the nation as a whole in terms of including all kinds of secondary schools. This was the first criterion: to be inclusive. As a second criterion, the province should be as small as possible, so as to facilitate collecting of data with minimum effort and expense.

Eskişehir met the above cited criteria. In addition it is conveniently located next to Ankara. Moreover, if application of the model were to illuminate relationships in such a province, one might expect it to serve similarly for the others simply by executing the computer program with the data for each province.

Data collection was carried out in a manner similar to that by which the Ministry of Education regularly collects its data. Forms for requested data were mailed to all of Eskişehir's 48 secondary schools, to be filled out by teachers and school directors so as to represent the circumstances on May 2, 1972. An English version of the list of requested data is included in Appendix A. Completed forms from all schools except one were received in six weeks. After coding the items in the forms, the data were transformed to punch cards and processed through the IBM 360 digital computer at the Middle East Technical University in Ankara. Examples of reduced copies of the resulting printouts are included in Appendix B.

Accuracy of the data was not strictly a matter of concern in this study because they were primarily used for building the model. However, one expects dependability of the data to be sufficient to reflect the real world represented by the model. One should not generalize the findings to other provinces because of the biased selection of the province and of socioeconomic, demographic, and geographic differences between the selected one and other provinces.

Organization of the Study

This study is organized as follows:

Chapter I includes a statement of the problem, assumptions, objectives, and delimitation of the work. Definitions of terms are included at the end of this chapter to clarify understanding of their specialized meanings in this work or in the Turkish culture.

Chapter II contains a review of literature, in terms of information for administrators on the systems approach to the solutions of problems, and on the uses of models in analysis. No previous research in education of exactly the same kind as the present study was available for review.

Chapter III is devoted to a review of the background of the teacher supply problem in the context of the total system. In this chapter, the particular state of the overall system in relation to the problem is briefly presented along with statistics on the extent of the problem.

For Chapter IV, a logical block diagram was developed of the operations of the teacher supply system under consideration. Use of the block diagram demonstrates how one may use a systems approach to investigate possible locations and characteristics of key variables causing the teacher shortage problem. A brief discussion of possible improvements of the system concludes Chapter IV.

Chapter V is devoted to a mathematical model developed to identify the state of the system in terms of need and supply of teachers at a particular time. Moreover, to demonstrate the uses of such a descriptive model, an abridged version of a previously prepared simulation model and the outcomes of its application also are included in Chapter V. Thus Chapter V consists of two basic parts: (1) Simulation Model for Turkish Lycée Teachers and (2) Mathematical Model for Identification of the Turkish Secondary School System.

Basic findings deriving from an application of the model, utilizing data as of May 2, 1972, from the province of Eskişehir are included in Chapter VI. This chapter therefore stands as an example of one of the many concrete applications which would need to be carried out in order to use the models and systems approach developed in previous chapters fully. Chapter VII is the final chapter of this study and consists of a summary of the work and its conclusions.

Definitions of Terms

For clarity of understanding, the following terms are defined either because of their specialized meaning for the purposes of this study or because of their meaning in the Turkish culture.

Adaptive control: Control of a system so that it attains a specified or optimum performance through changing the system's parameters by automated means without changing the system's structure.

Block diagram: "A block diagram is a shorthand, pictorial representation of cause and effect relationships between the inputs and outputs of a physical system."[3]

Closed system: A system that operates under control which is dependent on its own output. In other words, it utilizes feedback from its own operation to control succeeding outputs.

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[3] Joseph J. Distefano, III, *et al.*, *Theory and Problems of Feedback and Control Systems* (New York: McGraw-Hill Book Company, 1967), p. 12.

Constraint: A result of previous actions or conditions external to the system which constrains another action or variable. It may also be due to a performance specification. Constraints are classified in two categories--functional and regional. Functional constraints are mathematically represented by equations and do not change as long as the variables of the system remain as they are. A regional constraint is mathematically represented by an inequality which assumes a value between a minimum and maximum limit. The desired value in between the two limits can be defined as the optimum or best solution subject to the functional constraint.

Control: To bring a system into a desired state or to keep it in its desired state.

Core subjects: Subject matter included in the curriculums of all kinds of secondary schools as the core of general education.

Delay time: The time required for a unit-step input to reach the final stage in the system's interactions. It can be distinguished as the time-domain specification or as the speed of response to input.

Design: ". . . a purposeful activity directed toward the goal of fulfilling human needs."[4]

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[4]Morris Asimow, *Introduction to Design* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1962), p. 1.

Dynamic structure: "Time-dependent structure of a model; i.e., the rules for moving from one system state to another."[5]

Education institute: A three-year higher education institution in Turkey, which trains general education teachers for secondary education and inspectors for elementary education. It is essentially a boarding school and was established for training the first cycle of secondary school teachers. However, its graduates teach at the second cycle also.

Endogenous: "Caused from the inside; originating from or due to internal causes."[6]

Entity: "Object of a system; also, any distinguishable item, being, or processing unit within a system."[7]

Environment: "In systems terminology, objects which are outside the boundaries of the system but which can influence the system are said to constitute the environment of the system."[8]

Exogenous: "Caused from the outside; originating from or due to external causes."[9]

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[5] A. Alan B. Pritsker and Philip J. Kiviat, Simulation with Gasp II (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1969), p. 291.

[6] Ibid.

[7] Ibid.

[8] Ibid., p. 8.

[9] Ibid., p. 291.

Feedback: "Feedback is that property of a closed-loop system which permits the output (or some other controlled variable of the system) to be compared with the input of the system (or input to some other internally situated component or subsystem of the system) so that the appropriate control action may be formed as some function of the output and input."[10]

First cycle secondary school: A Turkish school analogous to "middle school" or "junior high school." It provides three years of general education after elementary school.

General directorate: The highest operational administrative unit in the Turkish Ministry of Education.

General secondary school: In Turkey either a middle school or lycée, or both.

Higher school: Any higher education institution in Turkey other than a university. It is subordinated to the Ministry of Education and, depending on the kind of school, provides from two to four years of technical or vocational education.

Higher teacher training school: A boarding school which provides some vocational courses for the teaching profession. Lycée graduates are admitted. Students attend universities. Graduates are qualified to teach at the second cycle of secondary school.

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[10] Distefano *et al.*, *op. cit.*, p. 3.

Input: All sources supplied to a system enabling it to take action for accomplishing desired objectives.

Load of teacher: The total class hours taught in a week by a teacher. It is classified in two categories, as follows.

Observed load of teacher -- The load carried by a teacher when an observation is made.

Established load of teacher -- The load expected by law to be carried by a teacher.

Lycée: Three-year academic high school after the middle school. The Turkish spelling is "lise." It is the second cycle secondary school.

Middle school: Synonymous with first cycle secondary school.

Model: "Representation of a system. A model can be physical, mathematical, graphical, logical, or combinations of each."[11]

MOE: Abbreviation for the Ministry of Education.

Normal school: Teacher training school for elementary education. In Turkey until 1970, it was a three-year second cycle secondary school. Now it is a four-year secondary school. Some of them also include the first cycle (total of seven years) and recruit students from villages. It is basically a boarding school.

Open system: A system that operates under controls which are independent of its output.

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[11]Pritsker and Kiviat, op. cit., p. 293.

Output: "The output signal is the response of the system of the input signal."[12] In this work it is the final production of administration and central decisions and of teachers for the system or subsystem.

PAKD: The Turkish initials of the Planning, Research, and Coordination Office of the Ministry of Education.

Planned period: Refers to the era beginning in 1963 in terms of national management of social-economic development activities in Turkey.

Public school: This term is used in this study to refer to schools operated by the Ministry of Education.

Qualification of teachers: Refers to qualitative classification of teachers in terms of their training, such as

> Qualified teachers -- Those trained in the particular subject-matter they are teaching, at or above the level required by law for the school in which they teach.
>
> Semi-qualified teachers -- Those trained in the particular subject-matter they are teaching, but below the level required by law for the school in which they teach.
>
> Unqualified teachers -- Those not trained for the particular subject-matter they are teaching, either at or below the level for the school in which they teach, or who are not trained for teaching at all.

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[12] George R. Cooper and Clare D. McGillem, Methods of Signal and System Analysis (New York: Holt, Rinehart and Winston, Inc., 1967), p. 4.

Second cycle secondary school: The lycée, analogous to the "senior high school" in the U.S. Any kind of high school after the first cycle. They provide three to four years of education and include three categories: (a) academic, (b) vocational, and (c) technical.

Simulation: "Simulation is a numerical technique for conducting experiments on a digital computer, which involves certain types of mathematical and logical models to describe the behavior of a business or economic system (or some component thereof) over extended periods of time."[13]

State of system: Mathematically, the vector or the set of all variables needed to describe the system at a particular time. In other words, description of the system through all necessary information related to objects of the system at a particular time.

Static structure: "Time-independent structure of a model; *i.e.*, the framework within which system states are defined."[14]

Subsystem: A particular collection of objects (persons, activities, etc.) that is a part of a larger system.

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[13]Thomas H. Naylor *et al.*, *Computer Simulation Techniques* (New York: John Wiley and Sons, Inc., 1968), p. 3.

[14]Pritsker and Kiviat, *op. cit.*, p. 294.

System: There is no all-purpose definition of system. It can be determined in terms of a particular purpose. However, "a very general definition of a system is that it consists of a group of objects that can interact with one another and are assembled in a manner intended to achieve a desired objective."[15]

Systems analysis: Using the lexical meaning of the word of "analysis," systems analysis means investigation or examination of the properties of the system through studying its structure and components.

Undersecretary: The immediate subordinate to the Minister. He has the highest authority to act on behalf of the Minister in the Ministry of Education.

Summary

The basic purpose of this study is to demonstrate the utility of applying a systems approach to the analysis of problems in Turkish education. The problem of supplying secondary school core subject teachers has been selected for particular study. The analysis presented in Chapter IV will indicate the value of looking at entire systems, thereby providing a structure for unifying and integrating various sub-systems which may also be studied. Chapter IV illustrates the application of the general method to a

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[15] Cooper and McGillem, *op. cit.*, p. 2.

particular problem and shows how a specific study is a part of and is related to the total system. Definitions are presented above for terms which will be used in the following analysis.

CHAPTER II

REVIEW OF LITERATURE

Introduction

This chapter presents a review of only a portion of the literature on systems procedures and their applications to education. The whole literature is too massive in scope to try to include in the present type of study. Here the literature selected for review is restricted to serve two purposes:

a. To provide readers with a sample of general statements of the concepts, techniques, and applications of systems procedures, avoiding highly technical aspects of the discipline.

b. To provide a set of references in particular on the uses of systems procedures in studying social processes and organizations, with special emphasis on information, planning, and control in education.

Development of Systems Concept

The scientific origin of the systems concept goes back into the history of science. However, the systems concept as an explicit set of interrelated elements was first introduced prior to the Second World War, by Ludwig

Von Bertalanffy, the biologist. He called attention to the general systems concept through asserting that "organisms are organized things and, as biologists, we have to find out about it."[16] To him, observation of biological systems in a laboratory creates artificial situations different from real environments and can lead one to incorrect and wrong conclusions.

The great contribution of general systems theory is that it is not exclusive to a particular field or to a particular complex phenomena. Its basic contribution to science and technology is to present a new way of thinking applicable to any field of knowledge.

> It is a change in basic categories of thought of which the complexities of modern technology are only one--and possibly not the most important--manifestation. In one way or another, we are forced to deal with complexities, with "wholes" or "systems," in all fields of knowledge. This implies a basic re-orientation in scientific thinking.[17]

Application of Systems Concept

The new technology indicated in the concept of "systems approach" was applied and developed by the allied military services during the second World War. Scientists drawn from many disciplines performed multi-disciplinary teamwork with great success during the war.

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[16] Ludwig Von Bertalanffy, General System Theory (New York: George Braziller, 1968), p. 89.

[17] *Ibid.*, p. 5.

> These teams of scientists were usually assigned to the executive in charge of operations--to the "line"--hence their work came to be known as operational research in the United Kingdom and by a variety of names in the United States: operational analysis, operations evaluation, operations research, systems analysis, systems evaluation, systems research, and management science.[18]

Today, the terms systems analysis, operations research, management science, and applied economic analysis are used almost interchangeably with one another.[19]

Systems scientists who had worked together in the military became available after the war for peacetime employment in industry, business, and public organizations, but the electronic computers which they had used were not yet available in the market. The wide range of mathematics needed for the applications of operations research far transcends the capacity of a few mathematicians. The flourishing development systems applications to industry became possible only in the late 40s when electronic computers became available for commercial use. Some say that this period marks the beginning of the "Second Industrial Revolution, which was developed by the hardware

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[18]Russell L. Ackoff and Maurice W. Sasieni, Fundamentals of Operations Research (New York: John Wiley and Sons, Inc., 1968), p. 5.

[19]Richard W. Judy, "Systems Analysis and University Planning," Socio-Economic Planning Sciences, Vol. 2, Nos. 2/3/4 (April, 1969), p. 179.

of computers, automation and cybernation, and the software of systems science."[20]

Systems Approach

A systems approach is essentially a point of view, rather than a particular technique. This approach leads scientists to use scientific methods and knowledge along with considerations of systems concepts proper to the problem of concern. Bertalanffy indicates this in the following quotation:

> An important consideration is that the various approaches enumerated are not, and should not be considered to be monopolistic. One of the important aspects of the modern changes in scientific thought is that there is no unique and all-embracing "world system." All scientific constructs are models representing certain aspects of perspectives of reality. The various "systems theories" also are models that mirror different aspects.[21]

Identifying the interrelationships of components which constitute the system is imperative in a systems approach. The approach may require a team of scientists and specialists from various fields, such as economics, mathematics, sociology, education, etc. A systems approach facilitates not only looking at a system as a whole but also dealing with the details of any problematic area in the system. Utilization of a computer along with a systems approach facilitates scientific analysis of large, complex

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[20]Von Bertalanffy, op. cit., p. 4.

[21]Ibid., p. 94.

systems which otherwise might lie beyond the scope of human analysis.

Systems Analysis

Systems analysis is a purposeful research technique employed in terms of predetermined objectives. Regardless of the objectives, the systems analyst follows ways demanded by the systems approach. Any scientific way to accomplish the objectives of an analysis can be used. Cooper and McGillem[22] offer a rather sophisticated explanation of the advantages of using systems analysis:

1. To determine the response of a system to a specified input by analysis is easier and cheaper than by experiment.

2. Analysis is the only possibility to determine the feasibility of a particular system that is not actually in existence.

3. Analysis may assume conditions that would be impossible or dangerous to create on an experimental basis.

4. Systems analysis is often an important part of system design.

Perhaps the most significant contribution of systems analysis to management and administration is its ability to facilitate anticipating the probable outcomes of alternative measures without requiring experimentation (or "trial and error," or "wait and see") in the real world throughout a given period of real time, which would be highly consuming of resources.

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[22]Cooper and McGillem, op. cit., pp. 4-5.

Systems Techniques

One of the advantages of a systems approach is modeling the real world for the purposes of systems analysis and design. In general, modeling is the approximated representation of the real world. The concept of model is introduced by Ackoff and Sasieni, as follows:

> Models are representations of reality. If they were as complex and difficult to control as reality, there would be no advantage in their use. Fortunately, we can usually construct models that are much simpler than reality and still be able to use them to predict and explain phenomena with a high degree of accuracy. The reason is that although a very large number of variables may be required to predict a phenomenon with perfect accuracy, a small number of variables usually account for most of it. The trick, of course, is to find the right variables and the correct relationship among them.[23]

Models can variously be classfied in terms of purposes. There are three types of models: iconic, analogue, and symbolic.[24] Iconic models are representation of the properties with a change of scale, such as photographs, maps, model airplanes, etc. Analogue models consist of sets of properties which are used to represent other sets of properties, such as contour lines on a map are analogues of elevation, graphs are analogues of geometrical magnitudes, etc. Symbolic models include letters, numbers, or other symbols to represent variables and relationships among variables. Mathematical models are symbolic models.

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[23] Ackoff and Sasieni, <u>op. cit.</u>, p. 60.

[24] <u>Ibid.</u>, pp. 60-61.

Block diagrams and flow charts are usually made up of a combination of iconic and analogue models.

In a given research, any one of the above mentioned types of models may be used. In many cases, all three types of models are used in sequence. Iconic and analogue models or combinations of them are frequently used as initial approximation. In the present study, Chapter IV includes such models. Relationships among variables are usually quantitatively presented and stated by means of symbolic models. Chapter V in this study represents such uses of symbolic models.

The contribution of models in explaining problems is explained in the following quotation:

> Models are normally thought of as instruments for selecting the best (or at least a good) course of action from that set of courses of action that is "covered" by the model. However, models have another very important use that is frequently overlooked: they can be used heuristically, that is, as an instrument of discovery. They provide an effective tool with which to explore the structure of a problem and to uncover possible courses of action that were previously overlooked. The discovery of such courses of action may often be the most important use to which the model can be put.[25]

Models are used for varying purposes which may be classified, as follows:

> Originally models were used exclusively for descriptive purposes. With the advent of mathematics, models became predictive as well. Later, man's curiosity and his ever-increasing need for

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[25] *Ibid.*, p. 89.

> control drew him to explanatory models. It was not enough to know that something could be expected to happen; man had to know why this was so, to simplify, amplify, reduce, or change it.[26]

One may construct models to predict future events. Such models are presented as "simulation models," and this sort of model deserves further explanation.

Simulation Models

Simulation, as a problem-solving technique, is imitation of the real world. In other words, simulation involves "setting up a model of a real situation and then performing experiments on the model."[27] Simulation models are mathematical models which "consist of four well-defined elements: components, variables, parameters, and functional relationships."[28] Appearance of high-speed electronic-digital computers has facilitated uses of simulation models for complex and large socioeconomic systems. Through manipulating controllable variables in the models and iteration loops in the computer program, one may obtain a number of alternative solutions of a problem so that the decision maker can choose a best or good alternative under the circumstances.

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[26] Pritsker and Kiviat, op. cit., p. 1.

[27] Naylor et al., op. cit., p. 2.

[28] Ibid., p. 10.

Realization of the chosen solution of the problem necessitates exerting "control," which is another key systems concept. Management and administration are intimately concerned with the process of control.

Management As a Control System

In general, the terms "management" and "administration" are used for the same purpose--the agency and process for operating an organization. However, the term "management" usually refers to business oriented administration. Strictly speaking, "management" indicates guiding and operating an organization, and "administration" indicates determination of the policy and aims of the organization.[29] Nevertheless, in many cases--especially in public organizations--"administration" often connotes the function indicated in "management" also. "Management" and/or "administration" is a consequence of the existence of organizations.

Organization

Here the term "organization" refers to socio-economic organizations, not to the organized physical things, which exist in the world. "Organizations are social units which pursue specific goals; their very

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[29] Ordway Tead, The Art of Administration (New York: McGraw-Hill Book Company, Inc., 1951), p. 101.

raison d'etre is the service of these goals."[30] Obviously, organizations are systems, i.e., sets of interrelated entities. "Organizations are distinguished by four essential characteristics, each of which is subject to managerial manipulation."[31] The four characteristics to which this latter quotation refers may be summarized, as follows.[32]

1. Content: Consists of at least two purposeful entities which are capable of selecting objectives and the means by which to pursue them. The purposeful entities are men. The three resources--machines, materials, and money--are also included in the content.

2. Structure: The purposeful entities (men) are divided into at least two sub-groups which are responsible for different kinds of activity.

3. Communications: The purposeful entities must be capable of communicating to each other and the organization's environment.

4. Control: The organization must be capable of self-control in order to set its own objectives and to evaluate and improve its performance. Thus, the organization must be "adaptive" and "self-organizing."

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[30]Amitai Etzioni, Modern Organizations (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1964), p. 5.

[31]Ackoff and Sasieni, op. cit., p. 16.

[32]Ibid., pp. 16-19.

Control

Obviously, the accomplishment of desired performance by socioeconomic organizations is assured only by means of a functional control unit in the organization. The unit of an organization which is in charge of control responsibility is classified as the "control system." To be effective in its responsibility, the control unit should have a place in the organization with access to the decision makers and must directly be responsible to the managers who have authority to modify the organization in operation.[33] In addition, as is mentioned in item 4 above, the organization should be adaptive so as to improve its performance. An adaptive system is "one which measures its performance related to a given IP (index of performance) and modifies its parameters to approach an optimum set of values."[34]

Decisions

In socioeconomic organizations, operations and controls are put into action through decisions rather than through automation. Decision-making is therefore the fundamental process in management and administration. Decision-making is a process by which information is

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[33] Ibid., p. 442.

[34] Virgil W. Eveleigh, Adaptive Control and Optimization Techniques (New York: McGraw Hill Book Co., 1967), p. 135.

converted into action. Productivity of an organization depends largely on: (a) information available for use in making decisions and (b) skill of managers and/or administrators for making good use of information in the decision-making process. Forrester emphasizes this point as follows:

> If management is the process of converting information into action, then it is clear that management success depends primarily on what information is chosen and how the conversion is executed. The difference between a good manager and a poor manager lies at this point. Every person has available a large number of information sources. But each of us selects and uses only a small fraction of the available information. Even then, we make only incomplete and erratic use of that information.[35]

Forrester presents a structure of the decision-making process that also implicates the process of control action, as follows:

> First is the creation of a concept of a desired state of affairs. . . . Second there is the apparent state of actual conditions. In other words, our available information leads us to certain observations that we believe represent the present state of the system. . . . The third part of the decision process is the generation of the kinds of action that will be taken in accordance with any discrepancy which can be detected between the apparent and the desired conditions.[36]

Apparently, adequate information is a prime need for making effective decisions.

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[35]Jay W. Forrester, Industrial Dynamics (Cambridge, Mass.: The MIT Press, 1969), p. 93.

[36]Ibid., pp. 95-96.

Information

One may classify the sources of information to be used in management and/or administration in three groups, as follows:

1. Managers and/or administrators. The knowledge and experience they acquire in developing their skill in making decisions and conducting organizations.

2. Environment. Information from the environment is needed to answer the questions which need to be answered and, in turn, to indicate whether its objectives are being fulfilled by the organization.

3. The organization itself. Information from the organization itself is needed for control, e.g., for maintaining productivity and effectiveness in terms of fulfillment of the organization's objectives.

The difference between data and information is that data is the raw material and information is the end product of interpreting the data. However, "in certain situations, raw data may require little or no processing before constituting information for the user."[37] Item 3 above indicates the need for "feedback" information in socioeconomic organizations. This is an especially important form of information in analyzing systems.

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[37] Gene Dippel and William C. House, Information Systems--Data Processing and Evaluation (Glenview, Ill.: Scott, Foresman and Co., 1969), p. 2.

"Feedback" is information about the output of an organization, which is to be compared with the desired performance of the organization. Consequently, modern socioeconomic organizations, in order to be effective and productive, require the application of information-feedback control systems.

Educational Administration

Education is one of the largest enterprises, and is typically an insatiable consumer of resources, in almost every society. Education is therefore a field which may derive tremendous benefit from systems technology. For a long time societies have been suffering from the problems of utilizing scarce resources to meet expanding educational needs. Even so, educators have only recently become readily interested in the new quantitative, scientific techniques of system analysis.

> The irony is that the educational system, which has been so much the home and mother of the modern scientific method, has applied so little of it to its own affairs.[38]

Philip H. Coombs claims that resistance to change and innovation in education is not because teachers are more conservative than anyone else. To him, education's organizational structure and the inadequate nature of

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[38]Philip H. Coombs, The World Educational Crises--A Systems Analysis (New York: Oxford University Press, 1970), p. 116.

research in education are depriving it from utilizing productive technology.

> Yet ironically, the absence of a strong innovative spirit in educational systems is traceable in part to the very nature of traditional educational research. Not only was it starved for resources, both money and talent, but for years it tended to stagnate in quiet intellectual backwaters isolated from the main stream of scientific research and development.
>
> Thus much of "educational research" until very recently, though bearing the superficial hallmarks of scientific research, was essentially philosophical or descriptive in nature. It was not within the modern scientific tradition of rigorous analytical, experimental, and developmental research that was producing notable results elsewhere. Further, educational research for the most part was a fragmented collection of sporadic and ineffectual attacks--especially by Ph.D. candidates--either on problems which by their very nature required a broad-scale and sustained attack, or else on trivial but manageable topics of little basic significance.[39]

A frequent recommendation of scholars dealing with innovation and reform in eduction is to begin educational reforms with improving educational administration. They urge that a concept of management should be created and utilized in education.

> The new technology for management is not merely a theoretical exercise nor is it restricted to applications in the military and industry. The size and complexity of present day educational organizations have created a need for rapid and efficient methods of analysis planning and communication control in educational administrative functions. The administrator with the ability to get along with people as his primary or sole resource can no longer function effectively. In

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[39] Ibid., p. 115.

> order that the new concepts of management be implemented, new training programs are required. These training programs include such courses as quantitative methods in educational administration, computer science, statistics, mathematics, quantitative business management, econometrics, and urban planning.[40]

Systems analysts believe that systems procedures can effectively be utilized in educational administration, starting from individual schools up through the central ministry of education. This fact and need have been recognized and introduced into education by many noneducators in recent years.[41]

The basic responsibilities of administrators can be stated in two words: decision making. Effective and productive decisions are based first on adequate information and secondly on a talent for appropriate utilization of information in the decision-making process.

Information in Education

An administrator (or a manager) is a decision maker. In many cases, the decision maker is not an individual. It may be a team or a committee. Regardless of whether it is an individual or a group of individuals, the decision maker needs information.

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[40] Frank W. Banghart, Educational Systems Analysis (London: The Macmillen Company, Collier-Macmillen Limited, 1969), pp. 4-6.

[41] Ibid., p. 25.

> Information is data which is used as an aid to decision making. The knowledge which alerts us to the fact that a decision is necessary is one form of information. The objectives which are to be met by the system constitute another type of information. Details on the available alternatives and the likely outcomes resulting from each of these alternatives are further examples of how information is a necessary ingredient in the decision-making process.[42]

In addition, purposively processed data, which are collected from schools or other organizations, are information also. The degree of need for scientific and modern data processing is defined by the degree of complexity and the extent of administrative responsibility.

> The decision maker in larger organizations no longer has direct contact with his operations, and therefore, is dependent upon information flowing to his desk from another source. Only through the use of modern technology can this continuous flow of information reach the decision maker at the appropriate time to be effective. High speed equipment for storage, retrieval, and processing information coupled with newer mathematical concepts that permit an optimal amount of information to be abstracted have a vital role to play in administrative decision making. Applications of this technology will result in quicker and better decisions on the part of the administrator. In any management system there is no substitue for quick and valid information.[43]

Collected and processed data are valuable only as long as they affect decisions for the present and/or future administrative operations. Some of the criteria related to need for establishment of an information system are

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[42] Gary M. Andrew and Ronale E. Moir, Information-Decision Systems in Education (Itaska: F. E. Peacock Publishers, Inc., 1970), p. 2.

[43] Banghart, op. cit., p. 83.

indicated in the following questions: "Why is the Information Needed?" "What Information is Needed?" "How is The Information to Be Used?" "When Is The Information Needed?" "Who Is to Use the Information?" and "Where Should the Information Be Collected or Used?"[44]

"There are three main phases in an information system--(1) the data collection or input, (2) the data manipulation or processing, and (3) the information dissemination or output."[45] The effectiveness of an information system depends largely on realistic considerations of these phases in the system's design.

Indeed, a computerized information system does help administrators not only through providing needed information, but also through facilitating improvement and innovation in administration.

> Studying an administrative system as essentially an information system provides a useful model. To define who originates, processes, uses, or needs information is to describe much of the actual operation of administration. In a manual system, many rules and procedures can be left undefined, and intuition and experience can substitute effectively for logical precision.[46]

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[44]Andrew and Moir, op. cit., pp. 57-58.

[45]Ibid., p. 59.

[46]John G. Caffrey, "The Computer Imperative," Socio-Economic Planning Sciences, Vol. 2, Nos. 2/3/4 (April, 1969), p. 329.

Planning and Control

Definitions of planning may be stated in various ways. The following definition is well suited to the purposes of the present study. "Planning is the process of preparing a set of decisions for action in the future."[47] Though there are many statements of the pros and cons for adopting social planning sytems, and for utilizing systems procedures in planning processes as well, some common arguments regarding utilizing a systems approach to planning can be found in Michael S. Silvester's conclusion:

> To conclude then, the state of systems theory as applied to Planning Systems seems to me to suffer from,
> (a) the lack of clearly stated philosophic principles,
> (b) an inadequate study of the political process and
> (c) a lack of consideration of the limits which time and money may put on its use.
> It is very much at the engineering level. It provides techniques for control, but says nothing about the circumstances in which these controls may be used. If these areas could be covered then I see no reason why the systems approach should not be the most effective approach to analysis, forecasting and planning in the social sciences.[48]

Opposition to use of systems procedures in educational planning may stem partially from certain characteristics which are common to many human beings. As mentioned

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[47]Arnold Anderson and Mary Jean Bowman, "Theoretical Considerations in Educational Planning," in Educational Planning, ed. by Don Adams (Syracuse, N.Y.: Syracuse University, 1969), p. 9.

[48]Michael S. Silvester, "The Contribution of the Systems Approach to Planning," Socio-Economic Planning Sciences, Vol. 7, No. 1 (February, 1973), p. 103.

by Paul L. Dressel, (a) administrators who tend to operate on a "free-wheeling basis" do not like to be restricted by predetermined requirements of plans,[49] and (b) educators who do not know mathematics and who may have different concepts or points of view from model builders, may have prejudices against utilization of systems procedures in planning: ". . . the planner works to develop an applicable model, the educator works to destroy its applicability--although both may join in trying to increase the number of educated persons."[50]

Indeed, the educational enterprise is one which is a massive enterprise, quantitatively speaking, and one which also requires qualitative considerations that are political, social, and philosophical in nature. In addition, education is a field in which large resources are invested and consumed. Education involves far-flung, compex organizations. Because of these characteristics of education, systems procedures (including management science techniques) may be expected to be more helpful to the administration and planning of education than any other presently available technique. The interdisciplinary characteristic of systems procedures not only permits but also requires that

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[49]Paul L. Dressel, "Comments on the Use of Mathematical Models in Educational Planning," Mathematical Models in Educational Planning (Paris: OECD, 1967), pp. 275-288.

[50]Ibid., p. 279.

qualitative social, political, and philosophical considerations be taken into account.

> The design of different educational alternatives to be evaluated may involve studies of changes in curricula, acceptance rules, financial incentives, creation of new branches, etc. Consequential analyses of the future implications of the alternatives may give ideas concerning the formulation of new alternatives. Educational long-range planning can thus be considered an iterative feed-back process which in each iteration may require innovations and both qualitative and quantitative considerations. An inter-disciplinary approach with a close co-operation between "qualitative" and "quantitative" analysts may therefore be essential. This co-operation may be easier to establish when simulation models are used, as they break down complicated situations into a series of simple interactions. . . .
>
> Simulation models may be appropriate whenever it is a matter of studying the development of a system over time.[51]

Systems approaches can effectively be utilized in designing or redesignation of educational organizations also.

> Another principle of systems analysis is that the design of an improved system or a new system must be derived from a precise knowledge of what the system has to do, in other words, its mission or functional objectives. What is the system supposed to do and why? This may be expressed as "working backward" from effect to cause. Then we can design that cause much like an engineer does when he creates a new piece of hardware or weapon to perform a specific task. In education we might call this type of person an "educational engineer." The place to begin then, is with the requirements of the system, since this is the basic element that prescribes relationships between "inputs" to

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[51]Brita Schwars, "The Use of Simulation Techniques in Educational Planning," The Use of Simulation Models in Educational Planning (Paris: OECD, 1971), p. 25.

> the system (human and material resources, financial investment, etc.) and the "output" (the educational product, i.e., the educated students).[52]

Consequently, although "the model builder implementing the theoretical model is faced with some real constraints,"[53] systems procedures provide effective tools for administration, planning, and control in education.

> When complete or exact solutions cannot be found because of the large size of the system, intractable mathematical representations, system phenomena that are not well understood, etc., computer simulation techniques may be helpful in arriving at approximate solutions or in assisting the user in experimenting with selected changes in parameters, exogenous variables, and control inputs.[54]

Utilization of systems procedures frequently requires computer assistance. Computers are especially useful in facilitating the updating of parameters, thereby facilitating the making of required changes under changing circumstances, i.e., performing adoptive control.

> For this type of control of large-scale socio-economic systems, the use of high-speed computer is clearly essential. In addition to digesting vast quantities of data in a short time, the use of a computer permits simulation of planned changes under newly-observed conditions. Examinations of

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[52] Andrew and Moir, op. cit., pp. 27-28.

[53] George Van Dusen and Martin G. Keeney, "Experimenting with a Computer Simulation Program," Journal of Educational Data Processing, Vol. 8, No. 1 (1971), p. 2.

[54] H. E. Koenig, M. G. Keeney, and R. Zemach, A Systems Model for Management and Resource Allocation in Institutions of Higher Education, A Technical Report from Division of Engineering Research (East Lansing: Michigan State University, 1968), p. 4.

> the response under computer simulation may help to avoid decisions that will affect the systems in a way that is economically, socially, or politically undesirable.[55]

Summary

The prime contribution of systems concepts to science and technology is to present a new way of thinking applicable to any field of knowledge. Systems approaches provide scientific techniques which may be made compatible with the problems of the field and which can be utilized for solution of the problems through systems approaches.

Tools of systems approaches are usually derived from mathematical and physical sciences. It has been frequently claimed that systems approaches are incompatible with certain social phenomena, in which non-quantitative considerations are important. In fact, however, the interdisciplinary characteristic of a systems approach not only permits but also requires considerations of non-quantitative aspects of any problem. In addition, systems procedures facilitate experimenting with alternative solutions in which non-quantitative-considerations and their expected effects may be experimentally included.

It follows that systems procedures may be utilized effectively in approaching solutions of educational problems. Basic advantages of this conclusion may be summarized as follows:

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[55] *Ibid.*, pp. 5-6.

1. Demand for accurate data inspires an organization to improve and/or establish a computerized data processing system, which, in turn, requires and facilitates improvement and innovation in the organization and its administration.

2. Logical and mathematical precision is substituted for guessing and intuition.

3. While descriptive researches in education try to answer the question of "what it was," systems procedures can provide currently up-dated answers to the questions of "what it is now" and "what it can be or should be in the future under the present circumstances." These are vitally important questions to be answered in decision making and planning.

4. Through simulation, systems procedures facilitate experimental investigation of the future behavior of a system under given conditions, which otherwise would be impossible to study. This helps decision makers to choose the best or most desirable one among several alternatives. As a result, large portions of scarce resources can be saved from being wasted, or can be better utilized.

In short, utilization of systems procedures in coping with educational problems does not cause losses. Instead, it provides scientific, economical, realistic, and feasible approaches to the solution of many important problems.

CHAPTER III

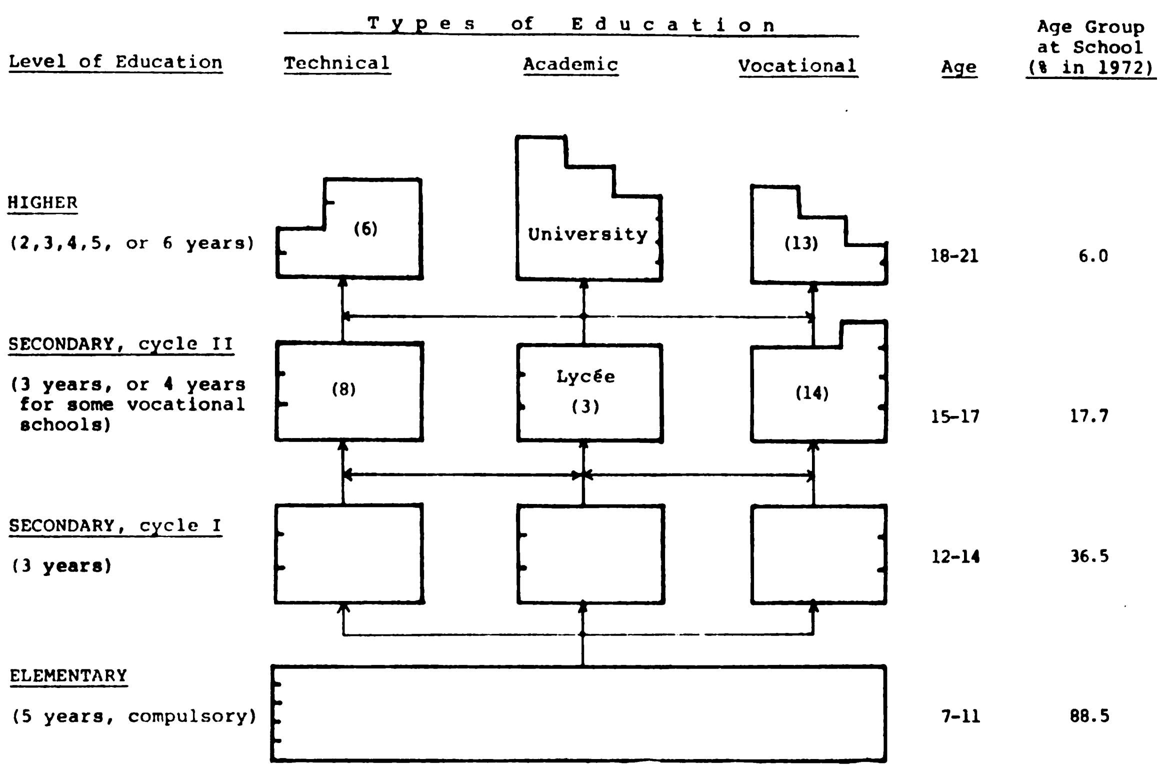
TURKISH SCHOOL SYSTEM AND THE BACKGROUND OF THE PROBLEM

This chapter presents: (a) diagrams of the organization of the Turkish school system, (b) data on its past state and recent development, and (c) evidences of the existence of the long-standing teacher shortage problem in secondary education.

Operational Organization of the Turkish School System

The basic structure of the Turkish school system is similar to systems in many countries in the world. With respect, however, to operational organization, the system has its own characteristics and is rather complex. As Figure 1 indicates in simple form, there are various academic, vocational, and technical schools which are separated from each other both at the secondary level and at the higher education level. Differentiation of individuals in terms of the knowledge and skill they receive is achieved through different types of schools at the same level instead of through different or flexible curricula in the same school. This practice to a large extent

FIGURE 1.--Block Diagram of the Operational Structure of Turkish Public Schools.



EXPLANATIONS :

-Arrows indicate channels of transition open to students.

-Figures in the cells enclosed in parenthesis indicate the numbers of different kinds of schools of that type, among which however there is no horizontal or vertical transition of students.

-Except for academic lysees, the graduates of other second cycle secondary schools are allowed to apply only to those particular higher institutions which are related to their secondary program.

-At the second cycle level, vocational group normal schools and religious schools are four-year programs.

-At the university, the programs of the college of engineering require five years and human medicine six years.

-For admission, it is necessary to pass a competitive examination:

a. For all kinds of higher institutions,
b. For normal schools (first and second cycle), the science lycee, and the preparation class for the first cycle in those lycees at which science and mathematics are taught in English, French or German.
c. To receive benefit from boarding facilities or to receive scholarships for secondary and higher level schools.

prevents the student from exercising his own choice in determining the type of education he is to receive. In addition, his opportunities for higher education are legally proscribed by the particular secondary school which the individual enters at the age of fifteen.

Higher education includes two different groups of institutions: the universities, and other higher schools. The universities are autonomous and only lycée graduates are eligible to apply. A vocational or technical school graduate is not allowed to apply to the university even if he completes a four-year program of a higher school after his secondary education. Higher schools are established and opened in terms of needs and are subordinated to the Ministry of Education. Some of them also have academic autonomy. Originally, these schools were established to produce needed middle level technical and vocational manpower who were not trained by the university. The education institute is one example. Lycée graduates are eligible to apply to some types of these schools, especially to the vocational ones.

As years passed, people related to vocational and technical schools put pressure on the Ministry of Education to recognize their secondary schools as equivalent to lycée and their higher schools as equivalent to the university. One may think of at least two basic reasons for this. First, the lycée and the university have the highest prestige at their respective levels and one naturally tries to get rid of feeling inferior because of his education or his teaching position. Second, the training programs and periods of vocational and technical schools were usually relatively restricted, and one might expect a person involved in technical vocational education to try to satisfy his aspirations for more education or for more social respect by working to establish his field of education on an equal footing with others.

As a result of the above mentioned pressures, changes in curriculum and extensions of training periods for technical and vocational schools took place gradually, step by step.

However, graduates of vocational and technical schools are still not eligible to attend the university, even if they were to take the entrance examination and achieve the highest score among the applicants. The contradiction in this practice is that the university on the one hand says it relies on the selectivity of the entrance examination, but on the other hand it ignores examination selectivity and relies instead on the title of the applicant's secondary school, not the performance of the individual.

This practice represents discrimination in education, whereas one of the first tasks of education is to unify the society through providing equal opportunity for social, cultural, and economic mobilization of individuals. An inestimable waste in human potential is another undesired effect of this practice.

Background of the Problem

The recent Revolution of May 27, 1960, marks a turning point in terms of the socioeconomic development of the Turkish society. The concept of planned development was formally introduced after the revolution. Under the overall rule of the new constitution, the State Planning Organization came into existence in the governmental structure, and was set up as the executive secretariat of the Higher Planning Council, made up of cabinet ministers, among whom the Prime Minister was chairman. Then, with the First Five Year Development Plan, the country virtually entered the planned period in 1963.

Because of this shift in approach to solving the social problems of the country, each of the following sections of this chapter is presented in two parts: developments prior to the planned period and developments in the planned period. Because of its function in administrative decisions, a discussion of the use of information in educational administration is included also.

Need and Supply of Teachers of Secondary School Core Subjects

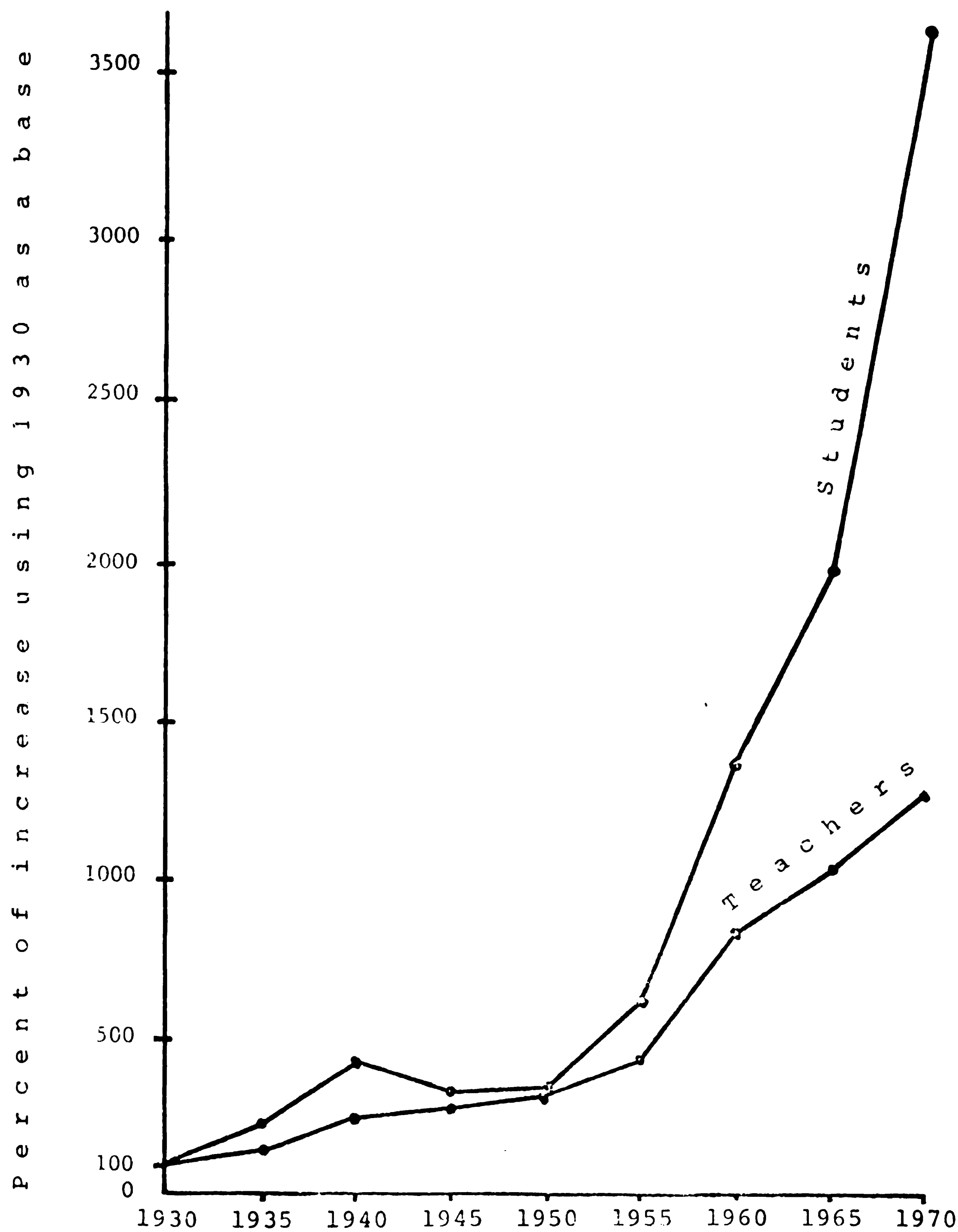
Before the Planned Period

In Turkey, the central Ministry of Education is the highest authority over all educational affairs excluding universities. Since secondary education has not been compulsory, the Ministry of Education has manipulated demand and supply through restrictions on opening new schools. As part of the rapid changes in socioeconomic and political structures of the society, the aspiration for education began to rise sharply after the Second World War. People became dissatisfied with what was provided by the government and asked for more secondary schools. Because of the public pressure, restrictions on opening new secondary schools were loosened in the fifties, but without providing effective measures for producing needed new teachers. The need for more new school buildings has frequntly been partly met by scheduling; where possible, two shifts of students are in attendance during the day.

Consequently, the gap between demand and supply of teachers has widened as the years passed, as shown in Figure 2.

In the graph, numbers of both students and teachers are expressed as 100 in the basic year, 1930. Then percentages of increases in five-year increments are traced. The rate of increase in the number of teachers was

FIGURE 2.--Indices of Increases in the Number of Students and Teachers in General Secondary Schools. (*)



(*) Sources: State Planning Organization and State Statistical Institute.

approximately one-third of the rate for students over forty years, and the largest widening of the gap took place after 1960.

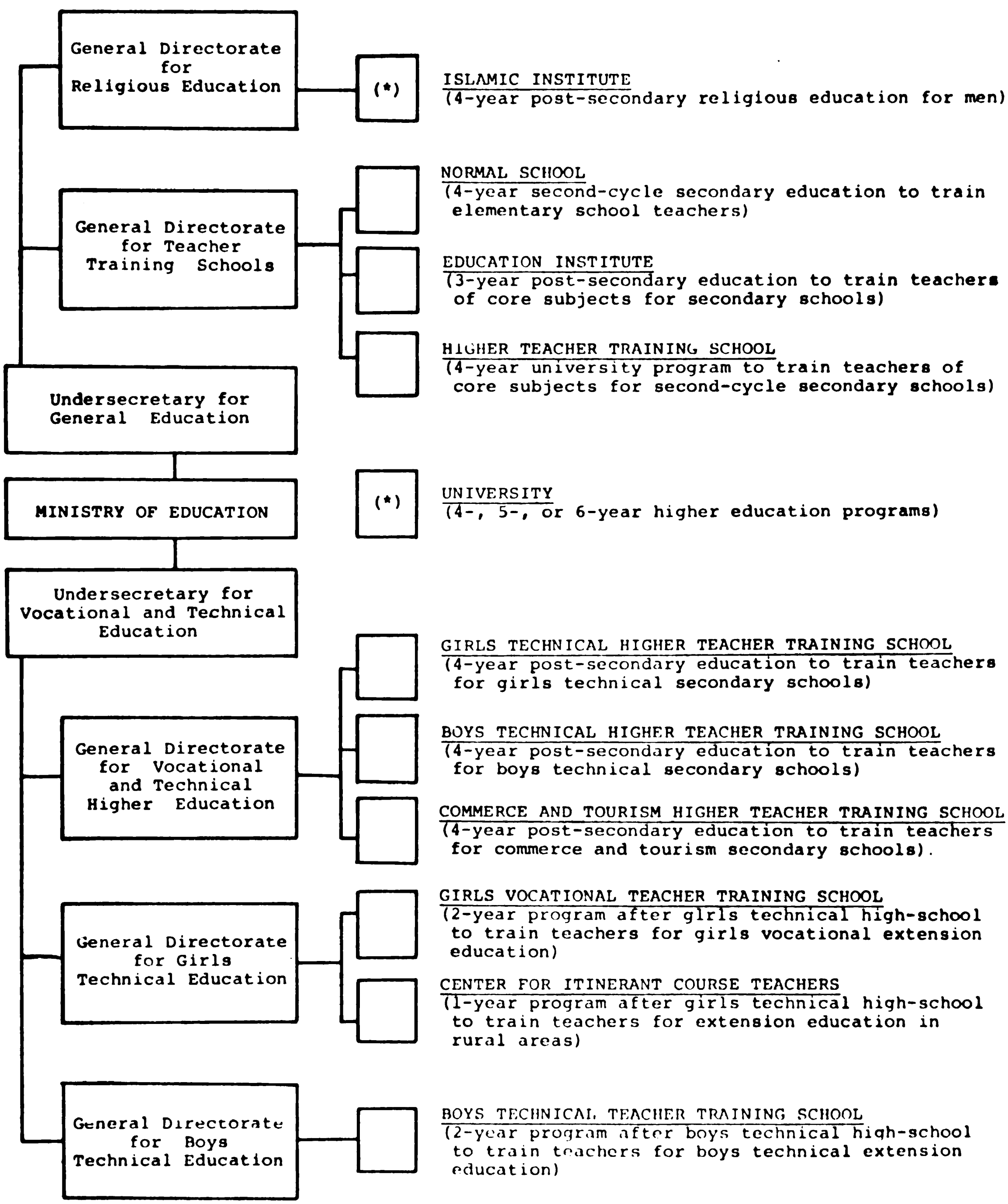
There is no free market for teachers in Turkey. Elementary and secondary school teachers are trained by the Ministry of Education. Other ministries and the private sector hire their core subject teachers from MOE sources.

In 1957, the General Directorate for Teacher Training Schools was established in the Ministry of Education for the purpose of tackling the problem of supply of teachers. Because of the reluctance of the vocational and technical education offices to relinquish control over the supply of their teachers, only the schools for general education teachers--namely, normal schools, education institutes, and higher teacher training schools--were subordinated to the new general directorate (see Figure 3).

In 1958, the "Turkish National Commission on Education" was assigned to study all aspects of the Turkish education system. The commission fulfilled the assignment in approximately one year and submitted its report to the Ministry of Education, but it was not published until June, 1960, immediately after the Revolution. In the report, the situation of the secondary school system was described as follows:

> We observed that institutes of secondary education needed more attention and hasty reform than all others in the system of education. Most of

FIGURE 3.--Basic Sources of Teachers in Turkey.



(*) Not a teacher training institution but its graduates are qualified to teach.

> those schools have inadequate buildings and facilities. In particular, quality and number of administrators and teachers of those schools are below the desired level. Because of the difficulty of finding qualified teachers, unqualified persons were assigned to teach and the institutions were very far from fulfilling their expected substantial functions. Subsequently, many students were caused to fail and a great proportion of the youth of the country has been deprived of education.[56]

In the secondary school system, supply of vocational and technical subject teachers was not a serious problem, but supply of core subject teachers was. Therefore, secondary schools for general education were more affected by the shortage of teachers of core subjects than vocational and technical ones, as shown in Figure 4.

To train core subject teachers for secondary schools, there were two types of institutions, as follows:

Higher teacher training schools.--Higher teacher training schools are essentially boarding centers for students who are selected to be trained as teachers for the second cycle of secondary schools. Students attend the universities, which have no school of education. They are trained under programs designed for professions or vocations other than teaching. Only lycée graduates are admitted to universities on the basis of competitive examinations and predecided quotas for colleges. Those

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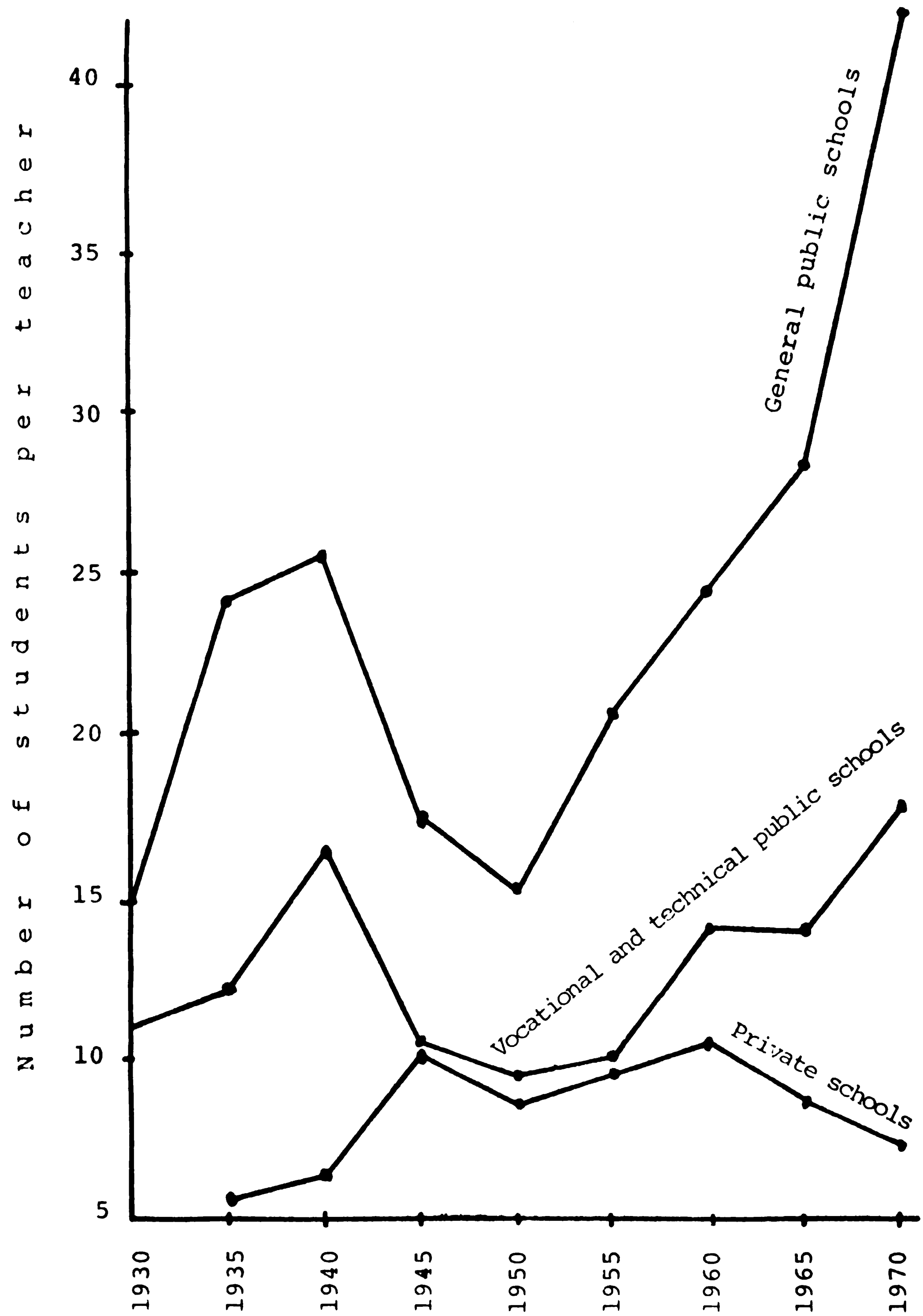
[56]Milli Eğitim Bakanliği, Türkiye Eğitim Milli Komisyonu Raporu (Istanbul: Milli Eğitim Basimevi, 1960), p. 48.

(Turkish Ministry of Education, The Report of the Turkish National Commission on Education.)

FIGURE 4.--Student/Teacher Ratios in Secondary Schools. (*)



(*) Sources: State Planning Organization and State Statistical Institute.

who are lucky enough to pass the entrance examination, especially for colleges of scientific subjects, do not usually choose teaching as a profession. In fact, because of socioeconomic and industrial changes, the teaching profession has been losing its attractiveness. In addition, training programs of colleges were incompatible with the requirements of the teaching profession. To be trained under the same program with other students was encouraging the teacher candidates to leave the profession for better paying jobs. Retention of trained teachers in the profession was another serious problem.

Education Institutes.--The Education Institutes were established in the late twenties as boarding schools to train core subject teachers for the first cycle of secondary schools. The school was a two-year higher education institution subordinated to the Ministry of Education. In 1946, the branches of general science, mathematics, Turkish, and social subjects were unified into one branch. After two years of practice, the newly unified branch was re-divided into two branches, humanities and science. Before the beginning of the planned period (1963) the training period for all branches except humanities, science, and pedagogy had been raised to three years.

In the face of the serious teacher shortage, graduates from education institutes were permitted and assigned to teach at the second cycle of secondary schools as well as at the first cycle.

The General Directorate for Teaching Training Schools was responsible for training core subject teachers for ten types of secondary schools subordinated to seven different general directorates of the Ministry of Education. Some of the trained teachers, however, were transferring to other ministries' schools, and some to private schools as well.

In an effort to solve the problem of supply, the general directorate tried to raise the production of the above mentioned two types of teacher training schools. To raise the production of education institutes was not a difficult problem, since they were under the control of the general directorate. But with regard to the higher teacher training schools, to raise production was hard to achieve because the general directorate had no voice in the universities. What was possibly the best measure under the circumstances was put into practice in 1959. The results are indicated in Table 1.

Methods adopted in 1959 for increasing production in higher teacher training schools were as follows: Normal school students, who passed to the final grade with high scores, were recruited and put into a newly established school called "The Preparation Class." It was equivalent to the final grade of the lycée and was subordinated to

TABLE 1--Development in Secondary School Teacher Training Institutions. (*)

School Years	EDUCATION INSTITUTES No. of Schools	No. of Students	No. of Graduates	HIGHER TEACHER TR. SCH. No. of Schools	No. of Students	No. of Graduates
1949-50	3	622	393	1	40	24
1950-51	3	514	206	1	7	--
1951-52	3	404	188	1	19	4
1952-53	3	534	218	1	21	--
1953-54	3	565	229	1	40	3
1954-55	3	771	265	2	62	7
1955-56	3	931	334	2	74	4
1956-57	3	1,224	434	2	75	5
1957-58	3	1,319	610	2	83	7
1958-59	4	1,251	445	2	94	14
1959-60	5	1,747	765	2	295	24
1960-61	5	2,049	716	2	347	7
1961-62	7	2,478	1,063	2	460	32
1962-63	9	3,042	1,140	2	531	68
1963-64	10	4,141	1,665	2	725	102
1964-65	10	4,729	1,905	3	833	146
1965-66	10	5,773	2,539	3	1,077	154
1966-67	10	5,827	2,878	3	1,268	156
1967-68	10	4,865	2,879	3	1,642	202
1968-69	10	4,785	951	3	1,904	281
1969-70	12	5,704	1,729	3	1,843	273
1970-71	13	6,722	2,288	3	1,572	424
1971-72	16	7,879	1,628	3	1,484	359
1972-73	16	8,717	-	3	1,441	-

(*) Source: MOE, General Directorate for Teacher Training Schools.

the higher teacher training school. After one year of education, the students took the lycée graduation examination, and then, having the lycée diploma, took the university examination. Most of them passed the examination and became students of the higher teacher training school. Thereafter this practice became a regular process.

In the Planned Period

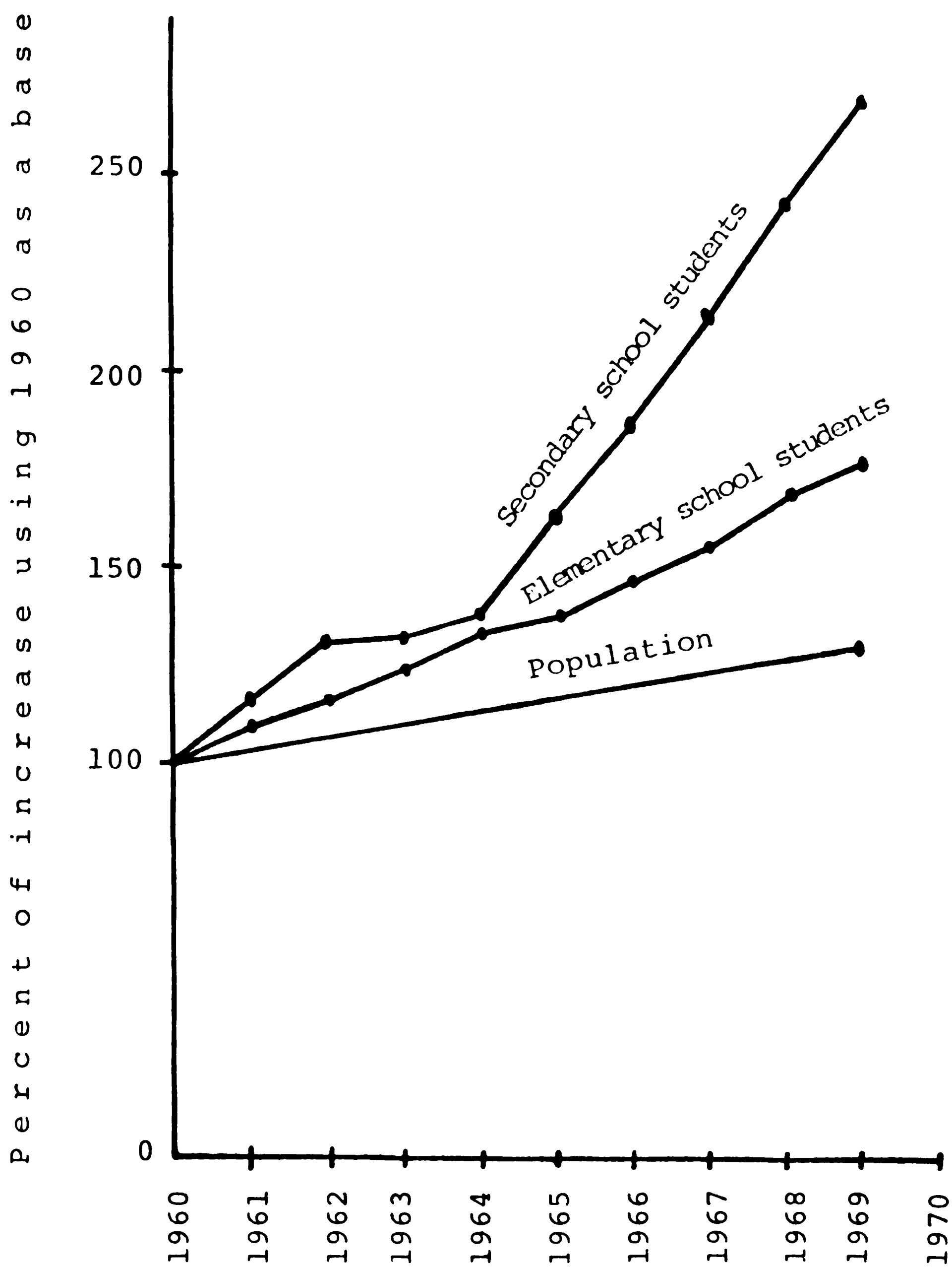
After the country entered the planned period in 1963, education was given a high priority. The Ministry of Education had begun to face the issue before 1960. After the revolution, the problem was handled by the ministry at two levels, macro and micro.

At the macro level, a commission was established to review the aforementioned "Report of the Turkish National Commission on Education" and to prepare another report on the basis of the new policies and the concept of state planning. The commission accomplished the task and published its Report of the Commission in Charge of Preparing a National Education Plan in 1960. It was a general guidance report including new policies for the entire education system of the country.

At the micro level, each of the general directorates studied its own problems. Then the General Directorate of Teacher Training Schools worked on the problem of the supply of elementary school teachers and secondary school core subject teachers. After approximately nine months of intensive work, The Report of the Teacher Training Committee and the Ten Year Plan was prepared and published. This researcher was responsible for the quantitative aspect of the plan. In an effort to insure feasibility, all possible details and timed implementation programs, school by school, were included in the plan. The overall target of the plan was to close the gap between demand and supply and to achieve a satisfactory rate of production of teachers over ten years.

Indeed, under the new policy, secondary education would in the long range be developed as education for the mass rather than for the few (the elite) as is implied in the graph in Figure 5. Over the ten years included in Figure 5, the average yearly rate of growth in population was three percent. Increase in elementary school students rose at a steady rate which was 2.5 times higher than the increase in population. The rate of elementary scholarization was increasing from 68 percent toward accomplishing the goal of 100 percent. Scholarization of secondary age-group students was 15 percent in 1960, but at this level the rate of increase was not steady. The average yearly rate of increase was ten percent in the first four years and exploded thereafter to a rate of more than 21 percent, seven times the rate of increase in population.

FIGURE 5.--Indices of Increases in the Number of Students in Elementary and Secondary Schools and in the Population. (*)



(*) Sources: State Planning Organization and State Statistical Institute.

Finding a solution to the supply of secondary school teachers was strongly recommended in the five-year national development plans and yearly implementation programs issued by the State Planning Organization after 1962. In the first plan, the existing situation in the early sixties was described as follows:

> The fact that the organization of education could not be adjusted to new developments caused imbalances in educational methods. The most important of these arises from the inadequate supply of teachers, and has led to a steady deterioration of student teacher ratios. In many branches there are serious gaps as regards both the numbers, quality and vocational branches of teachers. Other problems are the lack of administrative personnel in education and of closer cooperation between educational institutions and the various ministries.[57]

Implementation between 1963-1970 remained inadequate. The problem of supply worsened instead of improving. To try to mitigate the situation, the maximum load of teachers was increased by six hours. Thus a teacher could teach as many as 30 hours in a week. The situation after the mid-sixties was described in the second plan as follows:

> The insufficient number of teachers is limiting the progress and quality of education. At every level the student-teacher ratio is getting more and more out of proportion. In secondary schools there are 45 students for every teacher graduated from a teacher college and in high schools there are 38 students for every university graduated teacher. The scarcity of teachers is partly compensated for

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[57]State Planning Organization, Republic of Turkey, First Five Year Development Plan 1963-1967 (Ankara: 1963), p. 402.

> by non-professional people but this harms the quality of education. Methods which will provide the greatest benefit from teachers have not been developed and the teachers within Turkey are not evenly distributed. . . .
>
> In secondary schools an important bottleneck has arisen in quality and quantity. Even at this level, productivity has decreased. . . . In high schools the quality and productivity of education declines mainly because of inadequacies in buildings and teachers.[58]

Targets for increasing the capacity of education institutes were given in the second plan as shown in Table 2. These figures proved to be too high to be realized in the given time. Perhaps the planners had simply counted the overall number of teachers needed to close the gap between demand and supply within the five years. However, in spite of the urgent need and the definite requirements of the plans for more teachers, the number of students in education institutes decreased in the

TABLE 2--Planned Development of Education Institutes (1968-1972).[59]

Years	First Registrations	Graduates	Total Number of Students
1968-1969	4,600	1,750	10,100
1969-1970	7,000	3,800	15,200
1970-1971	8,800	5,850	19,100
1971-1972	10,600	7,400	23,100
1972-1973	13,000	8,950	28,150

[58] State Planning Organization, Republic of Turkey, Second Five Year Development Plan 1968-1972 (Ankara: 1969), p. 178.

[59] *Ibid.*, p. 191.

1967-1968 school year (see Table 1 on page 57). In the same year, the humanities and science branches of education institutes were again subdivided into Turkish, Social Studies, Science, and Mathematics, as they had been before 1946, and the training period for them also was extended from two to three years. These changes in the training program adversely affected the supply and utilization of teachers.

Although the number of education institutes and their students began to increase in the 1969-1970 school year as shown in Table 1, the rate still remained insufficient to answer the need.

After the 1971 announcement known as "The Ultimatum of March Twelfth,"[60] education was again one of the high priority issues. A broad study of needed reforms in education took place in the Ministry of Education for the second time within eleven years.

Thus, implementation in the planned period also has remained inadequate in terms of supply of secondary school

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[60]On March 12, 1971, the military leadership of Turkey issued a memorandum to the President indicating alarm and concern over the state of law and order and urging the government to take immediate steps to correct the situation and to move forward with needed social reforms. The clear implication was that if satisfactory steps were not taken, the military would be compelled to assume control of the government. The Prime Minister and his cabinet thereupon resigned and since that date Turkey has been governed by a sequence of civilian coalition governments and cabinets whose main motives have been to restore civil order and to push ahead with reforms.

core subject teachers. Table 3 presents the outcomes of implementation as compared with the estimation in the MOE's Ten Year Plan for supply of teachers.

The targets of the Ten Year Plan were exceeded by 3.5 percent in terms of training elementary school teachers and missed by a short-fall of 53 percent in terms of training secondary school core subject teachers. The actual situation of supply in 1971-1972, after the period covered by the Ten Year Plan, was a small surplus of elementary school teachers and a shortage of approximately 20,000 general secondary school teachers.

TABLE 3.--Estimation and Realization of Production of Teachers in 1961-1971.

	Normal School Graduates	Education Institute Graduates	Higher Teacher Training School Graduates
Realization[61]	110,338	19,037	1,768
Estimation[62]	106,625	36,842	7,744
Difference	+3,713	-17,805	-5,976

[61]Milli Eğitim Bakanliği, Öğretmen Okullari Genel Müdürlüğü, 1971-1972 Yilliği.

[62]Milli Eğitim Bakanliği, Öğretmen Yetistirme Komitesi Raporu ve On Yillik Plan, op. cit.

(Ministry of Education, Report of the Teacher Training Committee and Ten Year Plan.)

Making Use of Information in Administrative Decisions

Before the Planned Period

Prior to 1960, data were mainly collected only for immediate uses in routine operations, i.e., usually simply to record the numbers of students, teachers, and schools in the concerned year. It was not customary to analyze data, evaluate implementations, or employ data in making decisions until the adoption of the concept of planning in 1960.

In the late fifties a central bureau was established in the Ministry of Education to collect statistical data and one person was assigned to organize the bureau. However, after six months, apparently finding no need for such a bureau, the MOE then abolished it.

In fact, the State Statistical Institute, as one of its legal responsibilities, was collecting and publishing statistical data related to fields of social activity throughout the country, including education. The data were tabulated for general purpose and were usually published some years after they were collected. Therefore the possibility of timely use of data by concerned educators was very limited.

In the Planned Period

When the problems were studied in the Ministry of Education after the Revolution, the need for statistical data was recognized. Statistics and Planning branches were set up in the general directorates. However, there were no standards for evaluation or tabulation of data. Each of the offices had its own methods, which were empirical rather than scientific. Although extensive data were collected from institutions, a great proportion of them were neither used properly, nor were they retrievable once they were filed.

In the early years of the planned period the need became apparent for a central office to establish effective cooperation between the MOE and the State Planning Organization and to coordinate planning operations among the Ministry's offices. A central "Budget and Planning Office" was established in 1964. Soon after, another office similar to the "Budget and Planning Office" was established under the Undersecretary for Vocational and Technical Education, and this tended to generate a competitive dualism within the MOE. This, along with reluctance of other offices to accept it, adversely affected the early development of organization and function of the "Budget and Planning Office." However, the responsibilities and personnel of this office have expanded nevertheless, and its service has come to be valued as the years have passed.

In 1968, under a contract between Michigan State University and the Ministry of Education, the National Educational Research and Planning (NERP) Project was initiated. The objective of the project was to give necessary assistance to the Ministry of Education through the Budget and Planning Office.[63]

The project provided 22 scholarships at Ph.D. and Master's levels. Two full-time advisors, and short-term consultants as well, came from the USA. The need for an effective data processing system was recognized at the outset, as stated in the project's "Second Semi-Annual Report" prepared by the two advisors:

> An efficient, high-speed storage and retrieval system is the key to a data bank. Speedy access to data is an essential feature of the system. Tragically, the Government of Turkey expends vast amounts of money every year to collect data on its education system; data which are grossly underutilized. The Ministry of Education alone distributes over 370 forms; each Turkish school must complete, on the average, from 10 to 15 forms per year. The volume of information returned is so great that some of the general directorates can do nothing with much of it. In other cases, the staff can barely keep pace with the inflow because these data are laboriously transferred, in written form, to one or another filing system in the Ministry. In almost no case is there a capability to go to those files and extract one or more categories of information for all schools in Turkey within less than six months time, if by then. Turkey has a great deal of data that it can not use productively. An electronic system can remedy this situation.[64]

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[63]Kemalettin Akalin, Prospectus of Utilizing Foreign Resources in the Educational Reform, Ankara, 1971, p. 11. (Mimeographed.)

[64]NERP, Second Semi-Annual Report, PAKD, Ankara, December, 1968, p. 10. (Mimeographed.)

In spite of the early identification of the problem and of the need for an effective data processing system, still satisfactory progress toward solving the problem was not achieved.[65]

In 1970, the former "Budget and Planning Office" was redesignated the "Planning, Research and Coordination Office" (PAKD) with the intention that all planning and research activities of the Ministry would be consolidated under the direction of this office. Then the effort to establish the intended central data processing system became an urgent issue. To help realize the establishment of the data processing system, a "Data Bank Agreement Project" with the computer center of Hacettepe University (SISAG) was initiated in January, 1971. However, this project failed after the first step. The situation was summarized in NERP's Seventh Semi-Annual Report as follows:

> A working agreement was reached with SISAG in January and a Data Bank Work Group was established in the PAKD. After an initial two-month trial period, however, it appeared that cooperation between PAKD and SISAG might prove difficult to maintain. The MOE did not yet have a clear enough picture of its own needs to be able to communicate effectively these needs to SISAG. SISAG proposed to assume greater responsibility for the project, but the MOE was reluctant to place too much power in the hands of a contracting organization. As a

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[65]NERP, Eighth Semi-Annual Report, PAKD, Ankara, December, 1968, 1. 15. (Mimeographed.)

> result, SISAG's direct participation has been postponed until the PAKD develops a better picture of its needs and can draw up adequate specifications for SISAG to follow.[66]

As of the middle of 1973, PAKD had not resumed cooperation with SISAG. The establishment of an effective data processing system depends largely on the understanding and handling of the problem within the PAKD and the Ministry of Education.

Evidences of Existence of the Teacher Supply Problem

Though the fact is self-evident that there is a shortage of teachers throughout the country, nevertheless one needs to set forth specific evidence of its existence. Conceivably the shortage at some schools may be due to underutilization of teachers at other schools. If this were the case, the problem would become a problem in utilization rather than a problem of supply. Or perhaps both shortage of supply and underutilization may be important factors.

Evidences of the Shortage of Teachers

Direct data for actual demand and supply of teachers in the country are unavailable, but an aggregate calculation is possible through using presently available statistical

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[66] NERP, Seventh Semi-Annual Report, PAKD, Ankara, June, 1971, p. 6. (Mimeographed.)

data. The curriculum of secondary schools is fixed throughout the country. The number of class sections at secondary schools by level and the number of supplied teachers by field facilitate aggregate calculation of the average ratio of class hours per teacher. If adequate ratios can be realized through an effective policy of utilization, there would not be an actual shortage in the quantity of teachers. Table 4 includes findings for 14 courses in three different years. Calculation for the table was done as follows:

The number of class sections by level in a particular year was multiplied by weekly class hours of each course as fixed in the curriculum. The products for each level were summed up for each field. The sum, as the produced weekly class hours for the field in the particular year, was divided by the number of existing qualified teachers in the field. The quotients are the calculated aggregate average weekly class hours per teacher for each field for the year.

Ranges of aggregate average weekly class hours per teacher for the 14 different courses are 11.6-56.7, 6.0-50.4, and 11.2-105.1 in the 1962-1963, 1965-1966, and 1969-1970 school years, respectively. The first impression of these findings is that there is a large difference in the rate of supply among the 14 fields and the maximum limits of the ratios can hardly be realized even if a

TABLE 4--Produced Weekly Class Hours in General Secondary Public Schools and Aggregate Calculations for Average Weekly Class Hours per Teacher. (*)

Courses	1962-1963 Class Hours	1962-1963 Hours/ Teacher	1965-1966 Class Hour	1965-1966 Hours/ Teacher	1969-1970 Class Hours	1969-1970 Hours/ Teacher
LYCEE						
Turkish	8,618	23.8	9,795	27.1	20,953	35.3
Philosophy	2,981	20.4	3,636	24.6	6,625	33.0
History	3,793	12.4	4,387	11.4	8,921	16.8
Geography	3,419	11.6	3,646	6.0	8,023	11.2
Mathematics	9,072	56.7	10,345	42.4	21,929	41.5
Biology	3,825	15.3	4,226	14.9	9,235	25.0
Physics	4,882	41.4	5,769	49.3	12,175	63.0
Chemistry	4,475	38.9	5,258	44.9	11,142	105.1
MIDDLE SCHOOL						
Social Sub.	56,584	30.1	83,429	23.5	145,645	26.5
Science	66,518	32.0	96,205	31.8	168,378	26.8
TOGETHER (**)						
Drawing	17,586	43.0	24,354	50.4	44,859	71.8
Phys. Ed.	7,665	22.3	10,171	25.5	19,194	46.0
Music	7,665	33.8	10,171	41.7	19,194	66.2
Foreign L.	26,171	25.5	34,098	25.5	64,974	35.2

(*) Data were obtained from:

MOE, General Directorate for Secondary Education.

(**)Includes lycees and middle schools.

perfect policy of utilization were possible. Even more convincing evidence comes from applying a proper criterion for the upper limit of a realizable ratio.

In Turkish practice there is no means but human power for teaching. The traditional design of the system requires this and the gap between demand and supply of qualified teachers is filled by lay and unqualified teachers. There are no actual data for the total aggregate average loads of teachers. Calculations in a previous study by this researcher estimated this figure to be 19.2 hours per teacher.[67]

Another available criterion is the formally established load of teachers. Minimum and maximum limits of compulsory load for an individual teacher are 18-24 hours and 15-21 hours in the first and second cycle of secondary schools, respectively. It is possible these limits may be realized by individual teachers at larger schools but not as an aggregate average, because many schools are not large enough for optimum utilization of teachers. In spite of this fact, accepting the established load of teachers as an optimistic criterion, an evaluation was made as follows:

Calculated ratios in Table 4 were compared with the established loads of teachers. The 14 courses included

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[67]Kemalettin Akalin, A Simulation Model for Turkish Lycée Teachers, Michigan State University, East Lansing, July, 1971, p. 9. (Mimeographed.)

in the table fell in three regions: over, in, and below the range of established loads. The frequency distributions of this operation for each year are seen in Table 5.

One may conclude that an extensive problem of inadequate supply of teachers of secondary school core subjects does in fact exist in the country. No recent mitigation may be observed. Instead, the problem has grown as the years passed. The actual situation is probably worse than portrayed in Table 5 because the base criterion is probably too high to be realized as the aggregate average throughout the country.

Effects of the Sources of Teachers on the Existence of the Problem

There are two main sources which train teachers, and one might wish to compare the effects of these sources on the existence of the problem. For this purpose, the relationships between the two sources of teachers and the existence of the shortage of teachers were roughly compared, as follows (see Table 6):

Table 6 simply tallies frequencies from Table 4. Thus, for example, in Table 4, opposite the subject "physics," there are three entries for each of three previous school years. The ratios of weekly class hours per teacher for physics are listed in Table 4 as 41.4, 49.3, and 63.0, respectively, for the three years. Since each of these ratios is above the formally established

TABLE 5--Frequency Distribution of Courses in Terms of Established Load of Teachers.

	1962-63	1965-66	1969-70
OVER THE RANGE (Under-supply)			
Number of courses:	9	10	12
Percentage :	64.3	71.4	85.7
IN THE RANGE (Optimal supply)			
Number of courses:	3	1	1
Percentage :	21.3	7.1	7.1
BELOW THE RANGE (Over-supply)			
Number of courses:	2	3	1
Percentage :	14.3	21.5	7.1
TOTAL			
Number of courses:	14	14	14
Percentage :	100.0	100.0	100.0

Implications of the above table may be summarized, as follows:

a. Most of the courses were under-supplied, with the proportions increasing as the years passed.
b. The proportion of optimally supplied courses was small, and decreased as the years passed.
c. There were a few continuously over-supplied courses.

TABLE 6--Frequency Distribution of Fields in Terms of Supply Rate

Origins and Fields of Teachers	Frequency of Under-Supply	Frequency of Optimum Sup.	Frequency of Over-Supply
UNIVERSITY:			
Physics	3	-	-
Chemistry	3	-	-
Mathematics	3	-	-
Turkish	3	-	-
Philosophy	2	1	-
Biology	1	1	1
History	-	1	2
Geography	-	-	3
TOTAL	15	3	6
PERCENTAGE	62.5	12.5	25.0
EDUCATION INSTITUTE:			
Drawing	3	-	-
Music	3	-	-
Science Group	3	-	-
Social Group	2	1	-
Physical Ed.	2	1	-
Foreign Lang.	3	-	-
TOTAL	16	2	0
PERCENTAGE	88.8	11.2	0

range (15-21 hours at second cycle secondary schools), the subject of physics may be said to have been undersupplied with teachers in each of the three years. Hence in Table 6, the "Frequency of Under-Supply" for physics is entered as "3." And since physics teachers are supposed to be supplied by universities (i.e., by higher teacher training school students who study at universities), the tally of "3" for physics is listed among tallies for the university as a source of supply. The other tallies in Table 6 were derived in the same way. The eight "lycée" subjects from Table 4 were all considered for Table 6 to be in the "university domain," while the six "middle school" and "together" subjects in Table 4 were all listed in Table 6 under the "education institute domain."

Courses Taught by Teachers Trained in Universities

In this domain there are consistently undersupplied fields, such as physics, chemistry, and mathematics; and geography is a consistently over-supplied field. The frequency of optimally supplied courses is very small in this domain.

Courses Taught by Teachers Trained in Education Institutes

Under-supply has existed in all courses with varying frequencies, but no oversupply was observed. Four courses in six are consistently undersupplied courses.

In short, neither source of supply--neither the universities nor the education institutes--appears to have been doing an adequate job of meeting the demand.

Summary

In the Turkish school system, academic, vocational, and technical schools at secondary and higher educational levels are separated from each other. Because of this practice, higher education of the individual is legally determined by the particular secondary school from which the individual is graduated. There are two groups of higher educational institutions--universities and higher schools. The former are autonomous and the latter either have academic autonomy or are entirely controlled by the Ministry of Education.

Supply of teachers of secondary school core subjects has been a chronic problem in Turkey since the fifties. In spite of planned activities and requested measures in the national plans, no mitigation of the problem has been observed. Among the fields taught in secondary schools, mathematics, physics, chemistry, Turkish, drawing, music, science group, and foreign languages are consistently under-supplied in the planned period, while geography is consistently over-supplied.

There are two groups of institutions to train general secondary school teachers--universities and

education institutes. As suppliers of teachers, there is little or no difference between these two institutions--both have been inadequate sources.

Scientifically processed data for administration and planning were scarcely employed in the Turkish education system prior to 1960. However, in the planned period, the need for processed data was recognized. The responsibility for providing such data now belongs to the Planning, Research and Coordination Office (PAKD). Although there has been a struggle since the late sixties to establish a modern and scientific data processing and storing system, a practical solution to this problem has not been achieved yet.

The next chapter presents an analysis of the causes of Turkey's teacher shortage. This analysis employs a "systems approach," and provides a more scientific basis for understanding the nature of the problem. In addition, it points to sorts of data needed in order to study the problem in detail. It is hoped that the following analysis will prove useful in both these ways: better scientific understanding of the problem and better uses of data to study the problem. Moreover, it is hoped that the following "systems approach" may serve as a general example, showing how many other problems in Turkish education may be similarly tackled.

CHAPTER IV

IDENTIFICATION OF THE SYSTEM AND THE PROBLEM

Merely to know the existence of a problem is not enough to cope effectively with it. An operational approach to solving the problem requires one to scientifically identify the system and the problem along with their natures and environments. The aim of this chapter is to make these identifications with respect to the Turkish secondary school core subject teacher supply system. The chapter closes with discussion and conclusions concerning these identifications.

Identification of the System

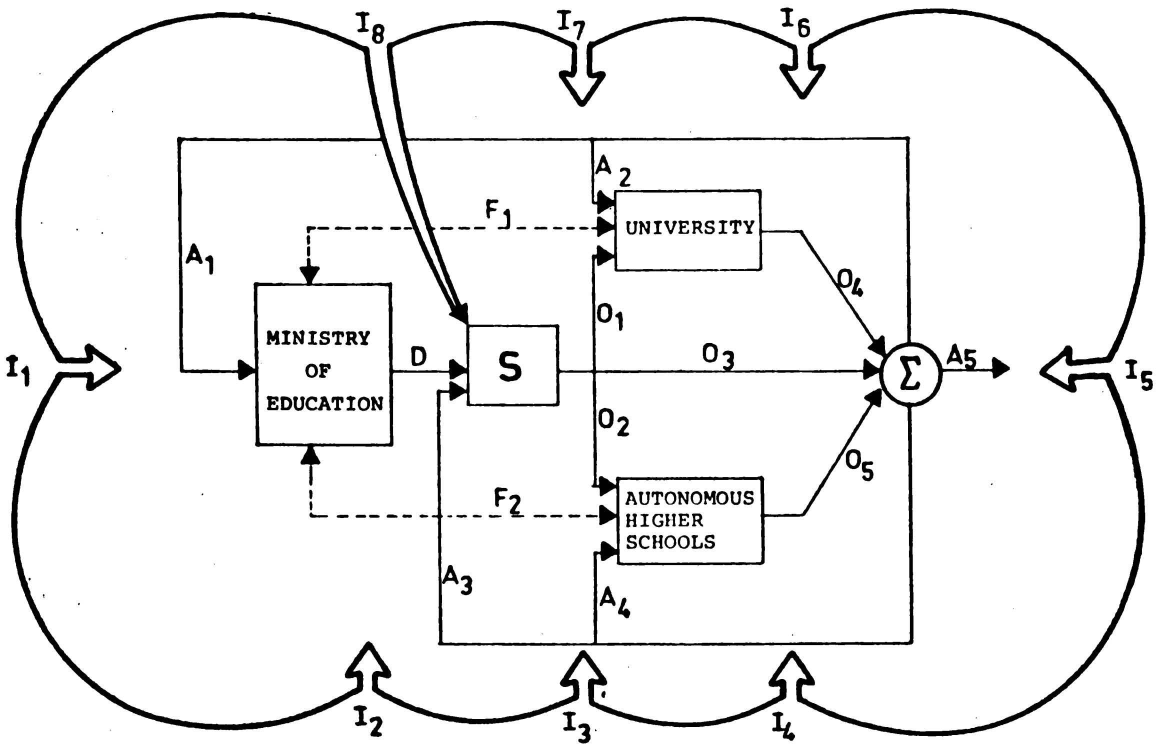
In general, a system is a group of components which interact with one another to achieve a desired objective. Therefore a system can be defined in terms of its components, objectives, and interactions among components. An education system may consist of a small group of students, a class, a school, a group of schools, and so on up to the whole society. For any particular study, boundaries have to be chosen. In this study, the boundary of the system will be defined in terms of the problem of secondary school core subject teacher supply. However, the entire system of education of the society is illustrated in a simple form so that one can see the situation of the particular problem within the whole education system.

Education System of Turkey

Figure 6 is a simplified illustration of the Turkish public education system within the society at large as the universe. The system consists of educational administration including the Ministry of Education, all types and levels of schools subordinated to or controlled by the Ministry of Education, higher educational institutions which are independent of the Ministry of Education, and universities. According to Item 50 of the Constitution, providing education for the people is one of the first responsibilities of the State. This responsibility is accomplished by the Ministry of Education on behalf of the State. Private schools are permitted at kindergarten, primary, and secondary levels, provided that they follow the patterns and standards established for the public schools. Private schools are controlled by the Ministry of Education.

In Figure 6, the box for the Ministry of Education includes educational administrative units in the provinces and districts. The administration of schools is included in the box for schools which is represented by the letter S and includes all kinds and levels of schools controlled

FIGURE 6.--General Illustration for Turkish Education System Within the Society.



SYMBOLS FOR THE SYSTEM:

A_1: Manpower and information input to the MOE.
A_2: Manpower and information input to the university.
A_3: Manpower and information input to the schools controlled by the MOE.
A_4: Manpower and information input to the autonomous higher schools.
A_5: Manpower stock of the society.
D : Implementation decisions and policies of the MOE for education (includes money).
F_1: Information relationships between the MOE and the university.
F_2: Information relationships between the MOE and autonomous higher schools.
O_1: Flow of public school graduates to the university.
O_2: Flow of public school graduates to the autonomous higher schools.
O_3: Flow of outputs of public schools to the society's manpower stock.
O_4: Flow of outputs of the university to the society's manpower stock.
O_5: Flow of outputs of the autonomous higher schools to the society's manpower stock.
S : All kinds and levels of schools controlled by the MOE.

INPUTS TO THE SYSTEM FROM ITS ENVIRONMENT:

I_1: Money.
I_2: Law and legislative requirements (includes targets of development plans and policies of the government).
I_3: Demand of the society for education (includes public pressures).
I_4: Professional requirements and pressures.
I_5: Feedback from the society at large.
I_6: Informal group pressures.
I_7: International affairs and effects.
I_8: Students enrolled in schools for the first time.

by the Ministry of Education. For simplicity, a few schools which are under the control of other ministries are not separately represented in the figure. In terms of this study's purpose, to identify the problem of teacher supply, the existence of these other ministry schools do not significantly affect the situation.

Other components of the system are universities and higher education institutions that are autonomous and independent of each other. Dotted lines between these schools and the Ministry of Education refer to informational connections.

Inputs from the society to the system are represented by eight arrows. Explanations of the arrows are provided below the figure. One of the eight arrows, I_8, represents student input to any other schools within the system. The flows of students among schools are represented by the arrows O_1 and O_2. The capital sigma in the circle represents the pool of manpower at any given point in time. Varying fractions of manpower that are used by the components of the system are represented by arrows A_1, A_2, A_3, and A_4. Arrow A_5 refers to the remaining manpower in the society.

The Organization for Core Subject Teacher Supply

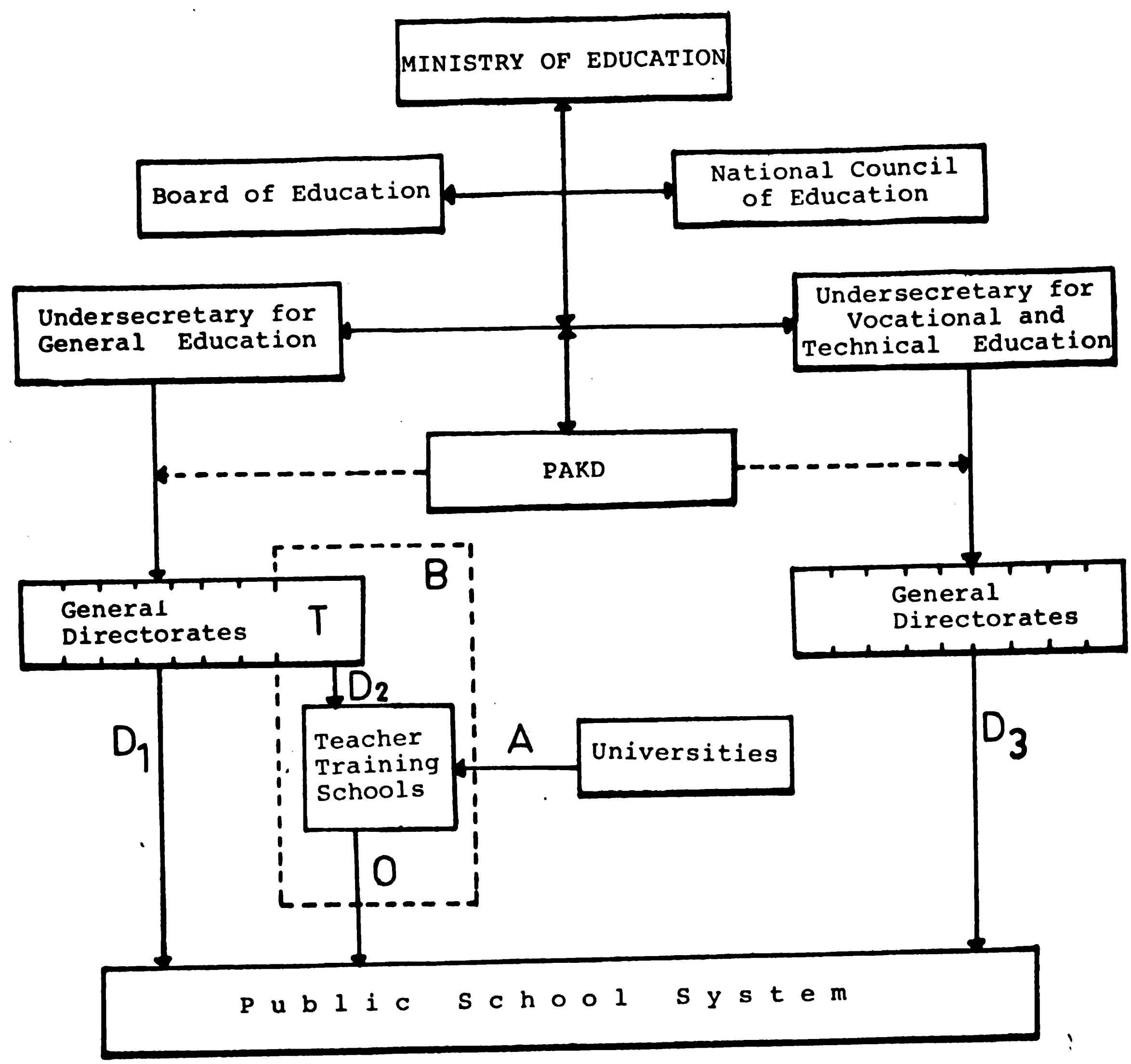
All entities which are directly related to the particular problem under consideration here must be included in an analysis of the system of secondary school core subject teacher supply. The components of this system are: the General Directorate for Teacher Training Schools (control subsystem), teacher training schools, and the admission and training policy of the university, which is, as a whole, not in the teacher supply system but affects it through the admission and training policy for higher teacher training schools.

In order to see the position of the General Directorate for Teacher Training Schools within the Ministry of Education, a simple organizational chart of the ministry is represented in Figure 7.

As shown in the figure, various general directorates are subordinated to the Undersecretaries for General Education and for Vocational and Technical Education. These general directorates make implementing decisions for the several types of secondary schools. The duty of training elementary and secondary school core subject teachers belongs to the General Directorate for Teacher Training Schools. This implies that decisions which affect the need for teachers and decisions aimed at answering the need are made by separate officers which are legally independent of each other.

Schools which are to train core subject teachers are represented by the box labeled "Teacher Training Schools" and are of two types: education institutes and higher

FIGURE 7.--Organization Chart: The Position of Organization for Training Core Subjects Teachers Within the MOE. (Rectangle B encloses the defined teacher supply system for core subjects.)



EXPLANATIONS:

A : Admission and training policy of the universities.

B : Core subjects teacher supply system.

D_1: Decisions for general education.

D_2: Decisions for training teachers of core subjects.

D_3: Decisions for vocational and technical education.

O : Product of teacher training schools for core subjects. (Trained teachers)

T : General Directorate for Teacher Training Schools. (The control component of the teacher supply system.)

teacher training schools. The former are entirely under the control of the General Directorate for Teacher Training Schools, whereas the latter are also subject to control by the university through its admission and training policies.

In order to provide a more complete analysis of this system, a logical block diagram is given in Figure 8.

Secondary School Core Subject Teacher Supply System

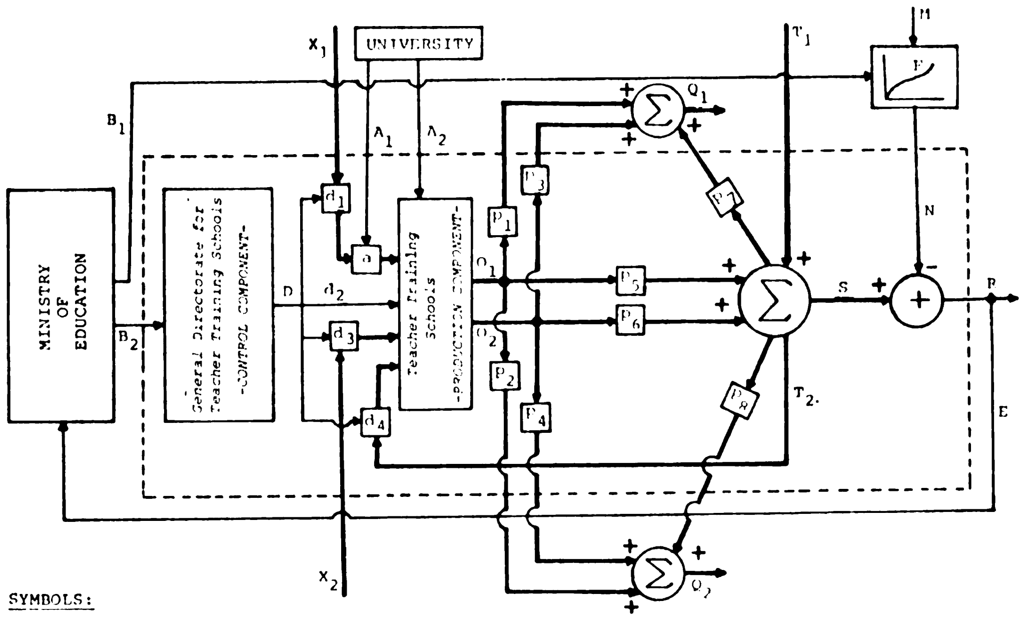
The secondary school core subject teacher supply system is included in the dotted rectangle in Figure 8. Although the two organizations--the Ministry of Education and the university--are essentially out of the defined system, they affect the system through their decisions, policies and implementations related to the need for training of teachers.

The offices of the Ministry of Education other than the General Directorate for Teacher Training Schools affect the system in two ways, as follows:

1. Implementation decisions which include opening new schools, establishing curriculum, etc. These decisions are represented by B_1 in Figure 8. The effects of these decisions are included in the "need generator function" and the resultant of this function is represented in the figure by N, the need for core subject teachers.

2. Connection with the control component, the General Directorate for Teacher Training Schools. The

FIGURE 8.--Block Diagram for Need and Supply of Teachers of Secondary School Core Subjects. (Enclosed in the dashed-line rectangle is the system for supply of teachers of secondary school core subjects.)



SYMBOLS:

A_1:Admission policy of the university.

A_2:Training policy of the university.

B_1:Implementation decision of the MOE for secondary education.

B_2:Administrative and informational connections between offices of the MOE and the control component of the system.

D :Control decision of the control component for training teachers.

E :Feedback (Information).

F :Need generator function.

M :Demand of the society for secondary education.

N :Number of needed teachers of secondary school core subjects.

O_1:Number of teachers trained in higher teacher training schools.

O_2:Number of teachers trained in education institutes.

Q_1:Number of teachers in the stock of private and other ministries' schools.

Q_2:Number of teachers who have left the profession in the previous year.

R :Algebraic difference between numbers of needed and supplied teachers.

S :Number of teachers employed by the public secondary school system. (Supplied teachers)

T_1:Number of teachers hired by the public secondary school system from outside of the profession.

T_2:Number of secondary school teachers eligible to teach in teacher training schools.

X_1:Number of students who apply to higher teacher training schools.

X_2:Number of students who apply to education institutes.

PARAMETERS FOR:

a :student admission policy of the university.

d_1:control decision for students to higher teacher training schools.

d_2:control decision for interactions in teacher training schools. (Includes funds, policies, training programs, regulations, etc.)

d_3:control decision for students to education institutes.

d_4:control decision for hiring teachers from secondary schools to teacher training schools.

p_1:percent of flow of higher teacher training school graduates to private and other ministries' schools.

p_2:percent of flow of higher teacher training school graduates out of the profession.

p_3:percent of flow of education institute graduates to private and other ministries' schools.

p_4:percent of flow of education institute graduates out of the profession.

p_5:percent of flow of higher teacher training school graduates to public schools. $p_5 = 1-(p_1+p_2)$

p_6:percent of flow of education institute graduates to public schools. $p_6 = 1-(p_3+p_4)$

p_7:percent of flow of teachers to private and other ministries' schools.

p_8:percent of flow of teachers out of the profession.

connection arrow, B_2, is the input to the control component and includes information in addition to what the component, as the part of the Ministry of Education, receives from the environments of the ministry (see Figure 6). As Figure 8 implies, the feedback information, which is a necessary component of a closed system, is transmitted to the control component by means of the offices of the Ministry of Education. Therefore, the expected function of the feedback in the secondary school core subject teacher supply system depends fundamentally on the effectiveness of the information transmission through arrow B_2.

The university affects the secondary school core subject teacher supply system in two ways also, as follows:

1. Admission policy which is presented by A_1 in Figure 8. Candidates selected for higher teacher training schools through the policy parameter of the control component, d_1, take the university entrance examination which is represented by a.

2. Training policy which is represented by A_2 in Figure 8. Those who pass the university entrance examination are admitted as higher teacher training school students and trained at the university.

Obviously, the production of higher teacher training schools, O_1 in Figure 8, is controlled by the university, which is autonomous and independent of the system under consideration. Therefore, in respect to secondary school core subject teacher supply system, the number of higher teacher training school graduates, O_1, is an uncontrolled variable.

Control Component

The control component of the system is the General Directorate for Teacher Training Schools. The control is practiced through implementation decisions that include regulations, priority decisions, administrative authority, established quota for students, etc. These implementation decisions are represented in the block diagram by D, i.e., the output of the control component. A part of D, namely d_2, goes directly to the schools (the production component) as an input to them which includes established curriculum, regulations, administrative orders, funds, etc. Other parts of D are shown in the block diagram as parameters, as follows:

- d_1: decision parameter for selection of students for higher teacher training schools. Students are selected through either competitive examination or the school records.
- d_2: decision parameter for selection of students for education institutes. Students are selected by means of competitive examinations.
- d_3: decision parameter for assigning teachers from secondary schools to the faculties of teacher training schools.

The Production Component

The production component is composed of higher teacher training schools and education institutes. All inputs to the production component, including regulations and curriculum, are controlled either by the control component or by the university. Therefore, the products of this component, i.e., trained teachers, are controlled outputs. These outputs are represented by O_1 and O_2 in the block diagram.

Production of the System

Production of the system is trained teachers. In Figure 8, O_1 and O_2 represent numbers of teachers graduated from higher teacher training schools and education institutes, respectively. In the real world, all of the teachers graduated from the schools do not go to teach at public schools. A fraction of them may go to teach at other ministries' or private schools. Another fraction may go into jobs other than teaching. Some may not work at all. This situation is discussed at more length below in the section on the pool of teachers. First, however, the following mathematical expressions may be given for the outputs of teacher training schools:

$$O_1 = f(x_1, A_2, a, D, T_2, t) \qquad (1)$$

$$O_w = g(x_2, D, T_2, t) \qquad (2)$$

O_1: number of teachers graduated from higher teacher training schools,

O_2: number of teachers graduated from education institutes;

a: parameter for admission policy of the university,

A_2: training policy of the university,

D: implementation decisions made by the control component. (These decisions, which are related to each input, are represented by d's.)

T_2: number of secondary school teachers eligible to teach in teacher training schools,

x_1: number of students who apply to higher teacher training schools,

x_2: number of students who apply to education institutes, and

t: time.

Supply of Secondary School Core Subject Teachers, S

At any point in time there is an existing pool of teachers. The magnitude of this pool is equivalent to the supply of teachers at that particular time. The pool is subject to change in the domain of time because of the continuous flow of trained teachers into and out of the pool (part-time teachers are not included in the pool). Variables forming the pool of secondary school core subject teachers are classified in four groups as follows:

1. Teachers Trained in Higher Teacher Training Schools

All teachers graduated from higher teacher training schools do not go to teach in public schools. Some of them may go to teach in private and other ministries' schools and some go out of the profession. Therefore, teachers who graduate from higher teacher training schools and feed the pool can mathematically be written as follows:

$$TH = O_1 {}^* p_5 \qquad (3)$$

where,

TH: quantity of teachers who go to teach in public schools after graduation from higher teacher training schools,

O_1: quantity of teachers, graduated from higher teacher training schools as in Figure 8,

p_5: percent of flow to public schools as in Figure 8.

2. Teachers Trained in Education Institutes

As in the case of higher teacher training school graduates, a mathetmatical expression for the teachers who go to teach public schools after graduation from education institutes is as follows:

$$TE = O_2 {}^* p_6 \qquad (4)$$

where

TE: quantity of teachers who go to teach public schools after graduation from education institutes,

O_2: quantity of teachers graduated from education institutes as in Figure 8,

p_6: percent of flow to public schools as in Figure 8.

3. Teachers Assigned From Outside, T_1

Some graduates from the university or other higher schools may also apply to teach at public secondary schools. Some of them may have teaching certificates from the university. They may try to enter the teaching profession for various reasons, such as lack of opportunity for employment in their field, a preference for teaching, a desire to be located near their family, etc. The present over-supply of geography and history teachers is a result of teaching assignments which were given to applicants graduated from universities simply to provide some form of employment for them. In addition, those who have left but later return to the pool of public school teachers are counted in this group. Such entrants into the teachers' pool are represented by T_1 in the block diagram. T_1, the number of teachers assigned from outside, is thus a controlled variable controlled by the Ministry of Education.

4. Teachers Who Leave the Pool of Teachers

A portion of the pool of public secondary school teachers also tends to leave the profession for reasons that may be classified in three categories, as follows:

(a) Teachers may be assigned to teach at teacher training schools. This is represented in Figure 8 by $T_2{}^*d_4$.

(b) Like teacher training school graduates, some pool teachers may leave public secondary schools to teach at private or other ministries' schools. The parameter for this flow is represented by p_7 in the block diagram.

(c) A proportion of teachers in the pool leave the profession for a variety of reasons such as marriage, retirement, death, resignation, finding another job, etc. The parameter for the loss to the profession is represented by p_8 in the block diagram.

Male teachers who are drafted and discharged by the army can be counted in p_8 and T_1, respectively.

The available pool of teachers, i.e., the quantity of teachers supplied to public secondary schools at a particular time, is represented by the arrow S in Figure 8 and its mathematical expression is as follows:

$$S = h(O_1, O_2, T_1, T_2, p_5, p_6, p_7, p_8, t) \quad (5)$$

where

S = quantity of supplied core subject teachers to public secondary schools,

O_1: quantity of teachers graduated from higher teacher training schools,

O_2: quantity of teachers graduated from education institutes,

p_5: parameter for the proportion of the flow of teachers to the pool of public secondary school teachers after graduation from higher teacher training schools,

p_6: parameter for the proportion of the flow of teachers to the pool of public secondary school teachers after graduation from education institutes,

p_7: parameter for the proportion of teachers who leave the pool for teaching in private or in other ministries' schools,

p_8: parameter for the proportion of teachers who leave the profession for any other reason,

t: time.

Need for Core Subject Teachers, N

Need for secondary school core subject teachers is essentially a function of demand of the society for secondary education and the implementation decisions of the general directorates of the Ministry of Education. These decisions include all items necessary to operate schools, including the opening of new schools. However, utilization of teachers, established curriculum, school buildings, and the rate of failure of students at schools are important variables to define the number of needed teachers. All of these variables are included in the "need generator function" in Figure 8. This function may mathematically be stated, as follows:

$$N = n(B_1, M, r, l, c, b, t) \qquad (6)$$

where

N: number of needed general secondary school teachers,

B_1: implementation decisions of general directorates for secondary schools,

M: demand of the society for secondary education (this demand is partly answered through the decisions for opening new schools),

b: size of classes (defined by the curriculum and the space of classrooms),

c: established curriculum for secondary schools,

l: utilization rate of teachers,

r: percentage of failure of secondary school students (the greater the percentage of failure, the larger the number of needed teachers),

t: time.

<u>The Effect of Need and Supply of Teachers, R</u>

R is the algebraic difference between numbers of supplied and needed teachers, as follows:

$$R = S - N \qquad (7)$$

where

R: algebraic difference between the actual numbers of supplied and needed general secondary school teachers in Figure 8,

S: actual number of supplied teachers as in equation (5), and

N: actual number of needed teachers as in equation (6).

The interpretation of the algebraic value of R, which may be considered as an error signal, is as follows:

$$R = \begin{cases} -, \text{ shortage of teachers} \\ 0, \text{ optimum supply of teachers} \\ +, \text{ surplus of teachers} \end{cases} \qquad (8)$$

In Turkey, the value of R has been persistently large and negative for a number of years. The aim of the present analysis is to try to identify the exact nature of this crucial problem.

Feedback, E

Feedback is a necessary component of a closed system. As seen in Figure 8, it is the channel of information from schools to the offices of the Ministry of Education. Each school sends information related to demand and supply of teachers to the office to which it is subordinated. The concept of feedback implies that output information is transmitted back to the input so that production is modified. It required adequate channels of communication, i.e., any information from sender to the receiver is transmitted by the channel of feedback without being subject to any change.

Information related to demand and supply of teachers is regularly sent to the Ministry of Education by each school in predetermined forms and at specified times. Since schools are vitally affected by the problem of a shortage of teachers, one expects school administrators to send correct data, allowing for the possibility of chance error, to their superior offices in the Ministry of

Education. Then any insufficiency between R and the control component may be ascribed to inadequate transmission of feedback information between the General Directorate for Teacher Training Schools (control component) and other offices of the Ministry of Education.

Summary

In the Turkish secondary school system, numbers of both needed and trained teachers are controlled variables. Because of the organization of the education system and of the central Ministry of Education, the control action related to the need and supply of teachers is carried out by various organizations that are independent of each other. For example: the production of education institutes is controlled by the General Directorate for Teacher Training Schools (control component of the teacher supply system); the production of higher teacher training schools is controlled by the university; and the creation of need for secondary school core subject teachers is controlled by at least five general directorates of the Ministry of Education. In other words, on the one hand the need for teachers is created by offices which legally do not assume responsibility for training teachers, and on the other hand teachers are trained by the control component and the university which do not assume legal responsibility for satisfying the society's aspiration for secondary education.

This practice implies that in terms of need and supply of general secondary school teachers, the system works as an uncontrolled system although it should work as a closed, i.e., a controlled, system.

Nevertheless, the system may be made to work as a closed system, provided that effective communications are realized which extend the feedback between the control component of the secondary school teacher supply system and the above mentioned organizations.

Identification of the Problem

The inadequate supply of teachers for secondary school core subjects appears on the face of it to be a serious problem in the Turkish education system. The fact is, however, that is is really the effect of some other problems, rather than itself being the actual problem. An operational approach to solve the teacher shortage problem requires defining the location and the nature of the more basic causal problems responsible for the existence of the teacher shortage problem.

Theoretically speaking, the teacher shortage problem might be solved through practicing adequate controls over either the creation of need for teachers or the training of needed teachers, or both. In a democratic society, however, the need for teachers, i.e., demand of the society for education, is hardly controllable.

Nevertheless, as was explained in Chapter III, control of the creation of need for teachers had been practiced in Turkey until the early fifties through putting restrictions on opening new schools. Since then, this practice has been loosened by public pressure. Therefore, to try now to practice strict controls in order to keep needed and supplied teachers quantitatively in balance is out of the question in the Turkish society.

As to the number of supplied teachers, it has without any question remained a strictly controlled variable in the Turkish school system. One may therefore conclude that the existence of the problem of inadequate teacher supply is basically the effect of inadequate control over the teacher supply process, rather than over the creation of need. That is to say, the causal problems should be sought where the control action for teacher supply takes place.

Problem Area

To define the location of the causal problems under consideration, entities related to teacher supply are reviewed in terms of control action, as follows:

Pool of Teachers

In Figure 8, the letter S represents the quantity of the pool (stock) of teachers employed by the public school system at a particular time. The quantity of the pool is subject to change because of the continuous flow of teachers into and out of the pool in the domain of time. All variables and parameters to define this change take place between the production component (teacher training schools) and the pool of teachers in Figure 8. Among all these variables and parameters, O_1 and O_2 (the productions of teacher training schools) and the quantity of teachers assigned to teacher training schools (through the control parameter d_4) are controlled by the control component. Obviously, the pool of teachers is fed fundamentally by O_1 and O_2 which are the controlled products of the teacher supply system. Therefore, causal problems responsible for inadequate supply of teachers should be sought in the process of production.

Process of Production

As seen in Figure 8, the process of production takes place between D, decision of the control component, and O_1 and O_2. Since responsibility for the control of the process belongs to the control component, one should discover whether the inadequate production is due to ineffective decision or to some uncontrollable constraint causing the control action to be ineffective. If such exist, they should be inherent in (a) inputs, (b) interactions, or (c) time related to the process of training teachers.

Inputs.--Figure 8 implies that all inputs to teacher training schools are controlled by either the university or the control component. The control exercised by the university is uncontrollable by the control component and therefore should be counted as a functional constraint on the control exercised by the control component. The two inputs, A_2 and d_2, are related to interactions and will be discussed under that topic. However, money input, which is included in d_2, is reviewed here among other inputs as follows:

Money: Money input to teacher training schools is not separately presented in Figure 8. It is included in d_2 because of the following reasons:

1. Money is allocated from the national budget via the Ministry of Education rather than directly to teacher training schools (see I_1 in Figure 6).

2. Money and any physical asset appropriated to a particular type of teacher training school by the budget law can be transferred to another type of teacher training school by the control component, namely, the General Directorate for Teacher Training Schools. Therefore, without any change in the amount of money, the amount of appropriated money to a particular type of teacher training school may be changed through decisions made by the control component. Such decisions, which can be called "priority

decisions," are included in d_2 and, in turn, in D in Figure 8.

3. There is a legal way to transfer money from other items of the budget for the Ministry of Education to the item for teacher training. Such a transfer can be practiced after a joint decision by related offices of the MOE. Therefore, even the amount of money input to teacher training schools can be changed through priority decisions, which are included in B_2 in Figure 8.

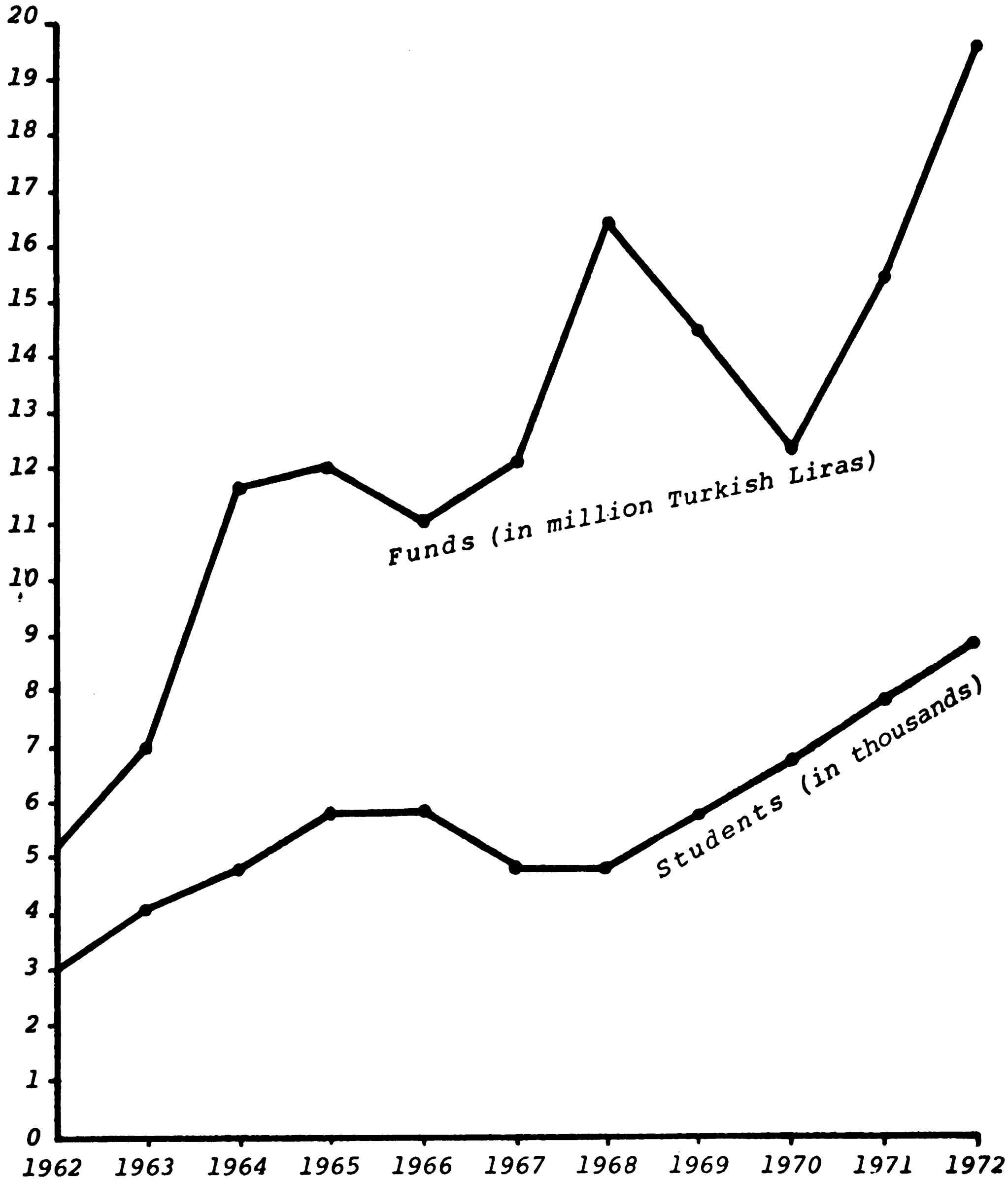
Consequently, money input to teacher training schools is not only a matter of resource but also a matter of decisions which are made by the control component and/or by the Ministry of Education at large. Therefore, taking the real world into consideration, the means for money input to teacher training schools can be represented by B_2, D, and d_2, respectively.

All in all, money is well known for its scarcity throughout the world, including Turkey. Nevertheless, in terms of training teachers, the country has not experienced a serious money problem, at least after 1960. Instead, training needed teachers has been encouraged by legislators and planners who have a voice in appropriation of money from the national budget. In addition, as was explained above, there is a way to appropriate more money to a particular training school than is defined in the budget law.

Figure 9 reveals the fact that increases or decreases of the quantity of students in higher teacher training schools and education institutes are not strictly tied to the amount of money appropriated from the national budget. In fact, decrease of money happens after the decrease of the number of students. In 1968 and 1969, for example, in spite of increases in the amount of money appropriation for cash expenditures, the quantity of education institute and higher teacher training school students decreased. Since there already were enough equipment and student stations to train more teachers, decrease in the quantity of education institute students cannot be attributable to the scarcity of money. Consequently, resources of money should not be counted as a functional constraint on the quantity of trained teachers.

Students: As was explained before, lycée graduates who can pass the university entrance examination, especially for colleges of scientific subjects, do not usually choose teaching as a profession because of the scarcity of student stations in colleges and because of better payment in other professions. To find students for higher teacher training schools, a fraction of normal school students passed to the final grade are selected to train under the lycée final grade program in the preparation class. Because of contracts with the Ministry of Education, the preparation

FIGURE 9--Increases in Funds and Quantity of Students of Education Institutes. (*)



(*) Source: MOE, General Directorate for Teacher Training Schools.

class graduates take the university entrance examination as candidates for higher teacher training schools.

Less than one-fifth of the potential candidates are selected for the preparation class. Even if all students who pass to the final grade in normal schools were prepared under the lycée final grade program, a significant raise in the number of higher teacher training school students in needed fields would hardly be realized because of the competition for preestablished quotas of students for colleges. The competition among applicants to the university is extrmely high, such that, in recent years, only one-eighth of them have been admitted.[68] For scientific subject colleges, the fraction is doubtless even less than that.

In summary, inadequacy in the quantity of higher teacher training school students in needed fields is due to control actions practiced by the control component of the system and of the university (d_1 and A_1, respectively, in Figure 8), rather than a scarcity in the source of potential students (X_1 in Figure 8). One may conclude, therefore, that the admission policy of the university does constrain the control action of the control component.

As to the student input to education institutes, it is strictly controlled by the control component. As an average over the last five years, only six percent of the

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[68]Source: PAKD.

applicants were admitted to education institutes by means of competitive examination.[69] Each year, the number of new students is decided by the control component on the basis of policy for training teachers (d_3 in Figure 8). Therefore, the source of potential students to education institutes (X_2 in Figure 8) is not scarce and, in turn, does not constrain control.

Teachers of teachers: Teachers are assigned to teacher training schools by the control component from secondary schools. Every teacher assigned to teacher training schools is a loss to the supply for public secondary schools. Therefore the decision to assign teachers to teacher training schools is a priority decision (see d_4 in Figure 8). A governing rule of economics is that allocation for production should be given higher priority than allocation for consumption, if there is no other choice and more production is required. There should not be a functional constraint on decisions for hiring needed teachers to teacher training schools.

Interactions.--Interactions in the process of training teachers take place in the teacher training schools, which make up the production component of the system. Interactions are regulated by the training policy of the

[69]Source: General Directorate for Teacher Training Schools.

university and by the control component (by means of A_2 and d_2, respectively, in Figure 8). A_2 includes training programs and methods of the disciplines in which higher teacher training schoool students are trained. As to d_2, it includes: money, school regulations, all administrative decisions and orders, professional training programs for both higher teacher training schools and education institutes, and the entire training program for education institutes. Therefore, interactions in higher teacher training schools are controlled partly by the university and partly by the control component. Interactions in education institutes, however, are entirely controlled solely by the control component.

Consequently, control action of the control component for interactions in higher teacher training schools is constrained by the university, but for education institutes it is unconstrained.

Time.--Time is naturally an uncontrollable variable and the flux of time cannot be manipulated. Usage of time, however, is controllable, and because of that the size of a particular job and/or the magnitude of a specified production within a given period of time can be varied by manipulating related controllable variables and conditions of interactions. That is to say, there should be a best combination of inputs and conditions of interactions for an optimum rate of a specified output within a given period of time.

In many cases, however, delay time (the period of time required to yield a specified production) is independent of the magnitude of inputs and outputs. Institutional education is an example. For each type and level of schools, regardless of the quantity of students and teachers, there is a definite period of time (delay time) to accomplish the training program, designed for that school.

In a plan to yield more production than the school currently produces, the time delay should be taken into consideration as a functional constraint. Obviously, to construct new school buildings and to train new teachers in order to increase the rate of output also will require additional periods of time before an increase in output will be achieved.

If a future need for more output of a particular school is unpredictable, then necessary measures for satisfying that need can be put into effect only after the existence of the need has become manifest. In such a case, the delay time for additional output is a functional constraint on the measures and should be accounted for in making decisions to satisfy the need. If the need can be predicted and estimated to some degree sufficiently prior to its emergence, one can put necessary measures into effect in advance to satisfy the need on time. In this case, regardless of whether the necessary measures are put into effect on time or not, one should not consider the delay time as a constraint. That is to say, whether utilized or not, if there exists a possibility of yielding more production to be needed in the future, the delay time required for the production should not be counted as a constraint on answering the need.

Now, taking the above explanations into consideration, one can conclude that time has not been a functional constraint on control actions for training more teachers of secondary school core subjects, for the following reasons:

The problem of a shortage of teachers has existed since the early fifties. Especially after 1960, the trend of the need and required measures to satisfy the need have been put forth through the ten-year plan and the development plans. There has been enough time if not to solve, then at least to mitigate the problem.

In summary, training teachers in higher teacher training schools has been constrained by the admission and training policy of the university. Therefore a part of the causal problem stands with the university. Nevertheless, one cannot see any functional constraint on the control action of the control component for the process of training teachers in education institutes. Therefore, decisions of the control component (D in Figure 8) seem to be chiefly responsible for the inadequate quantity of teachers for core subjects trained in education institutes.

After this conclusion and in order to discover the causal problems responsible for ineffectiveness of the control decisions, one should make an investigation into the entire process of making decisions to control teacher training. Such an investigation requires a review of all the entities which may affect the control decisions. These mentioned entities may enter the process at any point in Figure 8 from the control component through to the extreme left of the figure, i.e., within the Ministry of Education at large.

Decisions which control teacher training (D in Figure 8) are the outputs of the control component. This output is the product of the input B_2 which is subject to interactions within the control component in the time domain. Therefore, causal problems responsible for the ineffectiveness of the control decision D may be due to the input, or to interactions, or to time under consideration.

The time domain in the Turkish instance includes more than a score of years throughout which control decisions have been ineffective. Since control decisions are generally made on a yearly basis, the decisions are not constrained by time. In other words, throughout more than twenty years, one has had opportunities to make effective decisions if inputs and interactions are sufficient to do so. That is to say, the ineffectiveness of the control decisions should be due to input and/or interactions rather than to time.

Input B_2 is a complex of variables which can be classified in three categories, two of which are as follows:

(a) All inputs including funds, related to training teachers of elementary schools and secondary school core subjects received from the society by the control component via the Ministry of Education (see Figure 6).

(b) All other information bearing on the scope of responsibility of the control component which reaches the control component indirectly.

The first two inputs above do not include pressure aimed at limiting the quantity of trained teachers for secondary school core subjects. On the contrary, they represent pressures to train more teachers. The demand for more teachers has been encouraged and requested consistently by both the environment and the superior offices of the MOE. Funds are scarce inputs but, as was explained before, the problem has been inadequate decisions on how to use them, rather than inadequate resources. One may conclude that inputs included in the above first two items are not responsible for ineffectiveness of decisions which regulate teacher training.

As to the third category, it includes information received by the control component from other offices of the Ministry of Education excluding the superiors who are overall policymakers. This third sort of information may be classified in two sub-categories, as follows:

Feedback information: As was explained before, feedback is a necessary component for a closed system. The system supplying teachers of secondary school core subjects is a closed system, for which, therefore, feedback is vitally important.

Theoretically, the concept of feedback implies a sufficient channel of information within the system. In the real world, however, the feedback (E in Figure 8) is established via a multiplicity of channels between schools and various offices in the Ministry of Education at large, rather than directly with the control component. The reasons for this is that each school sends information related to need and supply of teachers to its particular superior general directorate, not to the General Directorate for Teacher Training Schools. This practice in the real world may create a problem if the information received from subordinated schools is not sufficiently transmitted by the general directorate to the control component. Then the system for supply of teachers of secondary school core subjects fails to function as a closed system, and decisions for controlling teacher training are made in uncertainty. This practice can be counted as one of the causal problems under investigation here.

Activity information: This includes any decision made by general directorates which indirectly entails creating additional needs for teachers of core subjects, such as decisions to open new schools or to extend existing schools (represented by B_1 in Figure 8). In the real world, each general directorate makes its own decision--which may create additional needs for teachers--without consulting with the General Directorate for Teacher Training Schools. If the control component is not informed in time about decisions, its control decisions are made under uncertain conditions. Such conditions may, again, cause the control decisions to be ineffective. In short, there is a possibility that input B_2 can be a location of causal problems responsible for the ineffectiveness of control decisions.

Interactions in the control component.--As for the interactions which produce the control decisions through using the inputs labeled B_2, they are arranged and conducted by the control component. It appears evident that these interactions over the past twenty years have not been sufficient, perhaps because of the following reasons:

First of all, if B_2 should not include sufficient information to make effective control decisions, it would be the task of the control component to ask for more information needed to make effective decisions. There can be no excuse for trying to accomplish the responsibility of supplying teachers for the entire school system of the society wihtout having had sufficient information for more than a score of years.

But it appears that the control component was not deprived of information needed to make effective decisions. The aforementioned Ten Year Plan, which was prepared by the control component, and the five year development plans, which had the force of law, included necessary basic information along with requests to train needed teachers. One might even suppose that these plans may have been ignored in the making of control decisions to train teachers of core subjects.

Consequently, another location of the causal problems responsible for ineffective decisions may be in the control component and the interactions which occur there, between it and the B_2 inputs it receives.

Basic Characteristics of the Problem

The preceeding analysis reveals possible locations of causal problems responsible for the existence of the current teacher shortage problem in the Turkish secondary school system. The problem is generated at points where measures might be designated for solving the problem. The analysis may begin to suggest why the problem has been growing without mitigation for more than twenty years. A systems approach elucidates relationships which otherwise might never be understood and locates specific points of causation which might otherwise remain hidden behind the glaringly apparent surface problem. After defining its locations, one needs to specify further the characteristics of the problem in order to facilitate an operational approach to tackling the problem.

We have seen that there are two basic inadequacies in the teacher training system: (a) structural inadequacies which allow uncontrolled components to operate within what should be a closed system, and (b) inadequacies in decision making for teacher training. Since these decisions are outputs which combine input B_2 and interactions in the control component, the inadequacy of decisions may be due either to the input or to the interactions, or to a combination of both.

If the inadequacy is due to input B_2, one may attribute it to inadequate administrative organization of the MOE at large. As was explained before, B_2 includes feedback and activity information which may not be adequately transmitted to the control component, thus causing its decisions to be inadequate.

If the inadequacy is due to interactions in the control component, one may count it as inadequate management in the control component. Here the term management is used, rather than administration, because the task of the control component can better be defined by the term management which implies: ". . . the decision making, planning, and implementing that must underlie effective utilization of manpower, money, materials, facilities, information, knowledge, and time which constitute the productive resources. . . ."[70]

Probably the causal problems should be counted as both inadequate administrative organization of the MOE and ineffective management in the control component. The control component should find a way of getting needed information if it assumes the responsibility for answering Turkey's need for teachers, and indeed the Ten Year Plan and the five year development plans included such information. At the same time superior offices and other offices in the MOE should find an effective way of communicating feedback and activity information to the control component.

Consequently, an operational approach to solve the teacher shortage problem would seem to include solution of problems related to (a) administrative organization

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[70] James L. Pierce, "The Planning and Control Concept," in Administrative Control and Executive Action, ed. by B. C. Lemke and J. D. Edwards (Columbus: Charles E. Merrill Books, Inc., 1961), p. 8.

of the MOE, (b) management in the offices of the control component, and (c) the structure of the teacher supply system.

Summary

Shortage of teachers of core subjects in the Turkish secondary school system is an effect resulting from certain causal problems. The quantity of the supplied teachers is drastically less than the quantity of needed teachers. The quantity of needed teachers is increasing constantly and is the inevitable result of Turkey's growing population and the rising aspirations of its society. The teacher shortage problem is therefore fundamentally a teacher supply problem. There is no free market of teachers, and the Constitution assigns the task of supplying needed teachers to the Ministry of Education in Turkey. In the final analysis the teacher shortage problem is fundamentally a teacher training problem--that is, a production problem.

In order to meet a defined need, there are two fundamental problems to be solved in the process of production--resources, and the utilization of resources. Analysis of Turkey's teacher shortage problem reveals that limitations on resources to train needed teachers (namely, students, funds, teachers of teachers, and time) have not created unsolvable problems, but the utilization of the resources (decision making, planning, and implementing) has been inadequate throughout the last twenty years.

Inadequacies in utilization of resources may be traced to three "locations" in the teacher supply system: inadequate coordination and control between MOE policies and the policies of the university regarding teacher training, inadequate organization of the Ministry of Education for supplying inputs to the control component, and inadequate management in the control component of the teacher supply system. These three may be counted as causal problems. It appears, however, that the problem is generated at points where measures to cope with it can and should be designated.

Discussions and Conclusions

The preceding analysis implies that an operational approach to solve many problems in the Turkish education system necessitates coping first with certain basic administrative problems in the Ministry of Education. Analysis of these administrative problems and their effects on the education system are beyond the scope of this study. Nevertheless, a brief characterization of administration in the Ministry of Education may help the reader to understand the paradoxical dilemma of the inadequate teacher supply.

Ministry of Education
and Problems

Theoretically, every organization strives to fulfill its objectives, but the Ministry of Education evidently fails in many ways to fulfill its objectives. Blame is usually placed on the inadequacy in organization. Individual authorities thus tend to feel free from personal responsibility for the failures. Nevertheless, in spite of many studies and recommendations, no basic reorganization of educational adminsitration has been put into effect over the past twenty years. The central Ministry of Education suffers from the characteristics of the innovation-resisting organization, as stated in the following quotation:

> An organization is itself an innovation, but most organizations of the past have been designed to be innovation-resisting. . . . To ensure reliable repetition of prescribed operations, the organization requires strong defenses against innovation. Efforts to innovate must be relegated to the categories of error, irresponsibility and insubordination, and appropriate corrective action taken to bring the would be innovators "back in line." Any change is likely to run counter to certain vested interests, and to violate certain territorial rights. Sentiments of vested interest and territorial rights are sanctified as delegations of legitimate authority in traditional organizations, thus guaranteeing quick and effective counteraction against disturbance. In theory, the innovation-resisting organization is not resistant to innovations issuing from the top of its authority structure.[71]

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[71] Herbert A. Shephard, "Innovation-Resisting and Innovation-Producing Organizations," as quoted in Newton Margulies and Anthony P. Raia, Organizational Development Values, Processes and Technology (New York: Mc-Graw Hill Book Company, 1972), p. 50.

In addition, the Ministry of Education operations are often characterized by their extremely personalized character of administration, such that the personality of the individual often is not differentiated from the position within the organization. Institutional authority is erroneously equated with the power of the individual. The absence of job descriptions and objective criteria for selection of individuals to administrative positions encourages and facilitates staffing the organization on the basis of personal preferences of the authorities. Under these circumstances, administrative activities tend to be governed by highly personalized concepts. Different administrators may or may not be seriously careful about organizational objectives. They may have highly individualized perceptions of their roles.

Arising perhaps mostly from an element of uncertainty, a particular emotional climate is usually associated with such personalized administration. Accordingly, relationships among individuals and groups are often disrupted by unpredictable complications of misunderstanding, unnecessary competition, jealousy, under-handed tricks, etc. Instead of fostering scientific thinking, creativity, initiative, and the taking of responsibility, the climate encourages sheer obedience as the secure way of work performance. This situation is mentioned also by

Dr. Ziya Bursalioglu, in his article devoted to the question of reorganization of educational administration.[72]

In addition, the more recent book by Edwin J. Cohn[73] sheds light on educational and administrative problems of concern here. These observations may help one to understand why the administration of the MOE seems to be so overly occupied with daily routine, at the price of ignoring planned activities, scientific studies, and follow-up implementations. In general, personalized administration cannot tolerate rigorous, objective programs which are oriented toward the long range unless higher authorities insist on it and follow up by controlling the organization. Moreover, unscientific attacks on existing problems only serve to generate new additional problems through more inadequate or improper decisions. All in all, the Ministry of Education stands in a state of inertia, while by contrast educational problems are spreading in a state of restless expansion, arising from unmet demands of the changing society. The result is extensive and chronic problems. This is the dilemma to be overcome.

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[72] Ziya Bursalioglu, "The Need for Reorganization in Turkish Educational System," in The Turkish Administrator, a Cultural Survey, ed. by Jerry R. Happer and Richard I. Lewin (Ankara: Public Administration Division, USAID, 1968), pp. 265-84.

[73] Edwin J. Cohn, Turkish Economic, Social and Political Change--The Development of a More Prosperous Open Society (New York: Praeger Publishers, 1970).

In brief, the assumption of this researcher is that an operational approach to secure an effective solution of the problems currently confronting the society's educational development will necessitate coping first with the personalized character of administration. The following two examples may serve to justify this assumption. They indicate how administrative shortcomings apply to teacher production problems (1) in higher teacher training schools, and (2) in education institutes.

Higher Teacher Training Schools

As was explained before, higher teacher training schools are subject to the general policy for admission and training of the university, but the university does not assume responsibility for the supply of teachers. Therefore the quantity and quality of teachers trained in these schools are out of the control of the control component, which is responsible for the supply of teachers.

The results of this dualism may be summarized, as follows:

(a) Because of limited quotas for faculties of scientific disciplines, lycée graduates who pass the university entrance examinations do not usually choose teaching as a profession.

(b) Candidates for teaching who nevertheless train at the university under the same programs as do candidates for other professions, especially in scientific fields, often leave the teaching profession for better paying jobs.

As an approach for solution of the problem, as was explained before, normal school students have been trained under the lycée program in the preparation class since the 1959-1960 school year. Since 1959, greater numbers of students have been able to go into teacher training through the higher teacher training schools by means of the change in policy and practice already mentioned above. Since that date normal school graduates also have been admitted, first to one-year "preparation" classes, and then they have been allowed also to follow the same training programs as the regular lycée graduates.

This approach may have been successful in the short run but it could not continue to succeed in the long run. Because of increasing requirements of competency, to put the needed number of students under needed programs became each year more difficult than before. Moreover, the problem of retraining trained teachers in the profession continues to exist. For example, the number of chemistry teachers in lycées was 115 in 1962-63 and 140 in 1971-72, whereas the respective numbers of teachers needed were approximately 220 and 700.

Clearly the approaches taken are incompatible with the characteristics of the problem. From a systems point of view, the problem has until now been dealt with as a regional constraint (i.e., a scarcity of the student resource), although in fact it is a functional constraint (i.e., a function of the organizational structure of the system). In other words, while the legal responsibility for the supply of teachers belongs to the MOE, at the same time the supply is subject to the admission and training policy of the autonomous university which does not assume responsibility for the supply of teachers. An operational approach to solving the problem should include a change of structure in the system so that at least the following two conditions are realized:

a. Student stations in higher teacher training schools should be controlled by the component which is responsible for the supply of teachers.

b. There should not be a large number of teachers in needed fields who leave the profession for other jobs.

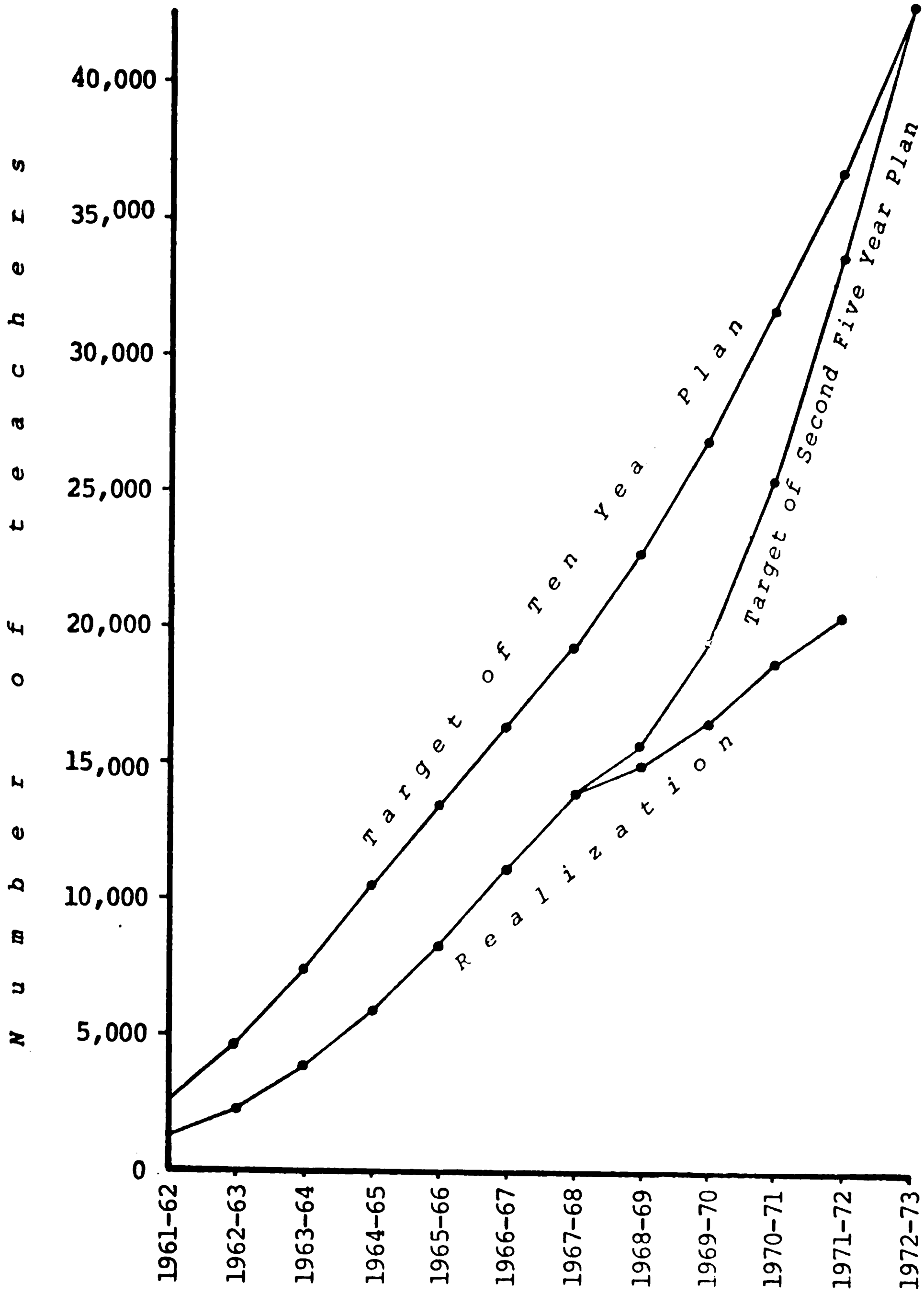
There may be several ways to realize the above-mentioned two conditions. One may expect, however, that the basic problem with respect to higher teacher training schools will remain unsolved as long as the structure of the system remains as it is.

Education Institutes

Education institutes are wholly controlled by the MOE. Nevertheless, an inadequate supply of teachers from education institutes has been a growing problem since the fifties. The persistence of the problem might lead one to suspect the presence of an unassailable functional constraint, preventing the administration from effectively coping with the problem. Our analysis above concluded, however, that the problem is due to inadequate resource utilization. That is to say, the functional constraint itself resides in that self-same administration which is responsible for solving the problem.

Figure 10 indicates that the quantity of trained teachers has lagged far behind the targets of the plans. Indeed, the need for thousands of new teachers is self-evident in the schools. The slope of the curve for trained teachers (for realization) has declined since 1967-68. The estimated number of teachers needed for the four years following 1967-68 was 18,800 in the Five Year Plan and 17,548 in the Ten Year Plan. The number of teachers trained in the same period, however, was 6,596. In the preceding four years, 10,251 had been trained (see Table 1, page 57). In 1967-68 the number of education institute students was reduced by about one thousand, even though all resources necessary to admit more students were then available and a shortage of teachers was then creating a bottleneck in the secondary school system. Moreover, the second Five Year Development Plan had called for an enrollment of 10,100 in education institutes for the 1968-69

FIGURE 10--Estimated Need for Education Institute Graduated Teachers and Realization.(*)



(*) Sources:

a. Tables 1 and 2,

b. Milli Egitim Bakanligi, Ogretmen Yetistirme Komitesi Raporu ve On Yillik Plan, (National Ministry of Education, Report of Teacher Preparation Committee and the Ten Yer Plan), Istanbul, 1961.

school year. The actual decrease in the number of education institute students in 1967-68 is nevertheless understandable.

This decrease in the quantity of trained teachers after 1967-68 seems to have resulted from two measures which were put into effect in the 1967-68 school year:

1. In 1966-67 it was decided to divide each of the two main branches of training (humanities and sciences) into four branches (humanities into "Turkish" and "social subjects," and sciences into "mathematics" and "sciences").

2. In addition, the training period for these branches was raised in 1967-68 from two to three years. These two measures, which were ostensibly aimed at improving the quality of training, had adverse effects, not only on the quantity but also on the possible utilization of trained teachers, as follows:

> (a) To divide two training branches into four means that four teachers instead of two should be assigned to each school. But in the real world the number of small secondary schools in Turkey with fewer than 200 students has until now always been more than one-third of the whole number of schools. Hence the capacity of schools to utilize teachers in the additional fields was seriously affected adversely by the above mentioned measure. In effect, the needed number of qualified teachers was indirectly expanded drastically.

(b) To extend a period of training from two to three years obviously requires fifty percent more resources, such as funds, school facilities, teachers of teachers, and time. A three-year program produces fifty percent fewer teachers to be trained through using the same available resources. This is another reason for the decline of the slope for trained teachers after 1967-68.

In other words, using the same available resources, the new subdivided three-year training program reduced the quantity of trained teachers by up to one-third in comparison with the previous two-year program.

The adoption of the above measures is a good example of how important decisions may be made without a sound understanding of systems implications. The drastic impact of these measures on the Turkish system can be tabulated in terms of fields and training periods as follows: In 1946-47, there were five separate branches of training in the education institutes--Turkish, social subjects (history and geography), mathematics, physical sciences (physics and chemistry), and biology. Since that date these branches have been subject to varying combinations and subdividings. The effects of these combinings and re-combinings, in terms of resource utilization, may be calculated in man-years. For instance, if training is divided into five fields as above and the training period is two years, then five teachers have to be trained in two years, and the result is 10 man-years, i.e., the product of five and two. If these five subjects are combined into two branches and the training period is again two years, the product is four man-years. Using this procedure, changes in the Turkish system relating to the combinations of the above five fields and to the training periods involved may be summarized since 1946-47 as shown in Table 7.

Notice that in two years, between 1966-67 and 1968-59, the man-year requirements for training a teacher in each required branch jumped from 4 to 12. Meanwhile, the actual shortage of teachers was a serious bottleneck in the education system.

TABLE 7.--Various Combinations of Training Branches in Education Institutes.

School Year	No. of Training Branches	Years of Required Training	Man-Years (Branches times years)
1946-47	5	2	10
1949-50	1	2	2
1966-67	2	2	4
1967-68	4	2	8
1968-69*	4	3	12

*Continuing to the present.

Of course, measures aimed at improving the quality of teachers should not be opposed, provided that necessary protections against their negative effects on the supply may also be designated and put into effect. There is a need for finding scientific ways of maintaining balance between the quantity and the quality of teachers on the basis of the country's need. One should not sacrifice either quantity or quality to the extent that the system as a whole ceases to function effectively.

Summary

Analysis of the problem indicates that the teacher shortage in the Turkish secondary school system is the result of inadequate resource utilization rather than resource scarcity. The causal problem is fundamentally an administrative problem. An operational approach requires first of all that the administrative problems be solved. Subsequent measures for solving the problem should facilitate fulfillment of the following requirements:

(a) An effective control in terms of systems concepts over the teacher training process.

(b) A realistic plan, including assessment of the quantity of needed teachers in each field, requirements of the profession, and curriculum to train teachers on the basis of the society's needs and of the characteristics of the schools.

(c) Appropriate conditions to retain trained teachers in the profession.

CHAPTER V

MATHEMATICAL MODEL FOR TURKISH SECONDARY SCHOOL SYSTEM

The main purpose of this chapter is to present a mathematical model to identify the state of the system at a particular time in terms of demand and supply of secondary school teachers. Obviously, to develop a descriptive model would be in vain unless its outcomes are utilized in planning for solution of the problem under concern. That means to say, the descriptive model presented here is developed to show what kinds of analyses need to be made in order to provide accurate information to be used in planning for solution of the problem. With accurate data in hand adequately analyzed, the planner would then require a corresponding simulation model to search for best solutions.

Developing a simulation model for planning was not covered by the objectives in this study. However, in order simply to demonstrate what needs to be included in a complete set of systems procedures applicable to solution of an educational problem, an abridged version of a previously prepared simulation model is presented at the outset of this chapter.

Therefore, this chapter consists of two parts. Included in the first part is the above mentioned abbreviated illustrative simulation model with its outcomes. It is presented simply to show that simulation can lead to optimum solutions. The descriptive model is the chief contribution of this chapter, as required by the second objective of this study. It is presented in the second part. Results of a pilot application of the descriptive model to the province of Eskişehir are reported in the next chapter.

PART 1

SIMULATION MODEL FOR TURKISH LYCÉE TEACHERS

The Origin of the Model

The aggregate simulation model presented in this part was originally prepared by the present researcher at Michigan State University in July, 1971. Available data were inadequate to establish needed parameters and variables for running the model through the MSU computer, so parameters and initial variables were either obtained from what data were available or were established on the basis of educated assumption and guesses.

Therefore, at least some of the simulated values might, most probably, not be precisely accurate approximations of the future behavior of the system. Nevertheless, the relative relationships which are discovered among the variables do appear generally to reflect interrelationships in the real world.

The model was developed to experiment with alternatives for planning the supply of Turkish lycée mathematics, physics, cheimistry, and biology teachers. Two basic alternatives were chosen: "present system" and "desired system."

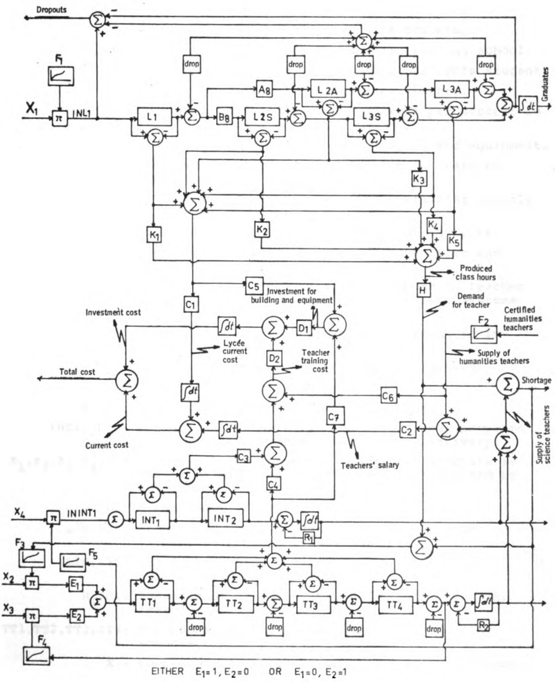
To these alternatives, two further alternatives in each case were included--thus making a total of four alternatives in all, as follows:

1. Present system
    a. Supply of teachers with regular training, and
    b. Supply of teachers with regular and inservice training.
2. Desired system
    a. Supply of teachers with regular training, and
    b. Supply of teachers with regular and inservice training.

In terms of the best alternative, i.e., desired system with inservice training, the problem would be solved in twenty years. The logical block diagram for the model is introduced in Figure 11.

FIGURE 11--Block Diagram for the Lycee and Its Teachers in Turkey.

(Student Flow, Teacher demand and Supply, and Cost)



Explanations for Parameters and Abbreviations in Figure 11

A8,B8: Parameters for student distribution from grade 1 to grade 2 literature and science divisions respectively in lycée.

C1: Unit cost per student in lycée.

C2: Average salary of lycée teachers.

C3: Unit cost per teacher in-service training.

C4: Unit cost per student in teacher training school.

C5: Unit building and equipment cost per lycée student.

C6: Unit cost of training humanities teacher.

C7: Unit cost of building and equipment per student in teacher training school.

D1: Amortization rate of school building and equipment.

D2: Amortization rate of expenditures on training teachers.

E_1,E_2: Regulators for inputs to teacher training schools in present and desired systems.

F_1: Function to calculate student input to lycée.

F_2: Function to calculate supplied humanities and science teachers.

F_3,F_4: Functions to calculate student inputs to teacher training schools in desired and present systems respectively.

F_5: Function to calculate teachers as input to in-service training.

H: Realized average teaching load of teachers.

INL1: Student input to lycée.

ININT1: Input to in-service teacher training.

INT1,INT2: Correspond to the first and second year programs for in-service teacher training respectively.

K_1,K_2,K_3,K_4,K_5: Parameters for converting number of students into number of produced class hours by grades and by subjects.

L1: First grade of lycée.

L2A,L3A: Second and third grades of lycée under the literature programs.

L2S,L3S: Second and third grades of lycée under the science programs.

R_1,R_2: Percentages of leave of the profession for any reason.

TT1,TT2,TT3,TT4: Correspond to the grades of teacher training schools.

X_1: Number of potential students eligible to attend to lycée.

X_2,X_3: Numbers of students who apply to desired and present teacher training schools respectively.

X_4: Teachers who apply to in-service training.

The model is presented here avoiding details and as three submodels, such as: (1) student, (2) teacher, and (3) cost. Throughout this part, indices are used without any change in identity, as follows:

$n = 1, 2, 3, \ldots, 20$ (corresponding to the number of years)

$k = 1, 2, 3, 4, 5$ (corresponding to the number of grades with area)

$i = 1, 2, 3, \ldots, 16$ (corresponding to the number of subject matters)

Objective (or Criterion) Function

$$U = U(x_1, x_2, \ldots, x_r) \qquad (9)$$

where U denotes the supply of teachers meeting demand and being subject to the constraints.

Student Submodel

Assumption 1: Increase in the number of lycée students will take place in such a pattern that about one-half of the age group will be in school after twenty years.

Assumption 2: The rate of student flow in lycée is directly related to the percentage of supply of qualified teachers. (However, the rate of student flow is not over 90 percent even if the supply of teachers is one hundred percent.)

Constraint 1: In the Turkish school system, a one hundred percent student flow can hardly be achieved. Dropouts and the large pool of repeating students constitute a heavy constraint on the enterprise.

$$l_1 \leq R_1 \leq L_1 \tag{10}$$

where

R_1: student flow ratio,

l_1: minimum student flow ratio, and

L_1: maximum student flow ratio.

<u>Student Input to Lycée</u>

$$I_n^1 = AI_{n-1}^1 \tag{11}$$

where

I^1: number of newly enrolled students to the first grade, and

A: the ratio in increase.

$$A = \begin{cases} .19 - T/100 & \text{if } 0 \leq T \leq 13 \\ .06 & \text{if } T > 13 \end{cases}$$

<u>Student Flow (Intermediate Inputs and Outputs</u>

$$Y_n^k = B^* X_n^k \tag{12}$$

$$D_n^k = C^* X_n^k \tag{13}$$

$$F_n^k = Y_n^k + D_n^k \tag{14}$$

$$I_n^k = B^* X_{n-1}^{k-1} \quad \text{if } k > 1 \tag{15}$$

$$I_n^k = I_n^1 \quad \text{if } k = 1 \tag{16}$$

$$X_n^k = X_{n-1}^k - F_{n-1}^k + I_{nn}^k \tag{17}$$

where

Y: number of students passed the grade,

B: ratio for the pass,

X: number of students enrolled in the grade,

D: number of dropouts,

C: ratio for droptouts,

F: number of students flowed out of the grade, and

I: number of students enrolled in the grade.

$$C = R_1(1 - R_1 * c) * b * c$$

$$B = b * R_1 - c$$

where

R_1: percentage of supply of teachers as explained in Constraint 1,

b and c: parameters for differences in flow rates among grades.

Teacher Submodel

The teacher submodel consists of two sections: demand and supply.

<u>Demand</u>

Aggregate estimation for demanded teacher is calculated by dividing produced class hours by the average load of teachers.

> <u>Assumption 3</u>: In the "present system," calculated average teaching load (19.2 hours per week) remains as it is. In the "desired system," however, the policy of utilization of teachers will be improved such that the load will be increased by 0.15 hours each year (3.0 hours after 20 years).

> <u>Constraint 2</u>: Smallness of school size and narrowness of teachers' fields are constraints on improving utilization of teachers.

$$l_2 \leq R_2 \leq L_2 \qquad (18)$$

where

R_2: hours of average teaching load,

l_2: minimum hours of teaching load, and

L_2: maximum hours of teaching load.

Produced Class Hours

$$H_{i,n} = \sum_{k=1}^{k} X_n^k / L^k * W_i^k \qquad (19)$$

where

H: number of produced weekly class hours,

X: number of students,

L: average number of students in classes, and

W: number of weekly class hours of the course in the curriculum.

Demand for Teachers

$$P_{i,n} = H_{i,n}/R_2 \qquad (20)$$

where

P: number of demanded teachers,

H: number of produced weekly class hours as in equation (19), and

R_2: teaching load of teachers as in Constraint 2.

Supply of Teachers

Assumption 4: At most, 50 teachers from each field will be put under inservice training each year if the shortage of teachers in that field is over 100.

Assumption 5: The number of new enrolled students in the first grade of teacher training schools will be:
(a) in the "present sytem"--25 more students than the number of graduated students from the field in the previous year;
(b) in the "desired system"--the base for calculation for student input is the demand for teachers for the field concerned.

Constraint 3: Training lycée teachers through inservice training is limited by the need for junior high-school teachers and by training facilities. (See Assumption 4.)

Constraint 4: Both available student stations and teachers' teachers in teacher training schools are constraints on new enrollment in the first grade.

$$l_r \leq R_4 \leq L_4 \qquad (21)$$

where

l_4: minimum number of new enrollment,

R_4: number of new enrolled students, and

L_4: maximum number of new enrollment.

Student Input to Teacher
Training Schools

$$I_{i,n} = G_{i,n-1} + D \tag{22}$$

where

I: number of new enrolled students,

G: number of graduated students, and

D: an additive parameter to utilize Assumption 5.

Supply of Teachers

$$Z_{i,n} = G^{t}_{i,n-1} + (1-r_1)*Z^{t}_{i,n-1} + G_{i,n-1} + (1-r_2)*Z^{s}_{i,n-1} \tag{23}$$

$$Z_n = \sum_{i=1}^{I} Z_{i,n} \tag{24}$$

where

Z: number of trained teachers,

G^t: number of teachers trained in teacher training schools,

Z^t: number of the stock of lycée teachers trained in teacher training schools,

r_1: ratio of those who leave the profession (for teachers trained in teacher training schools),

r_2: ratio of those who leave the profession (for teachers trained through inservice training programs),

G^s: number of teachers trained through inservice training programs,

Z^s: number of the stock of lycée teachers trained through inservice training programs,

$Z^s = 0$ in "present system."

Supply of Humanities Teachers

Because it is not a serious problem, the supply of humanities teachers is not included in planning through the simulation model. However, in calculation for the cost, humanities teachers should be counted. Therefore, though not differentiated by field, humanities teachers are included in the calculation for cost by utilizing the following equation:

$$P_n^h = P_n - P_n^s \tag{25}$$

where

P^h: number of supplied humanities teachers,

P: number of the entire stock of teachers, and

P^s: number of supplied science teachers.

Shortage of Teachers

$$V_{i,n} = P_{i,n} - Z_{i,n} \tag{26}$$

where

V: number of the shortage of teachers,

P: number of demanded teachers, and

Z: number of supplied teachers.

<u>Notice</u>: Objective (or criterion) function requires $V = 0$.

Cost

Assumption 6: All expenses for teacher training are counted as investment to the lycée.

Assumption 7: Purchasing power of Turkish money will remain as it is now.

Assumption 8: There is no constraint on provision of needed funds.

In this section, L denotes Turkish lira, equivalent to 1/14 dollar.

Cost of Training Teachers

$$L1_n = (S_n^t - S_{n-1}^t)*q_1 + S_n^t*q_2 + S_n^s*q_3 + (P_n^h - P_{n-1}^h)*q_4 \tag{27}$$

where

- L_1: investment in training teachers,
- S^t: number of students enrolled in teacher training schools,
- S^s: number of teachers under inservice training,
- P^h: number of humanities teachers,
- q_1: unit cost of building and equipment of teacher training schools per student,
- q_2: current cost per teacher training school student,
- q_3: current cost per teacher under inservice training program (in the a "present system," 9=0), and
- q_4: unit cost of training per humanities teacher.

Cost of the Lycée

$$L2_n = C1_n + C2_n + C3_n \tag{28}$$

where

L2: cost of lycée,

C1: cost of teaching,

C2: cost of school operation, and

C3: cost of school plant and equipment.

Actual Current Cost of Lycée

$$L_n = C1_n + C2_n + A1_n + A2_n \tag{29}$$

where

L: actual current cost of lycée

C1: cost of teaching as in equation (28),

C2: cost of school operation as in equation (28),

A1: prorated cost of school plants and durable goods, and

A2: prorated cost of training teachers.

Unit Cost Per Lycée Student and Graduate

$$\begin{aligned} LS_n &= L_n/S_n \\ LG_n &= L_n/G_n \end{aligned} \tag{30}$$

where

LS: unit cost per student,

LG: unit cost per graduate,

S: number of students, and

G: number of graduates.

Findings and Conclusions

The preceding model is an abridged version of the author's original model. This new version was abbreviated by either ignoring certain original alternative equations and adopting particular ones or by combining a few equations which were in the original model into one equation. Nevertheless, the presented model is expected to serve in demonstrating how a simulation model may be utilized. Evaluation of findings in an application of the model shows not only the possible future behavior of the system under given circumstances, but also the kinds of data needed in utilization of such models.

In this section, illustrative findings of the original study through computer simulation are presented in three subjections, corresponding to the preceding three submodels, as follows below.

Students

Student input (new enrollment) to the lycée is treated as an exogenous variable in the model. Since initial values are constant and the values for student inputs are originated by the same equation, changing values of numbers of new enrolled students in each of the alternative systems are necessarily the same for the same year. Therefore, any difference in exogenous variables related to students in the varying systems should be attributed to the differences included in the design of the system.

The differences included in designing for alternative systems are only the rate of teacher supply. Then, Assumption 2, "the better the teacher supply, the better the student performance," is utilized in simulation. The better performance of students is counted as a higher passing rate (larger flow) of students. These were included in the computer program in this way: The actual differences in the passing rates among various grades were presented as parameters. The general base for calculation was established as the percent of supplied science teachers in terms of need. However, if the percent of supplied teachers was less than 70%, it would be counted as 70%, and more than 90% would be counted as 90%.

As a result of utilization of Assumption 2 and a varying rate of teacher supply, calculated values for the variables of total enrollment, dropouts and graduates in the best alternative system differed from others after the 13th iteration. This means, even in the best possible system, the supply of science teachers could exceed 70 percent of need after 13 years under the assumed circumstances.

The outcomes in the 20th iteration (i.e., at the end of the assumed planned period) in the two systems are presented in Table 8.

Consequently, if falling pupil-teacher ratios is an indicator of a better performance of students,[74] the simulation model performed here helps to discover the long-range outcomes of a better teacher supply. A more precise approximation requires real data which were unavailable at the time this demonstration was performed.

Demand and Supply of Teachers

Demand and supply of science teachers are treated as endogenous variables in both present and desired systems.

TABLE 8.--Yearly Outcomes of the Lycée in Desired and Presented Systems in the 20th Iteration, Analogous to the 20th Year in a Planned Period.

Variables	Desired System (a)	Present System (b)	Difference (a-b)
Number of total students	1,499,207	1,580,118	-80,911
Number of graduated students	406,896	272,349	+134,547
Number of dropouts	56,849	165,137	-108,288

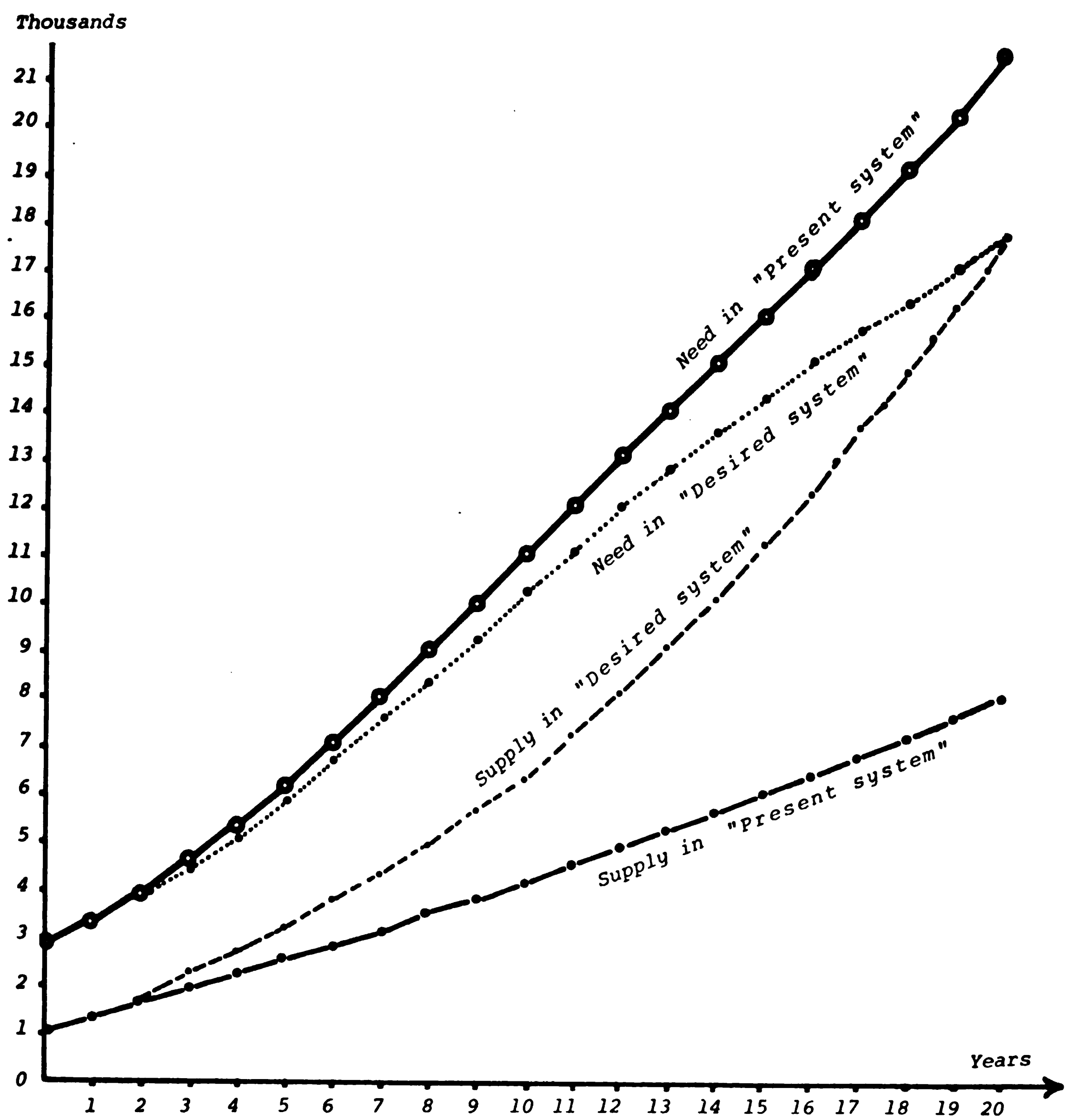
[74]Hugh Philp, "The Evaluation of Quality in Education," in Qualitative Aspects of Educational Planning, ed. by C. E. Beeby (Belgium: UNESCO, 1969), p. 288.

Demand for teachers is defined by the number of students, average class sizes, and average teacher load. Because of Assumption 3 average teacher loads differ slightly from one another in present and desired systems. In the "present system," the supply of teachers is defined in this way: The number of new students enrolled in a program is 25 more than the number of students graduated from the same program. In the "desired system," however, the number of new students is defined by the shortage of teachers. To eliminate a sharp increase in the number of students, a smoothing parameter was utilized in calculation.

The results of iterated calculations are presented by graphs in Figure 12. There are two situations to be noticed in Figure 12: (a) the gap between demand and supply is increasing as years pass in the "present system," and (b) the demand curve for the "desired system" is smoother than for the "present system." In other words, demanded number of teachers in the "desired system" is less than for the "present system." The difference between numbers is 3,800. In other words, improvement in the rate of teacher utilization and of teacher supply saves approximately one-fifth of the number of teachers needed otherwise.

Constraint 2 is taken into account in improvement of the teacher utilization and supply in the "desired system."

FIGURE 12--Estimated Need and Supply of Mathematics and Science Teachers in Present and Desired Systems.



Cost

Varying costs in the two systems are treated as endogenous variables. That is, what is needed is assumed to be available because Assumption 8 eliminates financial constraint in concerned systems.

Iterated calculations reveal that salary and training of teachers require more money in the "desired system" than in the "present system." As to investment in school facilities for lycées and current expenditures on the operation of schools, the "present system" is more costly than the "desired system."

The entire cumulative expenditure throughout 20 iterations is .008 more in the "desired system" than the "present system" simply because more money is invested in teacher training to close the gap between demand and supply. Thus, the entire yearly actual cost of the system, including teacher training, is less in the "desired system" than the "present system" after the eighteenth iteration. Cost per student is slightly higher but cost per graduate is significantly less (4 percent and 34 percent, respectively, in the twentieth iteration) in the "desired system" than in the "present system." This is an important finding in terms of the economical aspect of improvement of an educational system.

Summary

Simulation models are utilized whenever the future behavior of the system under given circumstances is under consideration. For a realistic approximation of the future behavior of the system, accurate actual data is necessary. However, as performed in this part, the trend of the future behavior of the system can be detected even in the absence of real data. This is an important contribution to planning for a socioeconomic system.

The overall conclusion derived from the presentation in this part is that, regardless of the numerical comparison, an educational system is expected to be more productive and economical if an optimum teacher supply is realized. Obviously, this conclusion is true only if a better teacher supply facilitates a better student performance and/or a better teacher utilization stated as assumptions 2 and 3 are true in some degree.

One may derive another conclusion from the preceding presentation. Accurate real information needed in simulation of the model facilitates a rather realistic approximation. That is the core of the theme of this present study. The model in the preceeding part was developed as a tool so that information needed in planning for the supply of secondary school teachers could be identified, and then be collected and processed.

PART 2

MATHEMATICAL MODEL FOR IDENTIFICATION OF THE TURKISH SECONDARY SCHOOL SYSTEM

Introduction

This part is devoted to a mathematical model for identifying the Turkish secondary school system in terms of need and supply of teachers at a particular time. The model is exclusively for the Turkish system rather than a general one. The primary aim of building the model was to set forth the situation of need and supply of teachers. However, cost of secondary education is included in the model because financial feasibility is always an essential condition to be considered in trying to solve the teacher supply problem.

The model is expected to facilitate computer-based data processing from the level of an individual school up to the level of the whole system. Any desired combination of schools, or districts, or provinces, etc., in between the individual school and the entire national system is possible through the use of the coding system in the computer program.

Notations

In order to facilitate notations, varying combinations of capital letters are used for variables. Calculations are specified with the school year, subject matter, grade level, and the type of school whenever needed. Indices that are used for these purposes consistently throughout the model without any change in identity are as follows:

i: 1, 2, 3, . . ., I (corresponding to each subject matter in curriculum), $0 < I < 33$.

j: 1, 2, 3, . . ., J (corresponding to each grade level), $0 < J < 8$.

k: 1, 2, 3, . . ., K (corresponding to each type of secondary school such as lycée, middle school, etc.), $0 < K < 11$.

n: corresponds to time, in school years.

The model was built to utilize data collected from schools. Therefore, any information related to a particular school in the scope of this model can be obtained through uses of the model. However, in terms of utilization of teachers as well as need and supply of teachers, a municipality with one or more secondary schools, rather than an individual school, was adopted as the basic unit because a teacher at a secondary school is, by law, compelled to teach in his field at another school in the same municipality whenever needed.

Because notations in equations are not extended beyond the school level, calculations for a municipality or for any desired unit other than a school can be done through uses of codes in the computer program.

As was mentioned in Chapter I, the model was applied for the province of Eskişehir to demonstrate its utility. To facilitate following the application together with related equations, table and column numbers of printouts in Appendix B are shown in parentheses right after the headline for each equation. In addition, without violating the logical order for calculations, equations are presented in three sections corresponding to the three types of tables in Appendix B.

Section 1 includes equations to calculate raw data to be used in subsequent equations. Section 2 is devoted to equations to calculate functional relationships of variables in terms of need and supply of teachers. Section 3 includes equations related to the cost of secondary education.

Section 1

Calculated results of equations in this section are presented in Table 1 in Appendix B.

Number of Students
(At the Top of Table 1)

The Turkish secondary school system has two kinds of students, daytime and boarding. Boarding students are provided free accommodations, clothes, books, etc., in addition to educational services. In the Turkish system, students are assigned to classes which follow fixed programs designed for each grade for a particular school throughout the country. Therefore, students are not identified by subject matter but by grade and the type of school. Sex of students is not needed in this study. However, it may be identified through coding.

$$ST_k(n) = \sum_{j=1}^{J} [SD_{j,k}(n) + SB_{j,k}(n)] \tag{31}$$

where

ST: number of all students,

SD: number of daytime students, and

SB: number of boarding students.

Number of Class Sections (At the Top of Table 1)

Number of class sections is one of the two variables to calculate produced class hours. Because of the fixed curriculum, the program for a class section is latent in the level of grade and the type of school. Therefore, the index for subject matter is not included in identification of class sections.

$$CS_k(n) = \sum_{j=1}^{J} CS_{j,k}(n) \tag{32}$$

where CS: number of class sections.

Number of Teachers (Table 1, Columns 1 and 2)

In the Turkish system, school administrators are counted as teachers. However, compulsory teaching hours for administrators are fewer than for teachers. Identification of sex of teachers is left to coding and not included in the equations. Teachers are identified by fields and by types of schools, not by grade levels.

$$T_{i,k}(n) = TT_{i,k}(n) + TA_{i,k}(n) \qquad (33)$$

where

T: number of all teachers,

TT: number of teachers without administrative status, and

TA: number of teachers with administrative status.

<u>Produced Class Hours (Table 1)</u>

Produced class hours imply the need for assignment of teachers. Since a fixed curriculum is followed, produced class hours is the sum of the products of the number of class sections times the number of weekly class hours in a particular field summed over grade level in a particular school, as follows:

$$HP_{i,k}(n) = \sum_{j=1}^{J} CS_{j,k}(n) * HW_{i,j,k}(n) \qquad (34)$$

where

HP: number of weekly produced class hours by existing schools,

CS: number of class sections as in equation (32), and

HW: number of weekly class hours in curriculum.

Supply of Teachers
(Table 1)

In the Turkish system, there is no means by which to provide substitute teachers. However, the shortage of teachers is partly compensated through assigning semi-qualified, unqualified, or lay teachers to classes. If none of these are available, the class is left teacherless. In other words, the class time passes without a teacher. The following equation was prepared to facilitate calculation for the situation of the supply of teachers with respect to produced class hours. Since teachers are not identified by grade levels, j is omitted in the equation.

$$HP_{i,k}(n) = HQ_{i,k}(n) + HS_{i,k}(n) + HU_{i,k}(n) + HV_{i,k}(n) \qquad (35)$$

where

HP: number of weekly produced class hours as in equation (34),

HQ: number of class hours taught by qualified teachers,

HS: number of class hours taught by semi-qualified teachers,

HU: number of class hours taught by unqualified teachers, and

HV: number of teacherless class hours.

Section 2

Equations in this section were prepared for calculations of functional relationships among variables in terms of the need and supply of teachers. If there be any, the possibility of better utilization of teachers can be detected through utilization of related equations. Because, by law, a teacher is compelled to teach in his field at another school in the municipality, equations in this section were prepared for such a municipality.

Findings through utilization of equations in this section for the province of Eskişehir is included in Table 2 in Appendix B.

Ratios
(Table 2, at the Top)

Student/teacher, teacher/class section, and student/class section serve to establish bases for estimation of needed teachers. For this reason, the above mentioned ratios were included in this section, as follows:

$$RS(n) = \sum_{k=1}^{K} ST_k(n) \Big/ \sum_{k=1}^{K} \sum_{i=1}^{I} T_{i,k}(n) \qquad (36)$$

$$RT(n) = \sum_{k=1}^{K} \sum_{i=1}^{I} T_{i,k}(n) \Big/ \sum_{k=1}^{K} CS_k(n) \qquad (37)$$

$$RC(n) = \sum_{k=1}^{K} ST_k(n) \Big/ \sum_{k=1}^{K} CS_k(n) \qquad (38)$$

where

RS: student/teacher ratio,

RT: teacher/class section ratio,

RC: student/class section ratio,

ST: total number of students as in equation (31),

T: number of teachers as in equation (33), and

CS: number of class sections as in equation (32).

Teaching Load

Teaching load is one of the important variables which directly affects the number of needed teachers. It may usually be expressed as an average value.

Theoretically, one would expect teaching load to fall within the legally established limits. It is empirically known however that, in practice, this is not true in Turkey. Inefficient utilization of teachers, smallness of schools, narrowness of the licensed field of teachers, and in some cases teachers also having administrative status, all work to lower teaching load below the established prescribed limit. Therefore, the teaching load is assessed according to the following two categories:

Established Teaching Load

Established teaching load is formally prescribed by law as given in Table 9 on the following page.

TABLE 9--Established Teaching Load of Secondary School Teachers in Class Hours.

Types of Teachers	Maximum Teaching Loads as Weekly Class Hours (see explanations below)					
	(1)	(2)	(3)	(4)	(6)	(6)
General and Vocational Education Teachers						
First Cycle :	18	6	24	6	30	15
Second Cycle:	15	6	21	9	30	12
Workshop Teachers:	20	20	40	4	44	--
Administrators :	6	--	6	12	18	12

Explanations for the Above Columns:

(1) Compulsory in return for the base salary.

(2) Optional if the teacher has more than 25 years of experience, compulsory otherwise.

(3) Total of columns (1) and (2).

(4) Optional for every teacher.

(5) Total of columns (3) and (4).

(6) Maximum class hours that may be taught by a teacher who is not certified in the subject. These hours are optional and are permissible only if there is no vacant class in the teacher's own field and provided that the sum of columns (5) and (6) should not exceed 30 class hours a week.

NOTE: Teachers are paid hourly honoraria for the loads included in columns (2), (4), and (6).

Observed Teaching Load

The precise rate of utilization of secondary school teachers in Turkey is unknown. It is empirically known, however, that secondary school teachers in Turkey are underutilized. A previous study (using the simulation model presented in Part 1) by this researcher revealed that the realized (observed) average load of secondary school core subject teachers was 19.2 class hours in the 1968-1969 school year, notwithstanding the fact of the chronic and severe shortage of teachers. Observed teaching load can be obtained for each municipality through actual data from schools. Conforming with the established teaching load, the equations for observed teaching load were prepared in two categories, i.e., with and without administrative status.

<u>Observed average teaching load of administrators</u> (Table 2, columns 4-9).--

$$LAT_i(n) = \sum_{k=1}^{K} HA_{i,k}(n) \Big/ \sum_{k=1}^{K} TA_{i,k}(n) \qquad (39)$$

$$LAQ_i(n) = \sum_{k=1}^{K} [HA_{i,k}(n) - HAU_{i,k}(n)] \Big/ \sum_{k=1}^{K} TA_{i,k}(n) \qquad (40)$$

$$LAB_i(n) = \sum_{k=1}^{K} [HA_{i,k}(n) - HAH_{i,k}(n)] \Big/ \sum_{k=1}^{K} TA_{i,k}(n) \qquad (41)$$

where

LAT: number of class hours as average teaching load in qualified and unqualified fields of school administrators,

LAQ: number of class hours as average teaching load in qualified fields of school administrators,

LAB: number of class hours as average teaching load in return for base salary of school administrators,

HA: number of total class hours taught by school administrators.

HAU: number of total class hours taught by school administrators in unqualified fields,

HAH: number of total class hours taught by school administrators as honorarium, and

TA: number of teachers with administrative status as in equation (33).

Observed average teaching load of teachers (Table 2, columns 12-17).--

$$LTT_i(n) = \sum_{k=1}^{K} HT_{i,k}(n) \Big/ \sum_{k=1}^{K} TT_{i,k}(n) \qquad (42)$$

$$LTQ_i(n) = \sum_{k=1}^{K} [HT_{i,k}(n) - HTU_{i,k}(n)] \Big/ \sum_{k=1}^{K} TT_{i,k}(n) \qquad (43)$$

$$LTS_i(n) = \sum_{k=1}^{K} [HT_{i,k}(n) - HTH_{i,k}(n)] \Big/ \sum_{k=1}^{K} TT_{i,k}(n) \qquad (44)$$

where

LTT: number of class hours as average teaching load in qualified and unqualified fields of teachers, LTQ: number of class hours as average teaching load in qualified fields of teachers,

LTS: number of class hours as average teaching load in return for base salary of teachers,

HT: number of total class hours taught by teachers,

HTU: number of total class hours taught by teachers in unqualified fields,

HTH: number of total class hours taught by teachers as honorarium, and

TT: number of teachers without administrative status as in equation (33).

Need for Teachers

Need for teachers is in general the quotient of produced class hours divided by the average teaching load. Produced class hours is constant for a particular school in a particular year as long as the curriculum and the number of class sections remain unchanged. As to teaching load, the situation is different. The number of assigned teachers, which is not as stable as the number of class sections and the curriculum, defines teaching load. In other words, the number of produced class hours is independent of teaching load but the number of needed teachers depends on realized teaching load. Therefore, the number of needed teachers is inversely related to the size of realizable teaching load. The higher the degree of utilization of teachers, the smaller the number of needed teachers.

Consequently, calculation for the number of needed teachers is done in terms of observed and possible best rates of utilization, as follows:

Need for Teachers in Terms of
Observed and Best Rates
of Utilization
(Table 2, Columns 18 and 19)

$$TDO_i(n) = \sum_{k=1}^{K} [HP_{i,k}(n) - HAQ_{i,k}(n)] \;/\; LTQ_i(n) + C \qquad (45)$$

$$TDB_i(n) = \sum_{k=1}^{K} [HP_{i,k}(n) - HAQ_{i,k}(n)] \;/\; LTB_i(n) + C \qquad (46)$$

where

TDO: number of needed teachers in terms of observed rate of utilization,

TDB: number of needed teachers in terms of best rate of utilization,

HP: number of produced class hours as in equation (34),

HAQ: number of class hours taught by school administrators qualified to teach,

LTQ: average observed hours of teaching load as in equation (43),

LTB: hours of teaching load in terms of best utilization of teachers, and

C: constant to round the fraction.

<u>Teachers Expected to Leave the Profession in the Near Future</u>

To make an appropriate estimation for teachers needed in the future, one should know all possible information related to the loss of teachers in the future. One can get actual information on two kinds of loss of teachers expected to happen in the near future. One of them is retirement. By law, a teacher has the right to get a pension after 25 years of service. Therefore, to know the number of teachers who may leave the profession for pension in any year in the near future helps to take necessary measures in advance. The other is a temporary loss. Every male teacher should be drafted by the army by the age of 31. Although this loss is compensated by discharged teachers, there is a possibility of the number of discharged teachers to be smaller than the number of drafted teachers because of the time difference. In addition, the discharged teacher may not ask for a teaching job at public schools. Therefore, the number of above described teachers are counted by means of the following equation:

Expected Loss of Teachers in
the Near Future
(Table 2, Columns 22 and 23)

$$TL_i(n) = \sum_{k=1}^{K} [T25_{i,k}(n) + TM_{i,k}(n)] \qquad (47)$$

where

TL: number of teachers expected to leave teaching in the near future, T25: number of teachers with more than 25 years of experience, and

TM: number of teachers who are not yet drafted by the army.

Shortage or Surplus of Teachers

$$\text{DEFINITION:} \quad D - S = \begin{cases} -, & \text{surplus} \\ 0, & \text{best supply} \\ +, & \text{shortage} \end{cases}$$

where

D: number of needed teachers and

S: number of supplied teachers.

Because need for teachers was calculated in terms of observed and best utilization rates of teachers, shortage or surplus of teachers is also calculated in the same way, as follows:

Shortage or Surplus of Teachers
in Terms of Observed and Best
Rates of Utilizations
(Table 2, Columns 20 and 21)

$$SO_i(n) = TDO_i(n) - \sum_{k=1}^{K} TT_{i,k}(n) \tag{48}$$

$$SS_i(n) = TDB_i(n) - \sum_{k=1}^{K} TT_{i,k}(n) \tag{49}$$

where

SO: number of shortage or surplus of teachers in terms of observed rate of teacher utilization, SS: number of shortage or surplus of teachers in terms of best rate of teacher utilization,

TDO: number of needed teachers in terms of observed rate of teacher utilization as in equation (45),

TDB: number of needed teachers in terms of best rate of teacher utilization as in equation (46), and

TT: number of supplied teachers.

Section 3

This section is devoted to the cost of secondary education. Obviously, financial feasibility is a necessity for implementation in education. For this reason, cost of secondary education is included in the model, which is expected to be used to facilitate decision making on planning and implementation for secondary education. This section is prepared in five categories, as follows:

1. Cash expenditures,
2. Prorated cost,
3. Current cost,
4. Unit cost per student, and
5. Unit cost per class hour.

All values to be assigned to variables representing cost in subsequent pages are in Turkish liras.

Cash Expenditures
(Table 3, Columns A, B, C, D)

Cash expenditure is the money paid for services and for consumer goods. All possible cash expenditures from the budget in the Turkish secondary school system are included in four categories, as follows:

Salary for Professional Services (Table 3, Column A)

Included in this part are teachers, school administrators, lay teachers, and school service personnel such as doctors, psychologists, counselors, etc.

$$SPS(n) = \sum_{k=1}^{K} \sum_{i=1}^{I} [BSP_{i,k}(n) + SHT_{i,k}(n) + SLT_{i,k}(n) + SES_{i,k}(n)] \quad (50)$$

where

SPS: salary of professional manpower,

BSP: base salary of professional manpower,

SHT: honorarium,

SLT: salary of lay teachers, and

SES: salary for extra services such as workshop, administration, etc., and other payments such as children allowance, etc.

Salary for Nonprofessional Services and Miscellaneous Personnel Benefits (Table 3, Column B)

In this part, salary for nonprofessional personnel, such as clerks, employees, etc., and occasional personnel benefits of professional and nonprofessional manpower, such as medical treatment, etc., are included.

$$SNS(n) = \sum_{k=1}^{K} [BSN_k(n) + SEP_k(n) + SPP_k(n)] \tag{51}$$

where

SNS: salary of nonprofessional manpower and all occasional payments to all manpower,

BSN: base salary of nonprofessional manpower,

SEP: extra payments to nonprofessional personnel, such as overtime, children allowance, etc., and

SPP: all occasional payments, such as medical treatment, travel expenses, etc.

Cash Expenditures for School Operation
(Table 3, Column C)

In this part, cash expenditures for all kinds of needs for operation of schools except manpower are included. Through the uses of the items in the budget law, the equation for general purposes is prepared, as follows:

$$CDS(n) = \sum_{k=1}^{K} [CO_k(n) + CT_k(n) + CV_k(n) + CR_k(n) + CM_k(n) + CL_k(n) + CE_k(n) + CP_k(n)] \tag{52}$$

where

CDS: cash expenditures for school operation excluding manpower (if there are boarding students in the school, X in equation (53) should be used as a multiplier for the equation),

CO: cost of utility, such as electricity, etc., CT: cost of transportation and communication,

CV: cost of vehicle,

CR: cost of renting,

CM: cost of material,

CL: cost of library,

CE: miscellaneous cost, and

CP: cost of minor repairs.

Cash Expenditures for Boarding Facilities (Table 3, Column D)

The above equation can be used for a school without boarding students. If the school has boarding students, however, there is no direct way to separate certain kinds of costs common to both educational services and boarding facilities, such as electricity, water, heating, etc. However, one can make an approximate separation by establishing a base in terms of experiences, or uses of practiced ways in preparation of the budget, or of any appropriate representative cases. In any case, a means is needed to separate the costs for educational services and for boarding facilities. The following equation is prepared to facilitate separation of educational costs from the whole cost, including the boarding facilities. As the multiplier of the operation cost, the equation is correct whether or not the school has boarding students. Therefore, it is used as a regular multiplier in calculation for the operation cost without a need for the check statement in the computer program. The equation for the multiplier is as follows:

$$X(n) = 1/ \left[1 + \left(\sum_{k=1}^{K} SB_k(n)\right) / \sum_{k=1}^{K} ST_k(n)\right] * C \qquad (53)$$

where

X: parameter for separating boarding expenses from the melded school operation cost,

SB: number of boarding students,

ST: number of all students as in equation (31), and

C: constant representing the proportion of board expenses.

Notice that if the school has no boarding student, SB = 0, then X = 1. Then, being an identity element for the multiplication, (X) does not change the product. Hence, cash expenditure for boarding facilities can be calculated by means of the following equation:

$$CBO(n) = \sum_{k=1}^{K} [CF_k(n) + CC_k(n) + CA_k(n] + (1 - x) * CDS \qquad (54)$$

where

CBO: cash expenditure on boarding facilities,

CF: cost of food,

CC: cost of clothes,

CA: allowance to students,

X: a parameter as in equation (53), and

CDS: cash expenditure for school operation as in equation (52).

Prorated Cost

Included in prorated cost are investments in buildings, durable goods, and training professional manpower. Since it is a public asset virtually unlimited in expected productive life, building sites were not included in the prorated cost for school plants.

Obviously, to calculate prorated cost, investment costs should be known. However, in the Turkish system, one can hardly obtain real data on investment in education. Nevertheless, possible ways for approximated calculation for investment under given circumstances are employed here.

New school buildings are built by the Ministry of Public Works. School administrators and even the Ministry of Education are not regularly informed as to the cost of building. In fact, in the Turkish system, records are seldom kept concerning school construction costs. Therefore, to include the cost of building in a data-gathering questionnaire would not be helpful under present circumstances. Consequently, use of the unit cost schedule established by the State Planning Organization to calculate construction costs was assumed to be a more dependable and feasible procedure than requesting information from school administrators. The list of cost schedules is given in Table 10.

As for the durable goods, they have not been allocated precisely on the basis of unit costs. Since the amount of money in the budget is usually less than the actual need, the allocation to schools is in turn less than the requirement of the established unit cost. The real data on the cost of durable goods can be collected directly from schools.

To update the estimated investment cost, which is calculated on the basis of the purchasing power of the currency when the unit cost was established or when the item was purchased, a multiplier is included in the equation as the money adjustment rate.

Calculations and explanations for the three kinds of investment costs are as follows below.

Investment Cost of Buildings

In the budget laws, repair and restoration expenses of buildings are not counted as investment unless they exceed two million Turkish liras.[75] Regular repair or restoration cost of school buildings does not exceed such an amount of money. Therefore, repair and restoration costs were not included in investment except for annexing new buildings to create additional capacity.

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[75]Republic of Turkey, National Budget Law of 1971 Fiscal Year, p. 469.

TABLE 10--Cost Schedule Per Student by Educational Level Established by State Planning Organization. (*)

(At 1965 prices)

Educational Establishment	Building Investment to Create Capacity	Educational Equipment Investment to Create Capacity	Repair and Restoration Investment	Cash Expenditure (Per Year)
	(1)	(1)	(3)	(4)
Secondary Schools (General) :	2,000	300	50	1,000
High Schools (General) :	2,500	500	70	1,250
Technical Schools:	4,500	4,750	300	2,000
Teacher Training Schools :	7,500	1,500	150	3,500
Primary Teacher Training Schools :	6,000	1,250	125	2,000
Higher Education				
a. Technical :	7,500	7,500	400	8,000
b. Medicine :	6,000	5,000	400	5,000
c. Agriculture :	6,000	5,500	400	5,000
d. Other :	4,000	1,500	300	3,500

(*) State Planning Organization, Prime Ministry, Republic of Turkey, <u>Second Five Year Development Plan, 1968 - 1972</u>, Ankara, 1969, p. 198.

The accepted operational rationale for calculation of estimated cumulative cost of construction was as follows:

The desired and suggested class size of the Turkish secondary school system is forty students. Established unit cost of construction was counted as one classroom for forty students, although observed class sizes were not like this. Then the number of classrooms became the basis for the construction cost. Since it is sometimes a misleading matter, number of classrooms was not requested from schools. It was calculated through requesting the number of class sections and the shifting status of the school.

As to the boarding houses, the investment is calculated through multiplying the number of boarding students and the established unit cost.

Equations for approximated calculations for school buildings and boarding houses are prepared as follows:

$$ISB(n) = [\sum_{k=1}^{K} CS_k(n) / Z_k(n) * USI_k(n-a)] * Q * R \qquad (55)$$

$$IBB(n) = [\sum_{k=1}^{K} SB_k(n) * UBI_k(n - a)] * R \qquad (56)$$

where

ISB: estimated investment of Turkish liras in school buildings,

CS: number of class sections,

Z: shifting status of the school,

USI: unit cost of construction of school buildings,

n-a: the year in which unit cost was established,

Q: class size considered in establishing unit cost of construction,

R: adjustment rate of currency,

IBB: estimated investment of Turkish liras in boarding houses,

SB: number of boarding students, and

UBI: unit cost of construction of boarding houses.

Investment Cost of Durable Goods

Calculations for durable goods is expected to be done on the basis of collected data. Therefore, one expects the recorded value of durable goods is the actual price of the purchase. Accepted lifetime for durable goods is in general ten years. Then, assuming the purchase of durable goods is equally scattered over ten years, one may consider the value of all durable goods is recorded in the purchasing power of the money in the middle of the previous ten years, i.e., five years prior to the collection of data. The adjustment rate of currency is defined in terms of the currency five years before the data collection. Equations for investment costs of durable goods are as follows:

$$ISE(n) = \sum_{k=1}^{K} SE_k(n) * R \qquad (57)$$

$$IBE(n) = \sum_{k=1}^{K} BE_k(n) * R \tag{58}$$

where

ISE: actual value of school equipment,

SE: recorded value of school equipment,

R: adjustment rate of currency,

IBE: actual value of boarding school equipment, and

BE: recorded value of boarding school equipment.

Investment Cost of Professional Manpower

Professional manpower for education is trained in public schools. In addition, a great majority of the manpower is trained as boarding students. This implies that training of educational manpower is an investment of public funds similar to any investment for production. Therefore, expenditures on training manpower are counted as investment. However, the cost of general education (i.e., the higher education of secondary school teachers and other professional personnel such as administrators, counselors, psychologists, doctors, etc.) is not included in the investment cost here.

As for the cost of training professional personnel, the unit cost for the school as in Table 10 and the time period of the school are the bases of calculation for investment. Twenty-five years is considered as the amortization period of investment because a teacher or other professional personnel acquires the right for pension after completion of 25 years of service. Therefore, professional personnel with more than 25 years of service should not be included in the calculation for prorated cost. Then the equation for investment cost of training professional personnel is as follows:

$$IPP(n) = \left(\sum_{k=1}^{K} \sum_{i=1}^{I} [PP_{i,k}(n) - PP25_{i,k}(n)]*UPI_{i,k}(n) \right)*R \qquad (59)$$

where

IPP: investment in training professional personnel, in Turkish liras,

PP: number of professional personnel including teachers, administrators, and school service personnel,

PP25: number of professional personnel with more than 25 years of experience,

UPI: unit cost of training professional personnel, and

R: adjustment rate of currency.

Calculation for Prorated Cost

Prorated cost is the accepted yearly depreciation (or amortization) rate of value of investment. The legal way in bookkeeping is to include prorated cost in the cost of production or service requiring capital. Therefore, in calculation for cost of secondary education, to include prorated cost, not investment cost, is necessary. However, one may use investment cost to facilitate estimation in making plans for the future. In this study, prorated costs were included in calculation for the cost of secondary schools through utilization of the following equations:

Prorated Cost of School Facilities (Table 3, Column E)

Prorated cost of school buildings and durable goods used for education (not for boarding) are included in calculation for prorated cost of school facilities.

$$PSF(n) = ISB(n) * AB + ISE(n) * AE \qquad (60)$$

where

- PSF: prorated cost of school facilities in Turkish liras,
- ISB: estimated investment in school buildings as in equation (55),
- AB: depreciation (amortization) rate of buildings
- ISE: actual value of school equipment as in equation (57), and
- AE: depreciation (amortization) rate of durable goods.

Prorated Cost of Professional Manpower (Table 3, Column F)

Estimated expenditure of higher education for professional manpower is included in calculation for prorated cost of professional manpower.

$$PPP(n) = IPP(n) * AP \quad (61)$$

where

PPP: prorated cost of professional manpower,

IPP: estimated expenditure on training professional manpower as in equation (59), and

AP: estimated amortization rate of investment in training professional manpower.

Prorated Cost of Boarding Facilities
(Table 3, Column G)

Estimated cost of construction of boarding houses and actual value of durable goods used for boarding students are included in calculation for prorated cost of boarding facilities.

$$PBF(n) = IBB(n) * AB + IBE(n) * AE \quad (62)$$

where

PBF: prorated cost of investment in boarding facilities,

IBB: estimated investment in construction of boarding houses as in equation (56),

AB: amortization rate of buildings,

IBE: actual value of boarding equipment as in equation (58), and

AE: amortization rate of durable goods.

Current Cost

Current cost includes cost of consumption that is composed of cash expenditures and prorated costs. Equations were prepared to facilitate calculation for current costs of secondary education, as follows:

Current Cost of Educational Services (Table 3, Column H)

Current cost of educational services is composed of salary of professional and nonprofessional manpower and all other payments to school personnel, cash expenditures for school operation, and prorated costs of investments in school buildings, school durable goods, and training professional manpower.

$$CCE(n) = SPS(n) + SNS(n) + CDS(n) + PSF(n) + PPP(n) \qquad (63)$$

where

CCE: current cost of educational services,

SPS: salary of professional manpower as in equation (50),

SNS: salary of nonprofessional manpower and all occasional payments to all manpower as in equation (51),

CDS: cash expenditures for school operation as in equation (52),

PSF: prorated cost of school facilities as in equation (60), and

PPP: prorated cost of training professional manpower as in equation (61).

Current Cost of Boarding
Facilities
(Table 3, Column I)

Included in current cost of boarding facilities are prorated cost of boarding houses and durable goods for boarding services, and cash expenditures spent on boarding facilities.

$$CCB(n) = CBO(n) + PBF(n) \tag{64}$$

where

CCB: current cost of boarding services,

CBO: cash expenditures on boarding facilities as in equation (54), and

PBF: prorated cost of investment in boarding facilities as in equation (62).

<u>Unit Cost</u>

Unit cost is one of the essential criteria for comparisons, evaluations, and cost analysis of the educational enterprise. Included in this section are unit costs per student and per class hour.

Unit Cost Per Student

Unit cost per student was calculated in terms of educational and boarding services separately. Equations for unit cost per student are as follows:

Unit cost of educational services per student (Table 3, column J).--

$$UES(n) = CCE(n) \; / \; \sum_{k=1}^{K} ST_k(n) \qquad (65)$$

where

UES: unit cost of educational services per student,

ST: number of all students as in equation (31), and

CCE: current cost of educational services as in equation (63).

Unit cost of boarding services per student (Table 3, column K).--

$$UBS(n) = CCB(n) \; / \; \sum_{k=1}^{K} SB_k(n) \qquad (66)$$

where

UBS: unit cost of boarding services per student,

CCB: current cost of boarding services as in equation (64), and

SB: number of boarding students.

Unit Cost Per Class Hour

One may calculate unit cost per class hour in terms of either the proportions of constituent costs (such as teaching activities, school operation, and prorated cost) or the fields or the group of fields, or both. In this study, equations were prepared to calculate average cost for one hour of courses in terms of cash expenditures on professional manpower, school operation, and prorated cost, and on average cost of teaching manpower per hour of selected groups of courses.

Average cost for one hour of courses (Table 3, columns L, M, N).--

$$UCT(n) = SPS(n) \;/\; [\sum_{k=1}^{K} \sum_{i=1}^{I} HP_{i,k}(n)] * W(n) \tag{67}$$

$$UCO(n) = [CDS(n) + SNS(n)] \;/\; [\sum_{k=1}^{K} \sum_{i=1}^{I} HP_{i,k}(n)] * W(n) \tag{68}$$

$$UCP(n) = PSF(n) \;/\; [\sum_{k=1}^{K} \sum_{i=1}^{I} HP_{i,k}(n)] * W(n) \tag{69}$$

where

UCT: average cost of teaching activities per hour,

UCO: average cost of school operation per hour,

UCP: average prorated cost per hour,

HP: weekly produced class hours as in equation (34),

SPS: salary of professional manpower as in equation (50),

W: number of weeks in the school year,

CDS: cash expenditure for school operation as in equation (52),

SNS: salary of nonprofessional manpower and all occasional payments to all manpower as in equation (51), and

PSF: prorated cost of educational services as in equation (60).

Average cost of teaching manpower per hour of selected group of courses (Table 3, columns O, P, Q, R).--

Since selected courses are grouped, the index "i" for fields is not appropriate and a new notation to replace "i" is needed here. For this reason, "p" is used to refer to groups of courses and "m" to refer to fields in the groups. The equation to calculate average cost of teaching manpower per hour of a selected group of courses is as follows:

$$UCH_p(n) = \sum_{k=1}^{K} \sum_{m=1}^{M} BST_{p,m,k}(n)/[\sum_{k=1}^{K} \sum_{m=1}^{M} \sum_{j=1}^{J} [HP_{p,m,j,k}(n)]*W(n) \qquad (70)$$

$$m = 1, 2, \ldots, M \qquad O < M < 7$$

$$p = 1, 2, \ldots, P \qquad O < P < 5$$

where

UCM: average unit cost of teaching manpower per hour,

BST: yearly salary of teachers,

HP: weekly produced class hours as in equation (34),

W: number of weeks in the school year

m: corresponds to fields in groups,

p: corresponds to each of the groups,

p = 1: humanities (Turkish and the social subjects in the first cycle and Turkish literature, history, and geography in the second cycle),

p = 2: mathematics and sciences (mathematics and general science in the first cycle and mathematics, physics, chemistry, and biology in the second cycle),

p = 3: foreign languages (English, French, and German in both cycles), and

p = 4: courses of skill (music, physical education, drawing, and handicraft in both cycles).

Summary

In the Turkish education system, the procedure for recording, collecting and processing data is not adequate to answer today's needs. To improve present procedure and to convert it into a modern and computerized information system is not an easy job, even when the authorities intend to do so. Nevertheless, it is not feasible any longer to defer adopting scientific approaches to the solution of educational problems, waiting until a modernized information system has been realized. Instead, we should start now utilizing scientific techniques and struggling for solutions with whatever information is obtainable under present circumstances. This very struggle is expected to help achieve improvements, not only for education itself, but also for the development of needed information system in education.

Two main things were taken into consideration in developing the descriptive model presented in Part 2 of this chapter. First, all variables which were perceived to be needed in dealing with the problem under concern were included in the model, regardless of whether or not related data were obtainable. Second, where data were unobtainable, equations (which would be unnecessary otherwise) were included in the model in order to calculate estimated values for those variables for which data were either irretrievable or not regularly recorded.

The model was applied to the province of Eskişehir. An English version of the questionnaires which were mailed to secondary school directors and teachers is included in Appendix A. Collected data was evaluated and tabulated by computer. Three kinds of tables related to each of 21 municipalities in the province and to the province as a whole are included in Appendix B. Notes in parentheses immediately under headlines above for the descriptive model refer to the title number of the table and to the column(s) in that table in Appendix B, as related to the equation(s) below the headlines.

The model, which was applied in this case to a single province, may also be utilized for an individual school, or for any of the other 66 provinces of the country as well. The expected use of the model is to provide as accurately as possible information related to the need and supply of secondary school teachers, so that (a) needed parameters for a simulation model for planning or for other studies may be obtained, and so that (b) current actual situations can be discovered promptly and kept up to date. Results obtained from an initial pilot application of the model are presented in the next chapter.

CHAPTER VI

EVALUATION OF FINDINGS IN THE APPLICATION OF THE MODEL

Introduction

As was mentioned in Chapter I, the model presented in Part 2 of Chapter V was applied to the province of Eskişehir which has all kinds of variables included in the model. Because the province was selected on a nonrandom basis, findings in utilization of the model for Eskişehir should not be generalized for Turkey.

Findings were interpreted with the assumption that data input to computer has no error except chance error. Since the essential aim is to demonstrate the utilization of the model, any undesired or unexpected error due to the original sources or to the process of transferring data from questionnaires to punch cards are not a matter of concern in this study. However, if the model is to be used to evaluate the state of the system, it will be essential to assure dependability of data input to computer.

Geographic and Demographic Circumstances of the Province

Eskişehir is one of the inner provinces immediately west of Ankara. According to the census of 1970 the population of the province was 463,458, which is 1.3 percent of the entire population of the country. As to the population of secondary school students, the number was 26,679, i.e., 1.9 percent of the entire student population of the country in the 1971-1972 school year. This implies that the school attendance rate at the secondary level is somewhat higher in this province than the average for the country.

Taking administrative divisions and demographic characteristics into consideration, municipalities with secondary school in the province can be classified in three groups: city, town, and village. In terms of these three groups, figures related to the population and students may be tabulated as shown in Table 11. Implications of this table are that (a) a sizable portion of the population resides in rural areas, and (b) the opportunity for secondary education for children in the rural areas appears to be drastically less than for the urban children.

TABLE 11.--Groups of Municipalities With Their Demographic Characteristics in the Province of Eskişehir.

	City	Town	Village	Total
Number of municipalities	1	7	13	21
Population*	216,330 (46.7)	33,903 (7.3)	213,225 (46.0)	463,458 (100.0)
Number of students*	20,693 (77.6)	4,261 (15.9)	1,725 (6.5)	26,679 (100.0)

*Figures in parentheses refer to percentages.

The findings in the printouts (see Appendix B)[76] will be discussed and evaluated in terms of need and supply of secondary school core subject teachers. The word "demand" in the printout tables was used interchangeably with the word "need."

Procedures for Collecting and Processing Data

Data collection was carried out in a manner similar to that by which the Ministry of Education regularly collects its data. Forms for requested data were mailed

[76]Only the tables for the largest municipality, Eskişehir, and one small municipality, Bozan, plus the aggregate tables for the province as a whole are presented in Appendix B, simply to illustrate the form in which the data were rendered in the printouts. Complete data are on file in the Planning, Research, and Coordination Office of the Turkish National Ministry of Education.

to all of Eskişehir's 42 secondary schools, to be filled out by teachers and school directors so as to represent the circumstances on May 2, 1972. Completed forms from all schools except one were received in six weeks. After coding the items in the forms, the data were transformed to punch cards and processed through an IBM 360 digital computer at the Middle East Technical University in Ankara. English and Turkish versions of the forms and their directions are included in Appendix A. A few items included in the forms were neither needed nor used in this study. However, they were included in the forms assuming that, if needed, further studies related to the scope of this study might be facilitated.

Using collected data through utilizing the mathematical model presented in the preceding chapter, three kinds of tables were obtained from the computer for each individual school and for the municipalities as well.

Corresponding to the number of municipalities with secondary schools, the tables were numbered from 1 to 21 and number 22 was given to the tables for aggregate calculations for the province as a whole. For example, the numbers 1-5, 2-5, and 3-5 at the top of tables refer to the three kinds of tables for the same municipality, "GUNDUZLER," which was numbered 5. Explanations for headings and columns of the three kinds of tables were added to the beginning of Appendix B.

The three kinds of tables for each municipality were arranged as follows:

Table 1 includes data on produced class hours and how they are supplied. Numbers of all students, boarding students, and class sections in the province were printed over the tables.

Table 2 includes data on need and supply of teachers and related information. Ratios of student/teacher, teacher/class section, and student/class section were printed over the tables.

Table 3 was devoted to the cost analysis.

Tabulations and calculations for each kind of table were carried out as follows.

<u>Table 1</u>

Produced class hours and teachers assigned to these class hours were included in Table 1. Since subject matter and fields of teachers do not entirely correspond, the table could not be arranged so as to use the same code numbers for fields of teachers in the rows and subject matter in the columns. For example, physics courses were included in column 25, whereas there are three types of teachers certified to teach physics: (1) mathematics-physics, (2) physics, and (3) physics-chemistry, which were included in rows 22, 24, and 25, respectively. Thus, if the number of class hours of a particular course and the type of teachers assigned to teach that course is the concern, the column devoted to that course in Table 1 should be examined. If utilization of a particular type of teacher, i.e., teaching assignment of the teacher in his certified and/or uncertified fields, is the concern, the row devoted to that particular type of teacher in Table 1 should be examined.

Table 2

Need, supply and utilization of teachers were included in Table 2 by using data from the corresponding Table 1s.

As was mentioned before, since fields of teachers and subject matter in the curriculum do not correspond, a few courses and fields of teachers were grouped to facilitate calculations for Table 2. For example, there are physics-mathematics and physics-chemistry teachers in addition to the teachers qualified to teach any single one of these courses. Therefore, to include these three courses (physics, mathematics and chemistry) and their certified teachers into one broad subject, such as science, facilitates calculations. This kind of arrangement was done for Table 2.

When this study was carried out, compulsory teaching hours of teachers were three hours more than as presented in Table 9 on page 161. For this reason, one expects that calculations for needed numbers of teachers in this study may differ somewhat from calculations under present circumstances.

In the calculation for needed numbers of teachers, equations (45) and (46) on page 165 were used. For the purpose of explanation, those equations may be simplified in one equation, as follows:

$$X/Y + A = \text{Needed number of teachers}$$

where

X: corresponds to the number of course hours to be taught by teachers without administrative duty,

Y: corresponds to the teaching load in number of course hours. For the best utilization of teachers, numbers assigned to Y were 23 in the second cycle and 26 in the first cycle.

A: A constant to properly round the calculated number of needed teachers. In this study, A = .65. This means that one teacher is counted for over 7 hours in the second cycle and 8 hours in the first cycle.

In the calculation for needed teachers, the following assumption was taken into consideration:

The circumstances in terms of the number of administrators and of their teaching loads will not significantly change during the school year.

Thus, numbers of needed teachers and of shortage of teachers were calculated through counting only those teachers without administrative duty. This calculation was preferred because the assumption reflects, more or less, the real world and there is not a stable ratio between number of teachers with and without administrative duty. The preferred way of calculation seemed to be more practical and reliable in terms of establishing a basis to estimate needed teachers. Then one may add the number of administrators to the estimated number of teachers if needed.

Table 3

Cost analysis of secondary education is presented in Table 3. All kinds of expenditures, except for prorated costs of school plants and trained professional manpower, were calculated on the basis of collected data from schools. The mentioned prorated costs were calculated on the basis of the unit cost presented in Table 10 on page 175. Thus variations of unit costs among schools are the results of varying rates of teacher supply, stock of durable goods, and financial provisions, and average class sizes as well.

Evaluation of Findings

One may evaluate and use the findings from the application of the model for varying purposes. As was mentioned before, the ultimate purpose of this study was to demonstrate a scientific method and tool in order to facilitate effective approaches in coping with the nationwide chronic problem of core subject teacher supply in the Turkish secondary school system. An adequately scientific tool should be able to provide realistically approximate answers to at least the following five questions:

1. What are the present circumstances (the existing state of the system) from which to start approaching the solution of the problem?

2. What may be the trends of the problem throughout the future period of concern?

3. What criteria may be used to facilitate realistic nationwide aggregate approximations of the need for teachers in the future?

4. What may be the financial aspect of and, if they exist, the economical benefits from each of several alternative solutions of the problem?

5. What may be the means and/or tools to follow up and evaluate the results of implementation in terms of the goals throughout the period of concern?

An answer to the first question is expected to be obtained through application of the model presented in Part 2 in Chapter V. This answer also facilitates obtaining an answer to the fifth question by comparing the findings with estimated goals in the concerned year. Answers to the second, third, and fourth questions may be obtained by means of scientific and realistic evaluations of the answers to the first question throughout the domain of years. Answers to questions three and four require one also to employ a mathematical model similar to the one presented in Part 1 in Chapter V. It may be repeated that (a) this study was devoted only to the quantitative aspects of the problem, (b) the models presented in this study are open to modifications or changes whenever they may be needed, and (c) the method presented in this study should not be counted as the only feasible approach to solve the problem.

Findings in the present application of the model for the province of Eskişehir are briefly reviewed in order to search for a province-wide answer to the first question. This answer contains, as it should, information on the state of the system on May 2, 1972, in terms of (a) need and supply of teachers and (b) the cost of secondary education.

Need and Supply of Teachers

Need and supply of teachers are defined by (a) produced class hours, (b) available teachers, and (c) the rate of teacher utilization. The first two variables are defined by long-range decisions by the central Ministry of Education and are not subject to manipulation during the implementation. The third variable, however, is manipulated by means of administrative decisions at two levels. First, the central Ministry of Education is responsible for assigning available teachers to schools. Second, the local administration is responsible for assigning classes to teachers under existing conditions. Therefore, the immediate benefit from the application of the model may be obtained by examining the rate of teacher utilization, which affects the rate of teacher supply, which in turn eventually affects the number of needed teachers. Table 2s are used for this purpose, as follows:

In Table 2s, the estimated numbers of needed teachers for each field in terms of observed and optimal rates of teacher utilization are included in Columns 18 and 19, respectively. Then, the differences between the numbers of needed and supplied teachers are included in Columns 20 and 21. (Number of supplied teachers is the sum of the numbers in Columns 10 and 11.) In other words, shortage of teachers in terms of observed and optimal rate of utilization are included in Columns 20 and 21, respectively. As was explained in connection with equation (47) in Chapter V, the meaning of the results in the calculation for the shortage of teachers would be "satisfactory" for zero, "shortage" for plus numbers, and "surplus" for minus numbers.

In order to illustrate how to use the tables and how to interpret the findings, the circumstances related to science teachers will be discussed here. First, however, the following fact in the real world should be taken into consideration:

On the one hand, the first cycle teachers are not formally certified to teach at the second cycle. On the other hand, they are permitted to teach at the second cycle because of the chronic shortage of second cycle teachers. In rare instances, the opposite practice may also be observed. In calculation for Columns 18 and 19 in Table 2s, formal certification of teachers rather than the above mentioned practice was counted. This may affect the calculated number of needed teachers in terms of observed rate of teacher utilization. However, in spite of this inconvenience, which may be eliminated through using Table 1s, this calculation was preferred because (a) to teach at the other cycle does not change the certification status of teachers and (b) the actual characteristics of the stock of teachers should be known. To include both the theoretical and practical situations in one line would create a space problem in the printouts.

Now the findings in terms of need and supply of science teachers in the province of Eskişehir may be evaluated as follows:

Review of Columns 20 and 21, and Rows 2 and 18 in Table 2s indicate that schools of eight municipalities among 21 have problems of either supply or utilization of science teachers. This situation may be tabulated as shown in Table 12.

Code numbers of municipalities in this table are the numbers shown with the table numbers on the printouts.

Subtotal 1 in Table 12 for the first four municipalities implies that the needed additional numbers of science teachers are 11 at the first cycle and 41 at the second cycle, in terms of the observed rate of teacher utilization. At the same time, there is an excess of 14 teachers for the first cycle, while 37 additional teachers are needed for the second cycle, in terms of optimal rate of teacher utilization.

Since these four municipalities have second cycle level schools, 14 of the first cycle teachers are likely or may be available to teach also at the second cycle. Indeed, looking at Table 1s for the same municipalities, Rows 4, 5, and 6 (first cycle science teachers) and Columns 23, 25, and 26 (second cycle science courses) indicates that first cycle science teachers do teach science courses at the second cycle. Hence, assuming the 14 first cycle teachers are fully utilized at the second cycle, and subtracting 14 from 41 and 37, the results will be 27 and 23, respectively. After this calculation, one may conclude that the calculated shortage of teachers is 11 at the first cycle and 27 at the second cycle in terms of observed rate of teacher utilization. In terms of optimal rate of teacher

TABLE 12.--Teacher Supply and Utilization Problems Occurring in Eight Municipalities in the Province of Eskişehir.

Municipalities		Shortage of Teachers in Observed Utilization		Shortage of Teachers in Optimal Utilization	
Code No.*	Name	First Cycle	Second Cycle	First Cycle	Second Cycle
A. Municipalities With First and Second Cycle Schools.					
1	Eskişehir	8	31	-12	28
11	Mahmudiye	1	3	-1	3
12	Mihaliccik	1	4	0	3
19	Sivrihisar	1	3	-1	3
	Subtotal 1	11	41	-14	37
B. Municipalities With Only First Cycle Schools.					
2	Inonu	0	--	-1	--
6	Muttalip	0	--	-1	--
8	Kayi	2	--	-1	--
13	Beylikahir	1	--	0	--
	Subtotal 2	3	0	-3	--
	Grand Total	14	41	-17	37

*Code numbers of municipalities are the numbers shown with the table numbers on the printouts.

utilization, however, the numbers of shortage of teachers are zero for the first cycle and 23 for the second cycle. One may summarize that the numbers of needed science teachers at both first and second cycles are 38 in terms of observed and 23 in terms of optimal rate of teacher utilization in the four municipalities. The difference between the two numbers is 15. That is, at the observed rate of teacher utilization, there is a loss of teaching manpower equivalent to 15 teachers in the field of sciences.

As to the four municipalities with only first cycle schools, Subtotal 2 in Table 2 implies that the schools are under-supplied by 3 teachers in terms of observed rate and over-supplied by 3 teachers in terms of optimal rate of teacher utilization. Thus, the loss of teaching manpower is equivalent to 6 teachers in the observed rate of teacher utilization. Together with the first four schools, the loss of teaching manpower is equivalent to 21 teachers in the field of sciences in the province.

Obviously, the cells constituted by Columns 20 and 21, Rows 2 and 18 in Table 2-22 in Appendix B include the same figures as in the corresponding cells in the Grand Totals in Table 12 above. Therefore, Table 2-22, which was prepared for the province as a whole, seems to be sufficient to examine the situation in terms of the need and supply and the utilization of teachers for an aggregate conclusion. However, one notices a difference relating to the loss of teaching manpower in observed rate of teacher utilization as between the aggregate and disaggregate conclusions, as follows:

In the disaggregate conclusion, municipalities with and without second cycle secondary schools were counted separately and the calculated loss of teaching manpower was equivalent to 21 teachers in both cycles. The similar conclusion derived from the aggregate tabulation is that the figure for the loss is 18. This is because the number for excess first cycle science teachers is 17 in the aggregate tabulation, which does not include a separate calculation for the first and second cycles, as was done in the disaggregate calculation. Subtracting this number 17 from 14 plus 41 and from 37 the results are 38 and 20. Hence the difference between these two numbers; i.e., the calculated loss of teaching manpower in the observed rate of teacher utilization is found to be 18 in the aggregate calculation, instead of 21 as in the disaggregate calculation. In any case, the calculated base figures to represent the state of the system are the same in both aggregate and disaggregate calculations.

All in all, terms of approximating the actual state of the system, nothing is lost in using the aggregate tabulation to examine the need, supply, and utilization of teachers in the province.

Implications of Table 13

Table 13 examines the state of the system in terms of need, supply, and utilization of secondary school core subject teachers in the province at the given time.

Table 2 in the printouts and Table 13, below, were arranged to facilitate examining the situation of teacher supply and utilization in terms of the school levels for which core subject teachers are in practice formally categorized into three groups. These groups were separated from one another by code numbers 4, 12, and 20 in Table 2 and by partial totals numbered from 1 to 3 in Table 13.

As explained before, because certified fields of teachers and courses actually taught at schools do not entirely correspond to each other, some of the courses and fields of teachers listed in Table 7 are presented in broad fields in Table 2, in order to avoid space problems and an unncessary and impractical tabulation in the printouts. Table 13 includes data from Table 2-22 in Appendix B.

In Table 13, the numbers of supplied teachers excluding administrators are included in Column (4). Needed numbers of teachers in terms of observed and optimal rates of teacher utilization are included in Columns (5) and (6), respectively. Numbers in Columns (7) and (8) are the differences between numbers in Columns (5) and (4), and (6) and (4), respectively. In Columns (5) and (6) a minus number means an over-supply of teachers (surplus)

TABLE 13--Aggregate Calculation for Need and Supply of Secondary School Core Subjects Teachers in the Province of Eskisehir. (From Table 2-22 in Appendix B)

Fields of Teachers		Supply		Need for Teachers		Shortage of Teachers		Teachers With Seniority
Code No. (1)	Fields (2)	Adm. (3)	Teachers (4)	Observed Utiliz. (5)	Optimal Utiliz. (6)	Observed Utiliz. (7)	Optimal Utiliz. (8)	(9)
1	Humanities	43	121	153	127	32	6	13
2	Science-1, Math.-1	50	150	164	133	14	-17	4
3	Religion	1	12	17	13	5	1	0
Total 1:	Fields in the First Cycle	94	283	334	273	51	-17 7	17
5	English	0	38	54	52	16	14	2
6	French	2	18	20	18	2	0	1
7	German	4	14	15	16	1	2	0
8	Physical Education	7	10	18	20	8	10	1
9	Handicraft-Drawing	7	23	46	46	23	23	3
10	Home Economics	0	22	32	27	10	5	1
11	Music	1	9	19	22	10	13	0
Total 2:	Fields in Both Cycles	21	134	204	201	70	67	8
13	Turkish Literature	3	15	34	34	19	19	0
14	Geography	2	18	14	10	-4	-8	0
15	History	4	18	19	15	2	-2	0
16	History of Arts	1	2	4	3	2	1	0
17	Biology	0	11	15	10	4	-1	1
18	Science-2, Math.-2	3	35	76	72	41	37	1
19	Philosophy	6	10	12	11	2	1	2
Total 3:	Fields in the Second Cycle	19	109	174	155	-4 70	-11 58	4
GRAND TOTAL		134	526	712	629	-4 191	-28 132	29

and a plus number means an additional need for teachers (shortage). Column (9) includes numbers of teachers with seniority, i.e., with 25 or more years of experience, who are expected to leave the profession in the near future.

Now, without becoming involved in disaggregate evaluation, one may draw certain implications from Table 13 in terms of need and supply of teachers as follows:

1. <u>The first group of fields</u>: Fields in the first group are exclusively for the first cycle level of general secondary schools. However, teachers for this group may be allowed to teach in their field at the second cycle.

The shortages of teachers in humanities seems to be 32 and 6 in terms of observed and optimal rates of teacher utilization, respectively. It means at first glance that under-utilized teaching manpower in humanities is equivalent to 26 teachers (the difference between 32 and 6).

Looking at Column 13 and Table 2-22 one sees that the overall average teaching load is 26.6 hours a week, i.e., .6 hours more than the established criterion in calculation for this group of fields. But since the average load in the humanities field is 20.3 hours (see Column 15 in Table 2-22), the calculation implies an under-utilization of teachers in humanities. The difference between 26.6 and 20.3 (i.e., 6.3 hours of teaching load) may include, however, courses in teachers' field taught at the second cycle of schools. Insofar as this is so, the difference should not be counted as an under-utilization of teachers. There are 13 teachers with seniority in humanities.

In the same manner, the field of Science 1-Mathematics 1 seems to be over-supplied by 17 teachers in terms of optimal utilization and under-supplied by 14 teachers in terms of the observed rate of teacher utilization. Again, teachers in these fields may (as in fact they are) be utilized at the second cycle of schools. Four teachers have seniority in this field.

The actual situation in utilization of teachers in the above two fields may be further discerned through using Table 1 of the printouts and this will be done later. As for the field of religion, the calculated overall average teaching load is 22.8 hours. The load is 18.3 hours in the teachers' field. As seen in Table 13, the course is exclusive to the first cycle and additional numbers of needed teachers is 5 in terms of observed and 1 in terms of optimal rates of teacher utilization. Hence, there exists loss of teaching manpower equivalent to 4 teachers in this field.

2. <u>The second group of fields</u>: The second group of fields exists at both first and second cycle levels of schools. Teachers for this group are allowed to teach at

both cycles of schools. Examining the figures in the same manner as above, one can conclude that observed and optimal rates of teacher utilization are very close to each other in the fields in the second group. Table 13 as well as Column 15 in Table 2-22 in Appendix B implies that:

(a) Except in the case of French and German, teachers for the fields in the second group are under-supplied in varying degrees.

(b) There exists some under-utilization of teachers in the fields of English, French and Home Economics.

(c) The rate of teacher utilization is equal to the established criteria in Handicraft-Drawing and higher than the expected rate of teacher utilization in the fields of German, physical education, and Music.

Looking at the total for the fields in both cycles the total supplied number of teachers is approximately two-thirds of needed teachers in the second group. The shortage of teachers is about half of the need in the fields of physical eduation, Handicraft-Drawing, and Music. The total number of teachers with seniority is 8 in this group.

It may be noticed that in more than half of the municipalities no teacher is counted for more than half of the fields in the second group, and because of that the number of weekly course hours in the fields is too small to count a teacher on the basis of the established criteria.

3. The third group of fields: Fields in this group are exclusive to the second cycle level of secondary

schools. Geography, history, and biology teachers are over-supplied and, in turn, under-utilized. A large shortage (more than 50 percent of need) occurs in the fields of Turkish Literature and Science 2-Mathematics 2. One may observe an under-utilization of teachers at varying rates in every field except Turkish Literature. In terms of totals, the number of supplied teachers in the third group is 109, whereas the number of needed teachers is 174 in terms of observed and 155 in terms of optimal rates of teacher utilization, respectively. In other words, the number of supplied teachers is about 63 percent and 70 percent of calculated numbers of teachers in terms of observed and optimal rates of teacher utilization, respectively. The total number of teachers with seniority in the third group is 4.

In terms of grand totals, one may observe that the number of supplied teachers excluding administrators is 526 in the province of Eskişehir, whereas the calculated number of needed teachers is 712 and 629 in terms of observed and optimal rates of teacher utilization, respectively.

An imbalanced supply of teachers in terms of relative ratios among numbers of produced class hours in the various fields seems to be another aspect of the problem. One may notice that the number of needed teachers is unnecessarily high because of ineffective rates of teacher utilization.

There seems to be another problem that may be mentioned here. The number of school administrators is 134 (see Column 3 in Table 13) for 41 schools in the province. This number is 87 for 17 schools in the municipality of Eskişehir. (See Row 21, and Columns 2 and 3 in Table 2-1 in Appendix B.) In other words, there are 87 administrators for 17 schools (an average of 5 administrators per school) in the largest municipality, and 47 administrators for 24 schools (2 administrators per school) in the remaining 20 municipalities. This means that about 20 percent of available teachers are employed in school administration with their small loads of teaching; there may be a need for reconsideration of present practices of assigning teachers to school administration duties.

In summary, the dimensions of the problems mentioned in Chapters III and IV may be observed in practice by these means, as demonstrated by the above application to the province of Eskişehir. As indicated at several points above, these particular data for Eskişehir may not be altogether reliable, precise or representative. But the above demonstration indicates that the method is feasible.

After the discussions of aggregates above, a few examples may be given of ways of examining improper supply and ineffective utilization of teachers revealed by disaggregate tables, as follows:

1. Examples of improper supply of teachers: Supply of teachers to schools, and in turn to municipalities, is the responsibility of the National Ministry of Education. To keep wife and husband together in one residential area may be a legitimate excuse for improper supply of teachers. There are cases in Eskişehir, however, where such an excuse may not be claimed. For example:

(a) There are 3 science and mathematics teachers for 57 hours of courses in Inonu.

(b) There are 2 male teachers for 35 hours of science and mathematics courses of which 16 hours are taught by lay teachers in Kayi.

(c) There are 3 male teachers for 20 hours of humanities in Kadikuyusu.

(d) There are 2 female teachers for 8 hours of home economics courses in Saricachaya.

(e) There are 3 male and 1 female humanities teachers for 77 hours in Seyitgazi.

In short, in spite of the fact that there were needs for certain teachers in other municipalities and/or in other provinces, more teachers than were needed were assigned to certain of the municipalities in the province.

2. Examples of Ineffective Utilization of Teachers: Utilization of teachers is the responsibility of local administrators. However, the National Ministry of Education has the right to control the utilization of teachers, and for this reason thousands of tabulated reports are

mailed to the Ministry. Nevertheless there are examples of teachers who are not utilized at the possible and expected rates.

The reliable way to detect the rate of teacher utilization is to compare the figures in Columns 13 and 15 in Table 2 of the printouts. Column 15 includes average hours of teaching load per teacher in their certified field. Column 13 includes overall average hours of teaching load per teacher, including loads in and out of their certified field. Differences between the figures in these two columns means that teachers teach courses other than their certified field. However, existence of such a difference does not always mean misutilization or under-utilization of teachers, because in many cases teachers may have more than enough time to teach in their field and then may teach other courses out of the certified field. The actual situation may be detected by using Table 1 together with the corresponding Table 2 of the printouts. For example:

(a) Eskişehir city is the largest municipality in the province and has 17 secondary schools. Therefore this city by all means provides a possibility for optimal teacher utilization.

Comparing figures in Column 15 with corresponding figures in Column 13 in Table 2-1 in Appendix B, one sees that there are teachers in all fields except German who teach courses out of their field. Through reviewing Table 1-1 in Appendix B, a few examples among many may be given as follows:

--On the one hand, humanities teachers (Columns 1, 2 and 3) teach various kinds of courses out of their field, even history and geography, in spite of the fact that there are more teachers than needed in these other fields. At the same time a number of courses in humanities (Columns 4 and 5 and Row 35) are taught by lay teachers.

--Turkish Literature teachers teach Handicraft-Drawing and Music (Row 16, and Columns 15 and 17) in spite of the fact that a number of Turkish Literature courses are taught by other teachers and lay teachers as well (Column 18).

--In spite of dire need for them, 2 Physics teachers teach only 32 hours (Row 24); Chemistry teachers (Row 23) teach English, Geography and Physics (Columns 11, 22, and 25); Mathematics-Physics teachers (Row 22) teach Science, Agriculture Commerce, and Chemistry (Columns 8, 9, and 26); and so on.

One might conjecture that teachers tend to teach courses out of their field to satisfy their hobby or personal interests. It is empirically known, however, that most teachers prefer to teach courses out of their field at his/her own school, rather than to travel across town to another school to teach in his/her field. Although it is against regulations, school administrators acquiesce and collaborate with teachers in this practice, which causes an already existing teacher shortage problem to grow worse.

(b) Misutilization of teachers may be observed also in other municipalities. A few examples are as follows:

--Two science teachers in Alpu teach 36 hours of science and mathematics while the additional 4 hours are taught by lay teachers.

--There are two science and mathematics teachers for 35 hours in Kayi. Sixteen hours of the 35 hour courses are nevertheless taught by lay teachers.

--There is one science teacher teaching no science while 18 hours of science courses are taught by lay teachers in Han.

--In Mahmudiye, one religion teacher teaches English and, meanwhile, English teachers teach 8 hours of Turkish.

--In Mihaliccik, one mathematics-2 teacher teaches mathematics 10 hours at the second and 12 hours at the first cycle, and 8 hours physical education, while 49 hours of mathematics-2 are taught by lay teachers.

--In Beylikahir, 20 hours of humanities are taught by lay teachers and humanities teachers teach 51 hours out of their field.

Summary

Findings from this application of the model for need and supply of core subject teachers of secondary schools in Eskişehir may be summarized as follows:

The numbers of needed secondary school core subject teachers in the province of Eskişehir at large are 712 and 629, in terms of observed and established optimal rate of teacher utilization, respectively, whereas the number of supplied teachers is 526. Hence the proportion of supply is about 74 percent and 84 percent of calculated needs in terms of observed and optimal rates of teacher utilization. One should notice that no need for a teacher was counted if the number of weekly course hours was less than 9 at the first cycle and 8 at the second cycle levels of schools.

As Table 13 reveals, the shortage of teachers is around 50 percent in about one-third of the fields taught at secondary schools. Imbalanced supply and ineffective utilization of teachers, as well as assignments of large numbers of school administrators, result in a teacher shortage problem which is more intense than it needs to be.

Twenty-nine teachers, i.e., 5.5 percent of the supplied core subject teachers in the province, have more than 25 years of experience in public service.

Cost Analysis

Cost analysis is needed for an effective educational enterprise for at least two reasons: first, so as to be able to take necessary measures in effecting the inevitable compromises between demands for education and the available financial resources of the society; and second, so as to be able to examine relationships between the cost of varying combinations of interactions and the quality of their outputs under varying conditions. This latter effort may also help to provide useful quantitative criteria for measuring the quality of educational outputs. The greatest benefit from utilizing a cost analysis lies perhaps in the search for a way in which the best possible educational opportunities may be provided by means of available or potential financial resources.

The funds paid from the 1971 and 1972 national budget in the province of Eskişehir for general education at the secondary level may be itemized, as follows (see Table 3-22 in Appendix B):

1. Cash Expenditures	34,960,074.88
A. Salary of professional manpower	24,623,286.08
B. Salary of nonprofessional manpower	4,837,720.80
C. School operation	2,415,100.00
D. Student boarding expenses and facilities	3,083,968.00

2. Prorated Costs	3,889,734.43
E. Facilities for education	2,849,729.02
F. Training of professional manpower	701,528.88
G. Facilities for boarding	338,476.53
3. Current Cost	38,849,809.32
H. For education	35,427,364.78
I. For boarding facilities	3,422,444.54

Average proportions of varying expenditures in the province at large may be stated as follows:

1. In terms of total expenditures including provisions for boarding students

   a. Professional salaries to
      i. cash expenditures 70.43%
      ii. current operating costs 63.38%

   b. Professional and nonprofessional salaries to
      i. cash expenditures 84.27%
      ii. current operating costs 75.83

2. In terms of expenditures for teaching only, i.e., excluding provisions for boarding students

   a. Professional salaries to
      i. cash expenditures 77.25%
      ii. current operating costs 69.50%

   b. Professional and nonprofessional salaries to
      i. cash expenditures 92.42%
      ii. current operating costs 83.16%

   c. Prorated cost of training teachers to current operating costs 1.98%

   d. Prorated cost of school facilities to current operating costs 8.04%

All in all, salaries comprise a very high proportion of costs in the enterprise of secondary education. Adding the proportion of prorated cost of training teachers to the proportions in items 2.b-i and 2.b-ii above, the proportion of salaries to cash expenditures and current operating costs rise to 94.40 percent and 85.14 percent, respectively. Effective measures for economical uses of resources for secondary education should therefore focus first and foremost on effective preparation and utilization of manpower in the system.

The second highest proportion is for the prorated costs of physical facilities (item 2.3, above). In the Turkish system, these facilities are seldom used during vacations, including summertime vacations. One may therefore justifiably recommend that physical facilities be used more productively in order to get maximum benefit from the costly investments that already have been made in them.

Various unit costs are included in Table 14, following, in three categories:

1. Unit costs per student per year: The average unit cost per student per year was calculated in terms of daytime and boarding students. Unit costs in Column 3, under the headline of "Daytime," includes all expenses needed for educational activities excluding boarding facilities. Unit costs in Column 4, under the headline of "Boarding," includes only the expenses for boarding facilities. There are three municipalities with boarding students in the province.

2. Average costs per course hour: These average costs per hour were calculated in terms of (a) salaries of

TABLE 14--Partial Results of Cost Analysis for Secondary Education in the Province of Eskişehir. (In Turkish Lira - one dollar = fourteen lira)

Municipalities		Unit Cost Per Student Per Year		Average Constituent Costs Per Course Hour			Average Cost Per Hour of Particular Groups of Courses			
Code No. (1)	Name (2)	Daytime (3)	Boarding (4)	Profess. Salary (5)	School Operation (6)	Prorated Cost (7)	Humanities (8)	Science (9)	Foreign Language (10)	Skill Courses (11)
1	Eskişehir	1340.43	1573.38	32.12	8.15	4.12	39.03	34.30	30.25	28.10
2	Inönü	1024.10	0.00	21.51	8.14	5.08	31.31	30.55	10.00	10.00
3	Alpu	1115.09	0.00	24.17	8.72	3.38	38.48	35.16	10.00	10.00
4	Bozan	1910.38	0.00	31.38	10.60	4.06	29.65	55.71	10.00	10.00
5	Gündüzler	1655.93	0.00	29.47	7.42	3.65	41.11	45.64	10.00	10.00
6	Muttalip	3969.75	0.00	31.02	23.13	6.74	21.51	44.50	10.00	70.39
7	Çifteler	784.89	0.00	32.62	5.48	5.76	30.73	44.58	24.60	10.00
8	Kayı	1502.98	0.00	26.76	9.22	4.30	44.51	40.72	10.00	10.00
9	Han	1323.23	0.00	23.53	7.41	3.78	24.83	44.76	10.00	10.00
10	Kadıkuyusu	1977.12	0.00	41.12	11.24	4.89	93.77	39.39	10.00	10.00
11	Mahmudiye	1523.67	1707.43	27.91	22.92	3.84	33.77	29.03	25.05	33.86
12	Mihalıççık	954.07	0.00	20.98	4.38	5.24	31.33	21.86	21.52	10.00
13	Beylikahır	818.89	0.00	22.33	4.00	3.57	33.27	32.47	10.00	10.00
14	Sarıcakaya	1662.53	0.00	26.17	8.70	6.72	24.41	28.63	10.00	10.00
15	Mihalgazi	1565.31	0.00	25.33	7.39	3.69	30.82	38.41	10.00	10.00
16	Seyitgazi	1311.88	0.00	27.47	9.57	5.80	46.71	28.48	29.81	10.00
17	Doğançayır	1229.91	0.00	28.60	8.84	5.21	31.32	40.06	10.00	10.00
18	Kırka	1365.13	0.00	32.57	18.81	6.18	30.99	33.49	10.00	10.00
19	Sivrihisar	1452.98	1953.47	24.96	16.03	9.38	26.80	31.33	14.78	24.35
20	Günyüzü	931.88	0.00	20.03	8.88	3.83	30.51	24.74	10.00	10.00
21	Kaymaz	1375.34	0.00	35.04	12.92	5.26	58.17	39.14	10.00	10.00
22	Average for the Province	1327.91	1632.84	30.78	9.06	4.43	37.61	33.81	27.76	25.50

professional manpower, including honoraria and payments to lay teachers, (b) school operations, including salaries of office personnel and other employees, and (c) prorated costs.

3. Average costs per hour of particular groups of courses: Calculation for the costs of particular groups of courses could be made so that they would include expenses for laboratories and equipment which are exclusive to the particular group of courses. In this study, however, these types of expenses were included in the column for "School Operations." Therefore the cost of particular groups of courses in Table 14 includes the cost of manpower involved in the teaching activities. Hence, deviations in the cost in varying municipalities basically due to the rate of supply and utilization of teachers. Courses included in the groups are as follows:

Humanities: Turkish and social subjects in the first cycle, and Turkish Literature, Geography, History, History of Arts, and Philosophy in the second cycle.

Science: Mathematics, General Science, Agriculture, and Commerce in the first cycle, Mathematics, Physics, Chemistry, and Biology in the second cycle.

Foreign Language: English, French, and German in both first and second cycles.

Skill Courses: Physical Education, Handicraft-Drawing, Home Economics, and Music in both first and second cycles.

Deviations among costs for varying municipalities in the same column may be basically due to (a) the rate of supply and utilization of teachers, (b) the size of classes, (c) the supply of office personnel and employees, and (d) regional and/or individual donations to schools.

The last two columns in Table 14 reveal that unit costs per course hour of foreign language and skill courses is 10.00 T.L. in many municipalities. This is because there is no certified teacher for those courses in the municipalities and, by law, others teaching these courses are paid 10.00 T.L. per course hour.

In any case, the average cost for the province at large in each column (Code No. 22) may be used as a roughly estimated criterion for purposes of comparison among municipalities.

Conclusion

Today there is a tendency to evaluate economic aspects of educational enterprises in ways similar to economic evaluation of production types of enterprises. This tendency may help to improve education provided that differences between human beings and physical matters involved in other types of production are taken into consideration.

In brief, in order to improve the system, ways of using cost analyses in educational enterprises may be categorized into two basic groups as follows:

First, educational cost analyses may help to improve education in the short range by examining the economic aspects of problems which are already known to exist. For example:

The proportion of failed students in general secondary schools was 36.71 percent in the 1971-1972 school year. Of 1,135,818 students, 417,014 were failed in that year. If the unit cost per student in Eskişehir could be generalized for Turkey, the financial loss from the national budget might be estimated at 553 million T.L., i.e., approximately one-tenth of the whole budget for the Ministry of Education in that year. Counting the economic loss to families as roughly twice as much as the loss from the national budget allocation, one might claim that the economic loss to the society caused by educational failures in only the general secondary school system was 1.659 billion T.L. in that particular year.

For a long time, Turkish educators, students, and their families have been well aware of at least two dimensions of the chronic problem of failing students, i.e., the social and individual dimensions of the problem. But students and their families, as well as educators who may have been accustomed to live with such a problem, may find through the economic dimension of cost analysis another point of view from which to look at the problem. When they appreciate the economic losses involved, living with the

problem may not be so easy. It may make them more intolerably uneasy than ever before, with the effect that a high priority may then be given to solving of the problem.

Second, cost analysis may help to improve education in the long range by providing means for choosing the best alternative for optimal use of resources in the educational enterprise. For example: (a) class size, i.e., the number of students in one class, heavily affects the unit cost per student. One may find the optimum class size which creates maximally productive environment in terms of quality of teaching. Similarly, an economically optimum school size may be determined. Such studies may help both to lead and to support administrations in making desirable changes in policy, in the structure of school buildings, or in programs for training teachers, in order to make education more economically efficient and productive than in the present practice. (b) One of the significant socio-demographic characteristics of Turkey is that the greatest portion of the population resides in small residential areas spread out over the country. Obviously, this residential characteristic of the society is a heavy functional constraint on the effort to answer the educational demands of the people because policy requires opening a school for each of the small residential areas. This practice causes not only slowing down the provision of the opportunity for secondary education to people in small residential areas, but also creates problems causing the provided service to be ineffective. A few of the important problems observable in today's practice are as follows:

--Secondary education remains a privilege for those people who are lucky to be living in larger residential units.

--To construct and to furnish small school buildings is costly and, in many cases, the buildings and the equipment are not fully utilized.

--Small schools create special problems of supply and utilization of teachers and, in turn, lower the quality of the service.

--Teachers are reluctant to work in socially deprived areas.

These are some of the important problems that the Ministry of Education has faced for years and that should be overcome. A study covering cost analysis may reveal alternative long-range policies that may realize more economically productive results. For example, to establish a school bus system or a broad boarding school system that may partially be supported by families on the basis of their economic capacity might make the system more effective than today's practice. Use of systems analysis and cost analyses could help determine whether or not such would be the case.

CHAPTER VII

SUMMARY OF THE STUDY

This chapter presents an overall summary of the preceding six chapters in order to provide a general overview of the problem under concern and of the approach described here to analyze it.

Introduction of the Problem

The supply of teachers for general education at secondary schools has been a chronic problem for more than a decade in Turkey. The shortage of teachers which was something less than 3,000 in the 1960-1961 school year, grew to more than 18,000 by the 1970-1971 school year, in spite of the imperative requirements of the five-year plans for solving the problem over the last decade. His first-hand observations led this writer to believe that the present administrative system's methods of analysis and decision making may be unable to cope with the problem in the context of the dynamic changes in the society. It was assumed that a systems approach (which may be expected to facilitate new and general methods of thinking and exploring) may help provide a solution of this problem and

of likely other problems, by means of an applied methodology as presented in this study.

Objectives

Since effective administrative decisions require sufficient and scientifically analyzed data, the objectives of this study include identification of the types of data needed for solution of the problem under concern. The main objectives were stated in Chapter I as follows:

1. To utilize a systems approach in analyzing the education system under consideration in order to identify the relevant variables involved in causing an inadequate supply of secondary school core subject teachers, and to explore the interrelationships among these variables.

2. To develop a mathematical model for approximating the state of the system related to need and supply of secondary school core subject teachers at a given particular point in time.

The scope of this study included identification of those quantitative elements and the decision processes in the Turkish secondary school system which relate to need and supply of secondary school core subject teachers.

Procedure of the Study

A logical block diagram (see Figure 8) of the structure of the system under consideration was developed to set forth through a systems approach the possible

location of key decision points in the operation of the system. In addition, sets of possible relationships were developed among variables of the system and stated in the form of mathematical functions so as to generate a model.

To demonstrate how the mathematical model (presented in Chapter V) might illuminate circumstances in a real situation, the province of Eskişehir was selected for study. One should not, however, generalize the findings from Eskişehir because the province was selected on a nonrandom basis in order to facilitate collection of data with minimum effort and expense as well as to be able to include examples of all kinds of secondary schools in the country.

Review of Literature

A review of literature was carried out to present the scope and characteristics of the techniques selected as an operational approach for solution of the problem under concern, as well as to justify the competency of such an approach. What may be drawn from the review of literature in Chapter II may be summed up as follows:

The Concept of a Systems Approach

The systems concept as an explicit set of interrelated elements was first introduced prior to the Second World War by Ludwig Von Bertalanffy. Today, the terms systems analysis, operations research, management science, and applied economic analysis are used interchangeably with one another. A systems approach is essentially a point of view rather than a particular technique. It allows scientists to use various scientific methods and knowledge in more fruitful conjunctions with considerations of systems concepts, as may be proper to the problem under concern. Identifying the interrelationships of components which constitute the system is imperative in a systems approach, and this may require a team of scientists and specialists from various fields.

Models as a Tool of a Systems Approach

One of the advantages of a systems approach lies in developing approximate representations of the real world by means of modeling. Models which may be used as instruments of discovery may be classified in three types: iconic, analogue, and symbolic. In this study, the first two types were used in Chapter IV and the last type was used in Chapter V along with sets of mathematical statements. Mathematical models may be descriptive, explanatory, or predictive. The latter type of model is called a "simulation model." Through simulation, systems procedures facilitate experimental investigation of the future behavior of a system under given conditions, which otherwise might be very difficult or costly, or impossible to study. This helps decision makers to choose the best or most desirable one among several alternatives without wasting scarce resources.

Change in the Concept of Administration

Because use of systems approaches facilitated modeling and simulation of the real world, and because the appearance of high-speed electronic digital computers facilitated investigation of large and complex socio-economic systems, traditional concepts of administration have been changing since the Second World War. Although the terms are still used in many cases interchangeably, today "administration" tends more strictly to refer to determination of policy and aims of an organization, and "management" indicates guiding and operating the organization.

Under the new concepts, the idea of "organization" should be designated or redesignated in terms of most efficient accomplishment of objectives, rather than holding to the patterns of a given or inherited model. Effective performance of an organization requires a functional control unit, which should be adaptive, so as to improve performance in order to accomplish the aims of the organization under changing circumstances. Such a concept of organization requires managerial and/or administrative decisions to become means for converting relevant information into appropriate action, rather than as a means for defining operations by levels into hierarchical orders. From this point of view, the availability of adequate information is a prime need for making effective decisions in modern organizations. Taking the need for control into consideration, feedback (information about the output of an organization, which is to be compared with the desired performance of the organization) should be counted a necessary part of essential information.

The Systems Approach and Education

Education systems in societies struggling for modernization should no longer stand aloof from these new concepts of administration. Systems procedures may be utilized effectively in approaching solutions of many fundamental education problems. Basic advantages in using a systems approach may be as follows:

(a) Demand for accurate data inspires an organization to improve and/or establish a computerized data processing system which, in turn, requires and facilitates improvement and innovation in the organization and its administration.

(b) Logical and mathematical precision is substituted for guessing and intuition.

(c) While descriptive researches in education try to answer the question "what it was," systems procedures can provide currently up-dated answers to the questions of "what it is now" and "what it might be in the future under present and/or varying circumstances." These are vitally important questions to be answered in decision making and planning.

(d) Through simulation, systems procedures facilitate experimental investigation of the future behavior of a system under given conditions.

The Background of the Problem

The teacher shortage problem represents a clearly undesirable set of circumstances in the education system and in the society at large. Among other varying factors, the structure of the education system itself may be responsible for a large portion of the difficulty of the problem.

The Turkish School System

In the Turkish education system, differentiation of individuals in terms of the knowledge and skill they receive is achieved in secondary education through different types of schools at the same level, instead of through different or flexible curricula in the same school. This practice to a large extent prevents the student from exercising his own choice in determining the type of education he is to receive. In addition, his opportunities for higher education are legally proscribed by the particular secondary school which the individual enters at the age of fifteen.

Higher education includes two different groups of institutions: unversities and other higher schools. Originally higher schools were established to produce needed middle level technical and vocational manpower who were not trained by the university. Lycée graduates are eligible to apply not only to the university but also to other higher institutions while graduates of vocational and technical schools at the lycée can apply only to a particular type of higher school prescribed by their secondary education. Because of predecided quotas for new enrollments, attendance to any of the higher institutions is highly restricted by use of entrance examinations.

Teacher Training Institutions

As illustrated in Figure 3 on page 52, there are eleven varying sources of teachers in the country. However, nine of them are teacher training institutions. To train secondary school core subject teachers, there are two types of schools: education institutes and higher teacher training schools. The former is a three-year higher institution under the control of the Ministry of Education. They were originally established as two-year schools to train core subject teachers for the first cycle level of secondary schools. However, teachers trained at these schools teach at the second cycle level of secondary schools also. Lycée and normal school graduates can apply to these schools. The latter is essentially a boarding center for students who are selected to be trained as teachers for the second cycle level of secondary schools. Students attend the universities. Graduates are certified to teach at the second cycle level of secondary schools. Only lycée graduates are eligible to apply to this school. Those who are lucky enough to pass the entrance examination, especially for colleges of scientific subjects, do not usually choose teaching as a profession. The reason for this is that, because of socioeconomic and industrial changes, the teaching profession has been losing its attractiveness.

The Growth of the Problem

Beginning in the fifties, the secondary school core subject teacher shortage problem has grown drastically (see Figure 2 on page 50 and Figure 4 on page 54). After the country entered upon the first five-year planned period in 1963, education was given a high priority. However, in spite of the targets of the first and second five-year development plans prepared by the State Planning Organization, and of the Ten-Year Plan prepared by the Ministry of Education, the number of trained teachers has remained insufficient. As a matter of fact, the shortage of secondary school core subject teachers, which was less than 3,000 in the 1960-1961 school year, grew to more than 18,000 in the 1970-1971 school year.

Need for Accurate Information

In the Turkish education system, it had not been customary to analyze data, evaluate implementations, or employ data in the process of decision making until acquisition of the concept of planning in 1960. Since then, the need for statistical data has been recognized and a great deal of data has been collected each year. However, the uses of data have not improved much beyond mere empirical tabulations, and collected data are grossly underutilized. There seems to be an urgent need for a scientific data processing system and for recognizing the necessity of utilization of accurate and scientifically analyzed data for effective decisions in the education system.

Identification of the System and the Problem

An operational approach to solving the problem requires one scientifically to identify the system and the problem along with their natures and environments.

In the Turkish system, numbers of needed and trained teachers are controlled variables. However, because of the structure of the system, the control action is carried out by various sub-organizations independently from each other. For example, the need for secondary school core subject teachers is manipualted by at least five separate general directorates which assume no responsibility for training teachers. Teachers are trained under directions from the General Directorate for Teacher Training Schools and also by the universities, but the latter do not assume any formal responsibility for the inadequate supply of teachers at schools. (See Figure 7 on page 84 and Figure 8 on page 86.)

The above stated practices imply that because of inadequate organization the system is not working as a closed system.

Identification of the Problem

The system under consideration in this present study is the teacher training system which consists of (a) all received variables and parameters related to train teachers (inputs), (b) trained teachers (outputs), and (c) teacher training schools and the General Directorate for Teacher Training Schools, which are responsible for the applied technology (interactions) to convert inputs into outputs. This system is illustrated within the dotted lines in Figure 8. Obviously, the system is affected by the Ministry of Education at large and by the university. Nevertheless, as the legal organization responsible for training needed teachers by whatever means, the MOE's General Directorate for Teacher Training Schools was presented as the control component of the system.

The inadequate teacher supply problem in the secondary school system is indeed a reflection of inadequate production processes in the teacher training system. Hence, defining the location and characteristics of the causal problem requires examination of inputs and of exercised production technology (interactions) of the teacher training system. The conclusion after such an examination was that the causal problem is essentially a resource utilization (production technology) problem rather than a resource scarcity (input) problem. Implication of the analyses may be summed up in terms of the two types of teacher training institutions as follows:

A. Higher teacher training schools: As seen in Figure 8, the university affects the production of higher teacher training schools in two ways: (a) through admission policy and (b) through its training programs. Being autonomous and assuming no responsibility for meeting the need for teachers, admission and training policies of the university bear on the production as functional constraints. In this connection, the first condition towards a solution of the problem as it relates to higher teacher training schools seems to lie in a redesignation of the organization of the teacher training system so that production

processes can be effectively controlled by the organization responsible for meeting the need.

B. Education institutes: Although education institutes are controlled by the General Directorate for Teacher Training Schools, their production has remained inadequate for years, especially throughout the planned period. Since no unsolvable problem was detected in inputs, inadequate production would appear to be a result of inadequate decisions. This logical conclusion leads one to search for the causes which result in ineffective decisions. Because the decision-making process is counted as the means to convert information into action, review of sources of information may facilitate defining the location and the characteristics of the problem as follows:

(a) Information from the environment: Information from the environment should include data to facilitate realistic assessments of needs and of inputs required to meet the need. At least the five-year development plans prepared by the State Planning Organization and the Ten-Year Plan prepared by the General Directorate for Teacher Training Schools not only provide relevant information but also include encouraging and mandating authorization to train more secondary school core subject teachers. Therefore, in order to make appropriate decisions, decision makers have not suffered from the lack of relevant information from the environment.

(b) Information from the organization: Since the General Directorate for Teacher Training Schools also gets fairly precise information on the outputs of its subordinated schools, lack of information from the organization, i.e., feedback information, does not itself constrain the making of efficient decisions towards solving the problem.

(c) Information as acquisitions of administrators: Also to be included under the heading of information used in the process of decision making are administrators' knowledge, experience, understandings, tendencies, abilities to utilize relevant data in making decisions, etc. Apparently administrators fail in making appropriate uses of the available information mentioned in the above items (a) and (b). This conclusion may serve to locate the causal problem. In other words, the problem is generated at the point where measures to cope with the problem could and should be designated.

The persistent growth, rather than mitigation, of the problem indicates perhaps a too typical characteristic of administration, namely, the use of authority along lines of personal preferences rather than to accomplish objectives of the organization. This characteristic may also be one of the fundamental causes for the inert state of an administration.

Consequently, the defined causal problem indicates that solution of the teacher supply problem in Turkey, as well as many other problems in the Turkish education system, requires first of all coping with the administrative problem in the Ministry of Education.

In particular, subsequent measures for solving the teacher supply problem should aim at fulfillment of the following requirements:

--An effective control over the teacher training process.

--A realistic plan, including assessments of needed teachers, requirements of the profession, and curriculum to train teachers on the basis of the society's needs.

--Appropriate conditions to retain trained teachers in the profession.

Mathematical Model for Turkish Secondary School System

Developing a descriptive model so as to identify the state of the system at a particular time will be in vain unless its outcomes are utilized in decision making at large. In particular, approaches for solution of the problem under consideration may be facilitated by means of employing a proper simulation model which in turn may be utilized by a digital computer.

Need for Data to be Used in Simulation Models

Simulation models approximate the future behavior of the system under given circumstances. Use of accurate data in simulation may be expected to provide a rather realistic approximation of the future behavior of the system. However, the simulation technique may also help to detect the trend of the future behavior of the system even in the absence of real data. To show how the system may acquire and utilize accurate data for realistic approximation to solve the problem is the central theme of this study. The model in Part 2 of Chapter V was developed in order to provide information needed for realistic planning.

Mathematical Model for Identification of the Turkish Secondary School System

One should start with examining the state of the system at a given point in time in order to make an effective plan for the future of the system. Defining the state of the system in the time domain facilitates examination of the trend of the system in the future. Then the next steps are to gather the needed information, to manipulate parameters so as to find an "optimum" or a "best" solution to the problem, and then to designate and/or redesignate the system so as to fulfill the desired objectives defined for the future.

The model presented in Part 2 of Chapter V was developed as a tool to accomplish the above mentioned task. An experimental application of the model was carried out in the province of Eskişehir. One logical next step after such an application is that, through looping in the computer program, the model could be applied for any of the other 66 provinces in Turkey in order to (a) promptly discover the current actual situation and (b) provide needed parameters for a simulation model so as to make realistic plans for solution of the problem.

Evaluation of Findings in the Application of the Model

The model presented in Part 2 of Chapter V was applied to the province of Eskişehir, which allowed inclusion of all kinds of variables in the model. Using collected data and utilizing the mathematical model, three kinds of tables were obtained from the computer for each school and for each municipality as well. Included in Table 1 are produced class hours and teachers assigned to these class hours by fields. Calculated need, supply, and utilization of teachers were included in Table 2. Cost analyses of secondary education were presented in Table 3.

Evaluation of Findings

Findings in the present application of the model contain information on the state of the system in the province of Eskişehir on May 2, 1972. Conclusions drawn from the findings may be summed up as follows:

(a) There exists an improper supply of secondary school core subject teachers.

(b) Available teachers are utilized ineffectively.

(c) The most crucial aspect of the problem is the significant scarcity of science, Turkish literature, English, physical education, handicraft-drawing, and music teachers.

(c) Existence of a number of small schools requires a particular reconsideration in terms of supply and utilization of teachers.

Because the province was selected for application on a nonrandom basis, one should not generalize the findings in Eskişehir. However, province-wide characteristics of the problem revealed by the application of the model seem to be quite similar to the general characteristics mentioned in Chapters III and IV in defining of the problem in the country at large.

Findings from the cost analyses for the secondary education seem to promise a way of facilitating the establishment of criteria for evaluating the quality of education as well as for assessment of the financial aspects of planning for the future. Such an analysis is not yet utilized in education in Turkey.

Concluding Statement

It is hoped that the study presented above may serve:

(a) To encourage widespread applications of systems approaches to analyzing the problems of educational development and planning in Turkey.

(b) To encourage the development of urgently needed improved systems and facilities for processing essential data in the Ministry of Education.

(c) To encourage the Ministry of Education to identify and reorganize those parts of its structure which contribute to the problems of education.

(d) In particular, to demonstrate how the crucial and chronic problem of teacher supply may be more effectively solved through research and planning.

APPENDIX A

T.C.
MİLLİ EĞİTİM BAKANLIĞI
Plânlama-Araştırma ve Koordinasyon Dairesi Başkanlığı

ZAMANLIDIR

Sayı : 530/1795 Ankara
Bölüm : Bilgi İşleme 9.5.1972
Konu : İstatistik Formları

Eskişehir Valiliğine

Çeşitli amaçlarla sık sık istatistik bilgiler toplanması Bakanlığımız için olduğu kadar okullarımız için de büyük bir külfet haline gelmiş bulunuyor. Bazan istenen bilgilerin okullarda tutulmakta olan kayıtlardan çıkarılmasının çok güç ve hatta imkânsız olduğu da bilinmektedir. Bu duruma bir çözüm yolu bulmak ve eğitim istatistiklerini bir elden ve belli zamanlarda, bilimsel metodlarla toplamak ve kullanılmaya hazır bulundurmak amacı ile gerekli çalışmalar yapılmaktadır.

Bu çalışmaların bir kısmı olarak, orta dereceli resmî okulların öğretmen ihtiyacını ve eğitim mâliyetini elektronik makinelerle hesaplayacak bir metod denemesi yapılmaktadır. Bakanlığımız Planlama, Araştırma ve Koordinasyon Dairesi Başkanlığınca yapılmakta olan ön çalışmalar için Eskişehir İli seçilmiştir.

Kısa zamanda sonuç alınabilmesi için, bu yazının bir örneği ve ekteki bilgi toplama formlarından yeteri kadarı iliniz dahilindeki bütün orta dereceli, resmî okullara gönderilmiştir. Ayrıca, okul yöneticilerine yardım etmek amacı ile görevlendirilmiş olan Bakanlığımızdan üç eleman 15.5.1972 Pazartesi günü sabahından 17.5.1972 Çarşamba akşamına kadar Eskişehir Milli Eğitim Müdürlüğünde bulunacaktır. Bu süre içinde doldurulacak formlar, Eskişehir içinde bulunan okul müdürlüklerince, söz konusu elemanlara verilmek üzere, Millî Eğitim Müdürlüğüne gönderilecek; Eskişehir merkezi dışında bulunan okul müdürlükleri ise doldurulan formları doğruca (Milli Eğitim Bakanlığı, Planlama, Araştırma ve Koordinasyon Dairesi Başkanlığı-Beşevler-Ankara) adresine postaya vereceklerdir.

Formların doldurulmasında herhangi bir tereddüde düşülürse iliniz Milli Eğitim Müdürlüğüne veya Bakanlığımızda 23 11 60/63 numaraya telefon edilebilir.

"P1" formu ücretli ve kadrolu bütün öğretmenler, yöneticiler ve varsa diğer eğitim personeli tarafından doldurularak okul müdürlüğüne verilecektir. "02" ve "01" formları okul müdürlüklerince iki nüsha olarak doldurulacak, bir nüshası ihtiyaç duyulduğu zaman kullanılmak üzere saklanacaktır.

"Pl" formunun doğrudan doğruya personelin kendisi tarafından doldurulması gerekmektedir. Herhangi bir sebeple bu mümkün olmadığı takdirde, formlar okul müdürlüklerince, okuldaki kayıtlara dayanılarak doldurulacak ve formun sonunda bu husus, sebebi ile birlikte belirtilecektir.

Bu deneme çalışmasından alınacak sonuçlar, öğretmen ve yöneticilerin göstereceği ilginin derecesine bağlı olacaktır.

Formların en geç 17 Mayıs 1972 Çarşamba akşamına kadar iliniz Milli Eğitim Müdürlüğünde bulunacak olan Bakanlığımız elemanlarına veya postaya verilmesinin teminini önemle rica ederim.

Milli Eğitim Bakanı a.

Bedi ERDEM
Planlama-Araştırma ve Koordinasyon
Dairesi Başkan V.

EK:
Pl Formu ( )
P2 Formu ( )
01 Formu ( )

ZAMANLIDIR

KA/pk

T.C.
Planlama-Araştırma ve Koordinasyon
Dairesi Başkanlığı

BİLGİ TOPLAMA FORMU:P1
(Öğretmen ve yönetici)

Sayın Meslektaş,

Bu bilgi formu, Milli Eğitim Bakanlığınca Türkiye çapında yapılacak yeni bir bilgi toplama ve değerlendirme sisteminin kurulması ile ilgili olarak hazırlanmıştır.

Deneme amacıyla yapılan ve orta dereceli okulları kapsayan bu ön çalışma için Eskişehir İli seçilmiş bulunuyor. Bu nedenle, daha sonra yapılacak çalışmaların başarılı olması sizin bu formu doldururken göstereceğiniz ilgi ve titizliğe bağlı olacaktır.

Göstereceğiniz ilgi ve yardım için teşekkür ederiz.

DİKKAT : 1- Bu form, 2 Mayıs 1972 günkü durumunuza göre doldurulacak ve en kısa zamanda okul müdürüne verilecektir.

2. Aşağıdaki maddeleri (duruma göre) ya noktalı boşlukları doldurmak, ya da soldaki karelere istenen bilgiyi yazmak veya X işareti koymak suretiyle cevaplandırınız.

1. Okulun Bulunduğu Yer :

a. İl : ....

b. İlçe : ....

c. Bucak : ....

d. Köy veya Kasaba : ....

2. Okulun Adı : ....

3. Adınız ve Soyadınız : ....

☐☐☐☐☐ 4. Bakanlıkça verilmiş olan sicil numaranız (ücretle ders okutanlar bu maddeye cevap vermeyecektir)

5. Cinsiyetiniz :

1 ☐ Kadın

☐ Erkek

6. Erkek iseniz askerlik durumunuz

2 ☐ Yaptım.

3 ☐ Yapmadım.

4 ☐ Askerlikten muaf tutuldum.

2

☐☐ 7. Doğum yılınız (son iki rakamı yazınız.)

8. Evli misiniz?

☐ Evet

1 ☐ Hayır

9. Evli iseniz eşiniz çalışıyor mu?

☐ Evet

2 ☐ Hayır

10. Eşiniz çalışıyorsa işi nedir?

3 ☐ Öğretmen

4 ☐ Öğretmenlikten başka bir devlet hizmeti

5 ☐ Kendi adına çalışıyor veya özel sektör hizmeti

☐ 11. Çocuğunuz varsa sayısı

12. Ücretli öğretmen iseniz:
(Kadrolu öğretmenler bu maddeyi cevaplandırmayacak, 13. maddeye geçecek)

1 ☐ İlkokul öğretmeniyim.

2 ☐ Orta dereceli okullara öğretmen yetiştiren bir okuldan mezunum, fakat aslî kadroda değilim;

(Okulun adı : ....)

3 ☐ Öğretmen yetiştirmiyen bir yüksek okul mezunuyum.

(Okulun adı : ....)

13. Kadrolu öğretmen iseniz:

Aylık kadronuz.

Derece	Kademe
......	......

3

13. (Devam)

1 ☐ Stajiyer öğretmenim, idarî görevim yok.
2 ☐ Stajiyer öğretmenim, idarî görevim var,
3 ☐ Aslî öğretmenim, idarî görevim yok.
4 ☐ Aslî öğretmenim, idarî görevim var.
☐☐ Emekliliğe esas olan hizmet yılınız
(6 ay veya fazlası bir yıl sayılacak)

Öğreniminiz bakımından kanunen okutmaya mecbur olduğunuz derslerin adları :

....
....
....
....

En son mezun olduğunuz ve öğretmenlik yapmanıza esas olan öğretim kurumun adı :

....

☐ Öğretim süresi (ders yılı olarak)

Öğretmenlik yapmanıza imkân veren belgenin cinsi:

1 ☐ Diploma
2 ☐ Yeterlik veya kurs belgesi
3 ☐ Yukardakilerden biri değil
(Adını yazınız: ....)

14. En iyi bildiğiniz yabancı dil (varsa) :

☐ a. Adı : ....

b. Bilme dereceniz:

1 ☐ Biraz konuşabilirim.
2 ☐ Rahatça konuşurum.
3 ☐ Okuduğumu sözlük kullanarak anlarım.
4 ☐ Okuduğumu sözlük kullanmadan anlarım.

☐☐ 15. Kendi okulunuzda veya başka okullarda haftada kaç saat ücretli dersiniz var?

4

16. Aşağıdaki cetvele branş içi veya dışı olarak kendi okulunuzda veya başka okullarda okutmakta olduğunuz derslerin adlarını yerlerine yazınız ve karşılarında birinci veya ikinci devredeki haftalık ders saatlerini gösteriniz ve bu saatlerin çapraz toplamlarını alarak kontrol ediniz. (Başka bir okulda dersiniz varsa, okulun adını noktalı yere yazınız)

Burayı İşaretlemeyiniz

	Dersin Adı	I Devre	II Devre	Toplam
KENDİ OKULUNUZDA				
BAŞKA OKULDA Adı:..............				
....				
	TOPLAM			

Not : Bu formda kolayca veya açıkca anlaşılmayan soru veya ifadeler varsa numaralarını ve bölümlerini lütfen aşağıya yazınız.

....

....

....

Bu form tarafımdan doğru olarak doldurulmuştur.

/ /1972

(İmza)

Tasdik olunur.

/ /1972

Okul Müdürü

T.C.
MİLLİ EĞİTİM BAKANLIĞI
Planlama-Araştırma ve Koordinasyon
Dairesi Başkanlığı

BİLGİ TOPLAMA FORMU : P2
(Memur ve hizmetli)

Aşağıdaki tabloyu 2 Mayıs 1972 günündeki duruma göre doldurunuz.

P1 formunu dolduran eğitim, öğretim ve yönetim görevlileri bu tabloda gösterilmiyecektir.

OKUL MÜDÜRLÜĞÜNCE DOLDURULACAKTIR.

Sıra veya sicil kayıt No:	Görevi	Öğrenim durumu	Adı, Soyadı	Aylığı		Zam verilen çocuk sayısı
				Der.	Kad.	

/5/1972

.... Okulu Müdürü

T.C.
Planlama-Araştırma ve Koordinasyon
Dairesi Başkanlığı

BİLGİ TOPLAMA FORMU:01

OKUL MÜDÜRLÜĞÜNCE DOLDURULACAKTIR.

DİKKAT : a. Bu form, 2 Mayıs 1972 günkü duruma göre doldurulacaktır.

b. Aşağıdaki maddeleri (duruma göre) ya noktalı boşlukları doldurmak ya da soldaki karelere X işareti koymak suretiyle cevaplandırınız.

1. Okulun bulunduğu yer :

a) İl : ....

b) İlçe : ....

c) Bucak : ....

ç) Köy veya kasaba : ....

2. Okulun adı : ....

3. Öğretim şekli :

1 ☐ Normal

2 ☐ Çift öğretim

3 ☐ Üçlü öğretim

4. Öğrenci durumu

1 ☐ Karma

2 ☐ Yalnız kız

3 ☐ Yalnız erkek

5. Öğrenci özelliği :

1 ☐ Tamamen gündüzlü

2 ☐ Tamamen yatılı

3 ☐ Yatılı - gündüzlü

2

6. Aşağıdaki tabloyu doldurunuz.

NOT: 1) Birinci devresi üç sınıflı olan ve hazırlık sınıfı bulunmıyan okullarda ilk kolon boş bırakılacaktır.

2) Lise sınıflarında önce EDEBİYAT, sonra FEN bölümleri yazılacaktır.

		I. DEVRE					II. DEVRE							
Sınıflar						Top.								Top.
Şube Sayısı														
Gündüzlü	K													
	E													
Parasız Yatılı	K													
	E													
Paralı Yatılı	K													
	E													
Burslu	K													
	E													
Yarım Yatılı	K													
	E													
Toplam	K													
	E													
Genel Toplam														

7. Aşağıdaki tabloda seçmeli veya yardımcı derslerle, varsa resmen açılmış olan kursları da katmak suretiyle, her konudaki ders veya atölye saatlerinin nekadarının nasıl kapatıldığını gösteriniz.

DİKKAT : "Ücretli öğretmenler" kolonuna asıl öğretmenlerin ücretle okuttuğu dersler değil, sadece ücretle tayin edilmiş bulunan öğretmenlerin okuttukları ders saatleri yazılacaktır.

DEVRELER	DERSLERİN ADI	DERSLERİN NASIL KAPATILDIĞI							Okuldaki Ders saati toplamı
		Okulun Asıl Öğretmeniyle		Başka okulun öğretmeniyle		Ücretli öğretmenle		Boş geçen saat	
		Branş içi	Branş dışı	Branş içi	Branş dışı	Branş içi	Branş dışı		
I. DEVRE	Türkçe								
	Sosyal Bilgiler								
	Matematik								
	Fen Bilgileri								
	Ticaret-Tarım								
	Din Bilgisi								
ORTAK	İnglizce								
	Fransızca								
	Almanca								
	Beden Eğitimi								
	Resim-İş								
	Ev-İş								
	Müzik								
II. DEVRE	Edebiyat								
	Felsefe Gurubu								
	Tarih								
	Sanat Tarihi								
	Coğrafya								
	Matematik								
	Biyoloji								
	Fizik								
	Kimya								
	Meslek Dersleri								
TOPLAM									

Not : Milli savunma dersi yazılmıyacak.

8. Aşağıdaki tabloları, üzerlerindeki açıklamaya göre doldurunuz. (Kuruşları yazmayınız) 4

a. Aşağıdaki tabloda istenen 1970 ve 1971 akçalı yıllarına ait bilgileri, Sayıştaya veya Bakanlığa gönderilmek üzere hazırlanmış olan listelerden veya demirbaş eşya defterinden faydalanarak doldurunuz.

DEMİRBAŞ ÇEŞİDİ	1970 den 1971 e devir	1971 de kayıttan düşülenler	1971 de alınan	1972 ye devredilen
Yatılı öğrenci ihtiyacında kullanılanlar				
Diğer bütün ihtiyaçlar için kullanılanlar				
TOPLAM				

b. Aşağıdaki tabloyu 1971 akçalı yılı ödenek defterinden faydalanarak doldurunuz (Demirbaş eşya için yapılan harcama yukardaki tabloda yer almış olacağından, burada gösterilmiyecektir.)

	GENEL GİDERLER			YATILI ÖĞRENCİ GİDERLERİ	
	Gider çeşidi	Lira		Gider çeşidi	Lira
GENEL BÜTÇEDEN	Kitaplık			Yiyecek	
	Büro			Giyim-kuşam	
	Ulaştırma				
	Taşıt işletme			Toplam	
	Kira			Bütçe dışı sağlanan	
	Malzeme		Personel Giderleri	Her çeşit yolluk	
	Küçük onarım			Doğum-ölüm-tedavi	
	Diğer			Ödül	
	Toplam			Toplam	
	Bütçe dışı sağlanan				

MINISTRY OF EDUCATION
Planning, Research, and Coordination Office

URGENT — Ankara: May 9, 1972

Number: 530/1795
Section: Data Processing
Subject: Statistics forms

To the Governor of Eskisehir

Frequent collection of data for varying purposes has become a troublesome work for our schools and for the Ministry of Education as well. It is recognized that sometimes it is difficult if not impossible to provide requested data from school records. A study has been conducted in order to solve this problem scientifically through improving the method of educational data collection.

As a part of this effort, an experimental study has been initiated in the Planning, Research, and Coordination Office of our Ministry to study ways of computerizing the processing of data on the need for teachers and on cost of public secondary education. The province of Eskisehir was selected for this pilot study.

In order to get results in a short time, copies of this letter and of the enclosed data collection forms were mailed to all of the secondary schools in your province. In addition, three persons from the Ministry of Education will be ready in the Office of the Educational Director assigned to help schooldirectors on May 15, 16, and 17, 1972. Forms to be filled out within this time should be handed to these three persons by the schools in Eskisehir city, and the schools which are in other cities, towns, or villages should mail their forms to the Ministry of Education, Planning, Research, and Coordination Office, Besevler - Ankara.

In case of doubt, one may call to the Office of the Educational Director of your province or to the following number in the Ministry of Education: 23 11 60 / 63.

Form "P1" will be filled out by professional personnel in schools, and then will be handed to the school director. Forms "P2" and "01" will be filled out by school directors, in two copies, one of which will be filed in order to be used later if needed.

Form "P1" will be filled out by the professional personnel individually. If this is impossible for any reason, the form will be filled out by the school director on the basis of official records, and this fact should be noted at the bottom of the form with an explanation of the reason.

Results of the pilot study will depend on the degree of consideration given by teachers and administrators.

Please make sure of that the forms should either be handed to the Ministry's people assigned to the Office of Educational Director of your province or should be mailed to the Ministry by the evening of May 17, 1972, at the latest.

On behalf of the
Ministry of Education

Enclosed: Form P1(   )
Form P2(   )
Form 01(   )

Bedi ERDEM
Acting Head of Planning, Research
and Coordination Office

URGENT

Planning, Research, and
Coordination Office

DATA COLLECTION FORM: P1
(Professional personnel)

Dear Colleague,

This data collection form was prepared by the Ministry of Education in order to establish a new data collection and evaluation system throughout Turkey.

The province of Eskisehir was selected for a pilot study covering secondary education. For this reason, the success of further studies will depend on your degree of care in filling out this form.

Thank you for your cooperation and consideration.

NOTICE: 1. This form will be filled out so as to represent the circumstances exactly on May 2, 1972.

2. Please answer the items below by either filling in the dotted lines, or putting an X in the cells to the left, or writing in the requested data.

1. Location of the school:
   a. Province: ....
   b. District: ....
   c. Sub-District: ....
   d. Village or town: ....
2. Name of the school: ....
3. Your name: ....

☐☐☐☐☐ 4. Your identification number (lay teachers will not answer this item).

5. Your sex:
   ☐ Female
   ☐ Male
6. If you are male, what is your military service draft status?
   ☐ Served
   ☐ Not drafted yet
   ☐ Exempted from duty

☐☐ 7. Your birthday (last two digits)

8. Are you married?
   ☐ Yes
   ☐ No
9. If married, is your husband/wife working?
   ☐ Yes
   ☐ No
10. If working, what is the occupation of your husband/wife?
   ☐ Teaching
   ☐ Public service other than teaching
   ☐ Her/his own business or service, or private sector

☐ 11. Number of children, if any

12. If you are not a regular staff member:
(Those teachers who are regular staff members should not answer this item but should skip to item 13.)

- [ ] I am an elementary school teacher.
- [ ] I graduated from a higher teacher training institution but am working as a temporary teacher.
(Name of the school you graduated from: ....)
- [ ] I graduated from a higher institution which was not a teacher training school.
(Name of the school you graduated from: ....)

13. If you are a regular staff member:
Your base salary:

Degree	Step
......	....

- [ ] I am a probationer <u>without</u> administrative status.
- [ ] I am a probationer <u>with</u> administrative status.
- [ ] I am a regular staff member <u>without</u> administrative status.
- [ ] I am a regular staff member <u>with</u> administrative status.

☐☐ Your seniority in number of years to be counted toward your pension (6 or more months will be counted as one year.)

Field(s) in which you are certified to teach:
....
....
....
....

Name of your last school from which you were graduated as a teacher:
....

- [ ] Length of training program (number of years of the school's program)

Kind of official document by which you are certified:
- [ ] Diploma
- [ ] Certification
- [ ] Neither of the above

14. The foreign language which you know best, if any:
- [ ] a. Name: ....

b. Degree of mastery:
- [ ] I can speak a little bit.
- [ ] I speak fluently.
- [ ] I understand what I read <u>through</u> using dictionary.
- [ ] I understand what I read <u>without</u> dictionary.

☐☐ 15. How many total hours are you teaching in a week for which you are paid in the form of and honororium either in your regular school or in other schools.

16. Please fill out the table below with all courses you teach either in your own school or in other school(s). (If you teach in any other school, please write the name of the school on the dotted line.)

Do not put any sign in the cells below

		Name of the course	Cycle I	Cycle II	Total
□□□□□□	IN YOUR OWN SCHOOL				
□□□□□□					
□□□□□□					
□□□□□□					
□□□□□□	IN OTHER SCHOOL				
	Name:				
□□□□□□					
		TOTAL			

Note: If there were any expressions that you found to be unclear or difficult to understand, please cite them below by refering to numbers of items and sections.

....

....

....

I certify that this form was filled out accurately.

May .., 1972

(Signature)

It is certified.

May .., 1972

School Director

MINISTRY OF EDUCATION
Planning, Research, and
Coordination Office

DATA COLLECTION FORM : P2
(Nonprofessional Personnel)

Please fill out the table below so as to represent the circumstances exactly on May 2, 1972.

Those who filled out Form P1 will not be included in this table.

TO BE FILLED OUT BY THE SCHOOL DIRECTOR.

Identification or serial no.	Duty	Educational status	Name	Base salary		Number of dependent children
				Degree	Step	

May .., 1972

Director of the School: ....

Planning, Research, and
Coordination Office

DATA COLLECTION FORM: 01

TO BE FILLED OUT BY THE SCHOOL DIRECTOR

NOTICE: a. This form will be filled out so as to represent the circumstances exactly on May 2, 1972.

b. Please answer the items below through either filling out the dotted lines or putting an X in the cells to the left.

1. Location of the school:
   a) Province: ....
   b) District: ....
   c) Sub-District: ....
   d) Village or town: ....
2. Name of the school: ....
3. Shift status:
   - ☐ One shift
   - ☐ Double shift
   - ☐ Triple shift
4. Composition of student body:
   - ☐ Coeducation
   - ☐ Girls only
   - ☐ Boys only
5. Status of students:
   - ☐ Day students only
   - ☐ Boarding students only
   - ☐ Both day and boarding students

6. Please fill out the table below.

<u>NOTE</u>: 1) Do not fill out the first column if the first cycle of the school is composed of three grades and there is no preparation class.

2) For lycée, data for <u>LITERATURE</u> sections should be entered <u>first,</u> to the left of data for <u>SCIENCE</u> sections at each grade level.

		FIRST CYCLE					SECOND CYCLE							
Class Levels						Total								Total
Number of Class Sections														
Day-time Students	F													
	M													
Free Boarding Students	F													
	M													
Paid Boarding Students	F													
	M													
Scholarship Students	F													
	M													
Half Boarding Students	F													
	M													
Total	F													
	M													
Grand Total														

7. In the table below, please show the status of teacher supply for all courses, including selective courses, formally established extra courses, or workshops which may exist in your school.

NOTICE: In the column for "Lay Teachers," please enter data only for those teachers who are not members of the regular staff.

CYCLES	Names of the Courses	STATUS OF SUPPLY							Total of Course Hours in the School
		Teachers of the School		Teacher from Other Schools		Lay Teachers		Teacher-less Class Hours	
		Certif.	Uncert.	Certif.	Uncert.	Certif.	Uncert.		
FIRST CYCLE	Turkish								
	Social Subjects								
	Mathematics								
	Sciences								
	Commerce, Agriculture								
	Religious								
COMMON	English								
	French								
	German								
	Physical Ed.								
	Drawing, Handicraft								
	Home Econ.								
	Music								
SECOND CYCLE	Literature								
	Philosophy								
	History								
	Arts History								
	Geography								
	Mathematics								
	Biology								
	Physics								
	Chemistry								
	Vocational								
	TOTAL								

Note: National Defense course will not be included.

8. Please fill out the table below on the basis of the explanations provided with each. (Do not include kurus)

a. The table below will be filled out using the official records for durable goods for the 1970 and 1971 fiscal years.

VALUE OF DURABLE GOODS	Carried over to 1971 from 1972	Written off in 1971	Purchased in 1971	Carried over to 1972
Used only for boarding students				
Used for all othter needs				
TOTAL				

b. The table below will be filled out using the official records for the 1971 fiscal year excluding durable goods and salaries.

GENERAL EXPENDITURES			EXPENDITURES FOR BOARDING STUDENTS		
	Kinds of expenditures	Lira		Kinds of expenditures	Lira
FROM NATIONAL BUDGET	Library			Food	
	Utility			Clothing	
	Transportation and Communication				
				Total	
	Rent			Provided from sources other than the budget	
	Supplies		Personel Expendit.	Transportation	
	Minor Repairs			Social security benefits	
	Miscellaneous			Bonus	
	Vehicle Operation				
	Total			Total	
	Provided from sources' other than the budget				

APPENDIX B

CODES USED IN THE PRINTOUT OF TABLE 1

FIELDS OF TEACHERS

(SIDE-HEADS OF TABLE)

CODES	NAMES	CODES	NAMES
01	TURKISH	20	BIOLOGY
02	SOCIAL SUBJECTS	21	MATHEMATICS-2
03	HUMANITIES	22	MATH.-PHYSICS
04	MATHEMATICS-1	23	CHEMISTRY
05	SCIENCES	24	PHYSICS
06	SCIENCE-MATH.-1	25	PHYSICS-CHEM.
07	AGRUCULTURE-COMMERCE	26	PHILOSOPHY GROUP
08	RELIGION	27	VOCATION-NORMAL SCH.
09	ENGLISH	28	VOC-COMMERCE AND TOURISM SCH.
10	FRENCH	29	VOCATION-RELIGIOUS SCH.
11	GERMAN	30	VOCATION-BOYS TECH.SCH.
12	PHYSICAL ED.	31	VOCATION-GIRLS TECH.SCH.
13	HANDICRAFT-DRAWING	32	SUB-TOTAL 1
14	HOME ECONOMICS	33	LAY TEACHERS
15	MUSIC	34	TEACHERS FROM OUTSIDE
16	TURKISH LITERATURE	35	SUB-TOTAL 2
17	GEOGRAPHY	36	TEACHER-LESS CLASSES
18	HISTORY	37	TOTAL
19	HISTORY OF ARTS		

SUBJECT-MATTERS

(HEADINGS OF TABLE)

CODES	NAMES	CODES	NAMES
A	FIELDS OF TEACHERS	16	HOME ECONOMICS
01	NUMBER OF TEACHERS	17	MUSIC
02	NR.OF ADMINISTRATORS,	18	TURKISH LITERATURE
03	TEACH.OF OTHER SCH.	19	PHILOSOPHY GROUP
04	NR.OF LAY TEACHERS	20	HISTORY
05	TURKISH	21	HISTORY OF ARTS
06	SOCIAL SUBJECTS	22	GEOGRAPHY
07	MATHEMATICS-1	23	MATHEMATICS-2
08	SCIENCES	24	BIOLOGY
09	AGRICULTURE-COMMERCE	25	PHYSICS
10	RELIGION	26	CHEMISTRY
11	ENGLISH	27	VOC.-NORMAL SCH.
12	FRENCH	28	VOC.CO.AND TO.S.
13	GERMAN	29	VOC.GIRLS TECH.S.
14	PHYSICAL ED.	30	VOC.BOYS TECH S.
15	HANDICRAFT-DRAWING	31	VOC.RELIGIOUS S.
		32	FREE STUDY

CODES USED IN THE PRINTOUT OF TABLE 2

FIELDS OF TEACHERS
(SIDE-HEADS OF TABLE)

CODES	NAMES	CODES	NAMES
01	HUMANITIES	14	GEOGRAPHY
02	SCIENCE 1-MATH.1	15	HISTORY
03	RELIGION	16	HISTORY OF ARTS
04	SUBTOTAL 1	17	BIOLOGY
05	ENGLISH	18	SCIENCE 2-MATH.2
06	FRENCH	19	PHILOSOPHY GROUP
07	GERMAN	20	SUBTOTAL 3
08	PHYSICAL EDUCATION	21	TOTAL
09	HANDICRAFT-DRAWING	22	VOC-COMMERCE AND TOUR.SCH.
10	HOME ECONOMICS	23	VOC-RELIGIOUS SCH.
11	MUSIC	24	VOC-BOYS TECH.SCH.
12	SUBTOTAL 2	25	VOC-GIRLS TECH.SCH.
13	TURKISH LITERATURE	26	GROSS TOTAL

(HEADINGS OF TABLE)

A-FIELDS OF TEACHERS
B-NO.OF ADMINISTRATORS
C-TOTAL INCLUDING UNQUALIFIED TEACHING
D-TOTAL OF QUALIFIED TEACHING
E-IN RETURN FOR BASE SALARY
F-NO.OF TEACHERS
G-TOTAL INCLUDING UNQUALIFIED TEACHING
H-TOTAL OF QUALIFIED TEACHING
I-IN RETURN FOR BASE SALARY
J- IN TERMS OF OBSERVED UTILIZATION
K- IN TERMS OF BEST UTILIZATION
L- IN TERMS OF OBSERVED UTILIZATION
M- IN TERMS OF BEST UTILIZATION
N- NO.OF TEACHERS WITH EXPERIENCE OVER 25 YEARS
O- NO.OF TEACHERS WHO ARE NOT DRAFTED YET
P- AVERAGE SALARY OF TEACHERS

HEADING OF TABLE 3

1. CASH EXPENDITURES
   - A. SALARY OF PROFESSIONAL MANPOWER
   - B. SALARY OF NONPROFESSIONAL MANPOWER
   - C. SCHOOL OPERATION
   - D. BOARD EXPENSES AND SUBSIDIES

2. PRORATED COST
   - E. FACILITIES FOR EDUCATION
   - F. TRAINING OF PROFESSIONAL MANPOWER
   - G. FACILITIES FOR BOARD

3. CURRENT COST
   - H. FOR EDUCATION
   - I. FOR BOARD AND FACILITIES

4. UNIT COST PER STUDENT
   - J. FOR EDUCATION
   - K. FOR BOARD AND SUBSIDIES

5. UNIT COST PER CLASS HOUR
   - L. TEACHING OPERATION
   - M. SCHOOL OPERATION
   - N. PRORATED COST OF INVESTMENT
   - O. TEACHING COST OF HUMANITIES (TURKISH, TURKISH LITERATURE, HISTORY AND GEOGRAPHY)
   - P. TEACHING COST OF MATH. AND SCIENCES
   - Q. TEACHING COST OF FOREIGN LANGUAGES
   - R. TEACHING COST OF SKILL COURSES (HANDICRAFT, DRAWING, MUSIC AND PHYSICAL EDUCATION)

T A B L E - 1-1

TEACHERS AND COURSE HOURS

PROVINCE-ESKISEHIR   DISTRICT-ESKISEHIR   MUNICIPALITY-ESKISEHIR(CITY)   NO.OF SCHOOLS- 17

NUMBERS OF.   A.ALL STUDENTS- 20693   B.BOARDING STUDENT- 1399   C.CLASS SECTIONS- 446

A	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	17	4	2	0	274	44	0	0	0	0	0	0	0	2	1	0	0	130	0	0	2	0	0	0	0	0	0	0	0	0	0	7
2	14	0	2	0	40	292	0	0	0	0	0	0	0	8	0	0	0	0	0	37	0	12	0	0	0	0	0	0	0	12	0	0
3	55	21	7	0	950	545	0	0	0	0	12	3	0	23	27	4	39	243	4	18	0	0	0	0	0	0	0	0	0	0	0	14
4	29	0	2	0	0	0	533	34	155	0	0	0	0	17	0	0	0	0	0	0	0	0	65	0	14	0	4	0	0	0	0	0
5	16	6	3	0	0	0	74	301	4	0	0	0	0	0	15	0	0	0	0	0	0	0	64	34	39	5	0	0	0	0	0	0
6	60	13	3	0	0	27	542	833	77	0	4	0	0	0	17	2	0	0	0	0	0	0	137	4	193	77	0	0	0	0	0	24
7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0
8	10	1	7	1	0	0	0	0	0	205	9	3	0	8	7	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	3
9	35	0	4	0	0	0	0	0	0	0	882	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	7
10	14	2	3	0	0	0	0	0	0	0	0	356	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	13	4	4	0	0	0	0	0	0	0	0	0	422	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	9	5	4	0	0	0	0	2	0	0	4	0	0	357	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
13	21	5	2	0	0	0	0	0	0	0	0	0	0	0	628	6	12	0	0	0	4	0	0	0	0	0	0	0	0	0	0	4
14	19	0	4	0	0	0	0	0	1	0	0	0	0	8	8	445	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
15	8	1	2	0	0	0	0	0	0	0	3	0	0	0	0	0	273	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
16	14	3	1	0	0	0	0	0	0	0	0	0	0	0	8	0	10	369	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	12	2	3	0	0	66	0	0	0	0	8	0	0	10	1	0	0	0	0	0	0	219	0	0	0	0	0	0	0	0	0	0
18	16	2	3	0	0	75	0	0	0	0	5	0	0	11	4	0	24	0	0	273	2	0	0	0	0	0	0	0	0	0	21	2
19	2	1	1	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	43	0	0	0	0	0	0	0	0	0	0	0
20	10	0	1	0	0	0	0	24	0	0	0	0	0	0	4	0	0	0	0	0	0	0	3	136	12	0	0	0	0	0	0	0
21	14	2	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	355	0	0	0	0	0	0	0	0	0
22	9	1	4	0	0	0	0	9	10	0	0	0	0	0	0	0	0	0	0	0	0	0	78	0	123	12	0	0	0	0	0	0
23	4	0	1	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	2	0	0	8	90	0	0	0	0	0	6
24	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	0	0	0	0	0	0	4
25	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72	24	0	0	0	0	0	0
26	5	2	1	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	98	0	0	0	0	0	0	0	0	0	0	0	0	0
27	4	2	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	108	0	0	0	0	10
28	8	4	4	0	0	0	4	0	12	0	15	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	202	0	0	0	0
29	8	4	0	0	0	0	0	0	0	36	0	0	0	15	0	0	9	0	14	0	7	0	0	0	0	0	0	0	0	0	216	0
30	66	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	3067	0	0
31	11	1	1	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	309	0	0	0
32	510	112	70	1	1264	1049	1137	1203	259	259	952	367	422	466	745	457	373	742	136	328	58	233	722	199	493	208	112	202	309	3082	237	85
33	0	0	0	35	12	84	5	37	0	2	127	13	13	20	19	0	0	0	8	0	0	0	15	0	2	23	0	0	0	44	0	0
34	0	0	0	58	23	78	0	17	9	14	16	0	12	48	133	8	84	0	0	0	0	0		0	3	3	0	0	0	0	0	2
35	0	0	0	93	35	162	5	54	9	16	143	13	25	68	152	8	84	0	8	0	0	0	15	0	5	26	0	0	0	44	0	2
36	0	0	0	0	0	0	0	12	0	0	0	0	9	0	3	0	9	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
37	510	112	70	94	1295	1211	1192	1269	268	275	1095	380	456	534	900	465	466	742	144	328	59	233	737	199	498	234	112	202	313	3126	237	87

TABLE # 2-1

SUPPLY AND DEMAND

PROVINCE#ESKISEHIR   DISTRICT#ESKISEHIR   MUNICIPALITY#ESKISEHIR(CITY)   NO.OF SCHOOLS# 17

RATIOS OF: A.STUDENT/TEACHER# 40.57   B.TEACHER/CLASS SECTION# 1.14   C.STUDENT/CLASS SECTION# 46.40

S U P P L Y — DEMAND / SHORTAGE / STATUS

A D M I N I S T R A T O R S — T E A C H E R S

A * B * C , D * E * F * G * H * I * J K L M N O P

F M HOURS LOAD HOURS LOAD HOURS LOAD F M HOURS LOAD HOURS LOAD HOURS LOAD

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	1	26	460	17.0	333	12.3	165	6.9	44	42	2286	26.6	1912	21.1	1748	20.3	104	85	18	-1	13	15	2621
2	1	26	471	17.4	287	10.6	155	5.7	55	51	2867	27.0	2286	21.6	2182	20.6	114	94	8	-12	3	30	2205
3	0	1	13	18.0	15	15.0	6	6.0	1	9	220	22.0	190	19.0	161	16.1	14	10	4	0	0	5	1765
4	2	53	949	17.3	335	11.5	347	6.3	100	102	5373	26.6	4288	21.2	4091	20.3	232	189	30	-13	16	50	2369
5	0	0	0	0.0	0	0.0	0	0.0	15	16	993	25.5	882	25.2	679	19.4	44	42	9	7	2	5	2093
6	1	1	35	18.0	36	18.0	14	7.0	9	5	326	23.3	320	22.9	229	16.4	13	13	1	-1	1	3	2405
7	2	2	77	19.3	77	19.3	44	11.0	12	1	345	26.5	345	26.5	241	18.5	14	15	1	2	0	2	2103
8	0	5	82	16.4	77	15.4	30	6.0	5	4	286	31.8	280	31.1	199	22.1	13	18	6	9	1	1	2799
9	2	3	90	18.0	75	15.0	30	6.0	10	11	564	26.9	553	26.3	413	19.7	32	32	11	11	3	3	2567
10	0	0	0	0.0	0	0.0	0	0.0	19	0	463	24.4	445	23.4	384	20.2	20	18	1	-1	1	0	2223
11	0	1	24	24.0	24	24.0	15	15.0	6	2	255	31.9	249	31.1	193	24.1	14	17	6	9	0	1	2087
12	5	12	309	18.2	233	17.0	133	7.8	80	39	3132	26.3	3074	25.8	2333	19.6	154	155	35	36	8	15	2312
13	0	3	46	15.3	45	15.3	10	3.3	8	6	341	24.4	323	23.1	250	17.9	30	30	16	16	0	5	1932
14	1	1	23	16.5	23	16.5	12	6.0	10	2	271	22.6	186	15.5	203	16.9	12	9	0	-3	0	0	2075
15	0	2	34	17.0	13	9.0	10	5.0	13	3	383	23.9	255	15.9	281	17.6	13	14	2	-2	0	0	2057
16	0	1	13	18.0	13	18.0	5	6.0	2	0	45	22.5	25	12.5	31	15.5	3	2	1	0	0	0	1912
17	0	0	0	0.0	0	0.0	0	0.0	8	2	190	19.0	147	14.7	151	15.1	14	9	4	-1	1	1	2389
18	1	2	63	21.0	63	21.0	27	9.0	10	23	776	23.5	731	22.2	568	17.2	64	61	31	28	1	16	2093
19	1	3	62	15.5	39	[illegible]	26	6.5	8	1	154	21.6	160	20.0	150	16.7	11	10	2	1	2	0	2419
20	3	12	256	17.1	212	14.1	91	6.1	59	37	2200	22.9	1347	19.2	1534	17.0	152	135	56	39	4	22	2126
21	10	77	1314	17.4	1135	13.1	571	6.6	239	178	10765	25.7	9209	22.1	8063	19.3	533	479	121	62	28	67	2300
22	3	1	54	14.5	53	14.5	34	8.5	5	3	181	22.6	144	18.0	147	18.4	9	6	0	-2	1	0	2271
23	0	4	72	18.0	54	13.5	24	6.0	0	8	225	28.1	162	20.3	141	17.6	7	8	1	0	0	2	1957
24	0	16	490	30.6	473	29.5	253	16.1	0	66	2351	39.2	2385	39.2	1565	23.7	63	68	2	2	17	24	2937
25	1	0	6	6.0	5	6.0	4	6.0	11	0	312	28.4	305	28.1	247	22.5	11	8	0	-3	1	0	2856
26	14	98	2140	19.1	1732	15.5	993	8.0	255	255	14014	27.5	12413	24.3	10163	19.9	534	569	124	59	47	113	2386

TABLE = 3-1

COST (IN TURKISH LIRAS)

PROVINCE= ESKISEHIR DISTRICT=ESKISEHIR MUNICIPALITY= ESKISEHIR(CITY) NO. OF SCHOOLS= 17

*1. CASH EXPENDITURES

A	B	C	SUBTOTAL	D	TOTAL
20066606.48	3363189.60	1730555.00	25160351.08	1954441.00	27114792.08

*2. PRORATED COST

E	F	SUBTOTAL	G	TOTAL
2010752.85	566527.44	2577280.29	232566.52	2809846.81

*3. CURRENT COST / *4. UNIT COST PER STUDENT

H	I	TOTAL	J	K
27737631.37	2187007.52	29924638.89	1340.43	1573.38

*5. UNIT COST PER CLASS HOUR

L	M	N	TOTAL	O	P	Q	R
32.12	8.15	4.12	44.40	39.03	34.30	30.25	28.10

T A B L E - 1 - 4

TEACHERS AND COURSE HOURS

PROVINCE-ESKISEHIR   DISTRICT-ESKISEHIR   MUNICIPALITY-ALPU-BOZAN(VIL)   NO.OF SCHOOL=1

NUMBERS OF.   A.ALL STUDENTS- 54   B.BOARDING STUDENT- 0   C.CLASS SECTIONS- 2

A	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	0	0	0	10	10	0	0	0	0	0	0	0	0	6	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
4	1	0	0	0	0	0	9	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
5	0	1	0	0	0	0	0	9	0	1	0	6	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	2	1	0	0	10	10	9	9	2	1	0	6	0	2	6	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	2	1	0	0	10	10	9	9	2	1	0	6	0	2	6	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4

T A B L E 4.2-4

S U P P L Y A N D D E M A N D

PROVINCE=[illegible] [illegible] MUNICIPALITY=ALPU-POZAN(VIL) NO.OF SCHOOLS= 1

RATIOS 004 A.STUDENTS/TEACHERS= 27.00 B.TEACHERS/CLASS SECTION= 1.00 C.STUDENTS/CLASS SECTION= 27.00

S U P P L Y — DEMAND PERCENTAGE STATUS

1	0	C	0	0.0	0	0.0	0	0.0	0	1	20	10.0	20	20.0	21	21.0	1	1	0	0	0	0	1756
2	C	1	13	13.0	[illegible]	5.0	[illegible]	5.0	1	0	13	13.0	11	11.0	13	13.0	1	1	0	0	0	0	1743
3	0	C	0	0.0	0	0.0	0	0.0	0	0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	0	0
4	C	1	13	13.0	[illegible]	5.0	[illegible]	5.0	1	1	43	21.5	31	15.5	34	17.0	2	2	0	0	0	0	1748
5	C	C	0	0.0	0	0.0	0	0.0	C	0	0	0.0	0	0.0	0	0.0	0	0	C	C	0	0	C
6	C	C	0	0.0	0	0.0	0	0.0	C	0	0	0.0	0	0.0	0	0.0	0	C	C	C	0	0	0
7	C	C	0	0.0	0	0.0	0	0.0	C	0	0	0.0	0	0.0	0	0.0	0	0	C	C	0	0	C
8	C	C	0	0.0	0	0.0	0	0.0	0	0	0	0.0	0	0.0	0	0.0	0	0	C	C	0	0	0
9	C	C	0	0.0	0	0.0	0	0.0	C	0	0	0.0	0	0.0	0	0.0	0	0	0	C	C	C	C
10	C	C	0	0.0	0	0.0	0	0.0	0	C	0	0.0	0	0.0	0	0.0	0	C	0	C	0	0	0
11	C	C	0	0.0	0	0.0	0	0.0	0	0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	0	0
12	C	C	0	0.0	0	0.0	0	0.0	0	0	0	0.0	0	0.0	0	0.0	0	0	C	C	0	0	C
13	C	C	0	0.0	0	0.0	0	0.0	C	C	0	0.0	0	0.0	0	0.0	0	0	C	0	0	0	C
14	C	C	0	0.0	0	0.0	0	0.0	C	0	0	0.0	0	0.0	0	0.0	0	0	C	0	0	0	C
15	C	C	0	0.0	0	0.0	0	0.0	C	0	0	0.0	0	0.0	0	0.0	0	0	C	C	0	0	C
16	C	C	0	0.0	0	0.0	0	0.0	C	0	0	0.0	0	0.0	0	0.0	0	0	C	C	0	0	0
17	C	C	0	0.0	0	0.0	0	0.0	C	C	0	0.0	0	0.0	0	0.0	0	0	C	C	C	0	C
18	C	C	0	0.0	0	0.0	0	0.0	C	C	0	0.0	0	0.0	0	0.0	0	0	C	C	0	0	C
19	C	C	0	0.0	0	0.0	0	0.0	C	0	0	0.0	0	0.0	0	0.0	0	0	C	C	0	0	0
20	C	C	0	0.0	0	0.0	0	0.0	C	C	0	0.0	0	0.0	0	0.0	0	0	C	C	0	0	C
21	C	1	13	13.0	[illegible]	5.0	[illegible]	5.0	1	1	43	21.5	31	15.5	34	17.0	2	2	C	0	0	0	1749
22	C	C	0	0.0	0	0.0	0	0.0	0	0	0	0.0	0	0.0	0	0.0	0	0	C	C	0	0	0
23	C	C	0	0.0	0	0.0	0	0.0	C	C	0	0.0	0	0.0	0	0.0	0	0	C	0	C	C	C
24	C	C	0	0.0	0	0.0	0	0.0	0	C	0	0.0	0	0.0	0	0.0	0	0	0	C	0	0	C
25	C	C	0	0.0	0	0.0	0	0.0	C	0	0	0.0	0	0.0	0	0.0	0	0	0	C	C	0	C
26	C	1	13	13.0	[illegible]	5.0	[illegible]	5.0	1	1	43	21.5	31	15.5	34	17.0	2	2	C	0	0	0	1749

TABLE = 3-4

COST (IN TURKISH LIRAS)

PROVINCE= ESKISEHIR   DISTRICT= ESKISEHIR   MUNICIPALITY= BOZAN(VILLAGE)   NO. OF SCHOOLS= 1

*1. CASH EXPENDITURES

A	B	C	SUBTOTAL	D	TOTAL
70306.80	20865.60	2880.00	94052.40	0.00	94052.40

*2. PRORATED COST

E	F	SUBTOTAL	G	TOTAL
6956.10	2152.32	9108.42	0.00	9108.42

*3. CURRENT COST   *4. UNIT COST PER STUDENT

H	I	TOTAL	J	K
103160.82	0.00	103160.82	1910.38	0.00

*5. UNIT COST PER CLASS HOUR

L	M	N	TOTAL	O	P	Q	R
31.38	10.60	4.06	46.05	29.65	55.71	10.00	10.00

T A B L E - 1 - 22

TEACHERS AND COURSE HOURS

PROVINCE-ESKISEHIR (AGGREGATE)   NO.OF MUNICIPALITIES- 21   NO.OF SCHOOLS- 41

NUMBERS OF.   A.ALL STUDENTS- 26679   B.BOARDING STUDENT- 2096   C.CLASS SECTIONS- 592

A	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	26	8	2	0	475	78	0	0	0	5	12	0	0	2	27	30	0	136	0	0	2	0	0	0	0	0	0	0	0	0	0	19
2	26	6	2	0	73	525	0	0	10	8	33	0	0	11	19	24	9	0	0	37	0	12	0	0	0	0	0	0	0	12	0	14
3	69	29	7	0	1157	693	0	6	6	2	27	3	0	38	58	6	54	293	4	18	8	0	0	0	0	0	0	0	0	0	0	28
4	47	3	3	0	6	4	794	52	195	3	19	0	0	41	20	8	1	0	0	0	0	0	99	0	14	0	4	0	0	0	0	12
5	24	20	3	0	0	11	134	534	20	5	0	6	0	8	34	6	0	0	0	0	0	0	102	37	80	18	0	0	0	0	0	8
6	77	26	3	0	0	33	659	1134	133	1	4	0	0	0	30	12	10	0	0	0	0	0	147	15	204	81	0	0	0	0	0	52
7	2	1	0	0	0	0	0	0	53	0	0	0	0	0	6	0	0	0	0	0	0	0	0	23	0	0	0	0	0	0	0	0
8	12	1	9	1	0	0	0	0	8	234	21	8	0	8	10	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	5
9	38	0	4	0	8	0	0	0	0	0	961	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	8
10	18	2	3	0	0	0	0	0	0	0	12	447	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
11	14	4	4	0	0	0	0	0	0	0	0	0	443	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	10	7	4	0	0	0	0	2	0	0	4	0	0	404	2	0	6	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
13	23	7	2	0	3	0	0	0	0	1	0	0	0	0	725	6	12	0	0	0	4	0	0	0	0	0	0	0	0	0	0	7
14	22	0	4	0	14	0	0	0	1	3	6	0	0	8	14	467	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
15	9	1	3	0	0	0	0	0	0	0	3	0	0	0	6	0	293	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
16	15	3	1	0	16	0	0	0	0	0	0	0	0	0	8	0	10	383	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	18	2	3	0	21	148	0	3	4	0	11	0	0	11	7	4	1	0	4	0	0	251	0	0	0	0	0	0	0	0	0	3
18	18	4	3	0	0	114	0	0	0	0	14	0	0	11	7	0	24	0	0	305	6	0	0	0	0	0	0	0	0	0	21	2
19	2	1	1	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	43	0	0	0	0	0	0	0	0	0	0	0
20	11	0	1	0	0	0	0	24	0	0	0	0	0	0	12	0	0	0	0	0	0	0	3	148	12	11	0	0	0	0	0	1
21	15	2	1	0	0	0	12	0	0	0	0	0	0	10	0	0	0	0	2	0	0	0	365	0	0	0	0	0	0	0	0	0
22	10	1	4	0	0	0	4	9	10	0	0	0	0	0	0	0	0	0	0	0	0	0	96	0	128	12	0	0	0	0	0	3
23	4	0	1	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	2	0	0	8	90	0	0	0	0	0	6
24	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	0	0	0	0	0	0	4
25	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72	24	0	0	0	0	0	0
26	5	2	1	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	98	0	0	0	0	0	0	0	0	0	0	0	0	0
27	5	4	0	0	0	0	14	0	0	0	0	0	0	0	6	0	0	0	44	0	0	0	0	0	0	0	132	0	0	0	0	10
28	8	4	4	0	0	0	4	0	12	0	15	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	202	0	0	0	0
29	8	4	0	0	0	0	0	0	0	36	0	0	0	15	0	0	9	0	14	0	7	0	0	0	0	0	0	0	0	0	216	0
30	69	19	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	4	0	0	0	3250	0	0
31	15	2	3	0	0	0	0	0		0	0	0	0	0	3	16	0	0	0	0	0	0	0	0	0	0	0	0	422	0	0	0
32	626	163	76	1	1773	1606	1671	1764	452	316	1152	464	448	567	1017	579	441	812	176	360	70	265	832	223	550	240	136	202	422	3265	237	198
33	0	0	0	46	34	77	18	40	14	16	145	16	13	20	19	0	3	0	12	0	0	0	55	0	2	23	0	0	0	44	0	5
34	0	0	0	124	51	102	0	27	51	32	48	0	12	81	228	48	122	0	0	0	0	0	9	0	3	3	0	0	0	0	0	15
35	0	0	0	170	85	199	18	67	65	48	193	16	25	101	247	48	125	0	12	0	0	0	64	0	5	26	0	0	0	44	0	20
36	0	0	0	0	0	0	0	12	0	4	21	15	9	11	13	38	43	0	0	0	0	0	0	0	0	0	0	0	4	0	0	2
37	626	163	76	171	1858	1805	1689	1843	517	368	1366	495	482	679	1277	665	609	812	188	360	70	265	896	223	555	266	136	202	426	3309	237	220

TABLE 2-22

SUPPLY AND DEMAND

PROVINCE=ESKISEHIR (AGGREGATE) NO.OF MUNICIPALITIES=21 NO.OF SCHOOLS=41

RATIOS OF= A.STUDENT/TEACHER= 42.62 B.TEACHER/CLASS SECTION= 1.06 C.STUDENT/CLASS SECTION= 45.07

A	B: ADMINISTRATORS E (F)	C (M)	C HOURS	C LOAD	D HOURS	D LOAD	E HOURS	E LOAD	TEACHERS F	F (M)	G HOURS	G LOAD	H HOURS	H LOAD	I HOURS	I LOAD	DEMAND J	DEMAND K	SHORTAGE L	SHORTAGE M	STATUS N	STATUS O	P
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	1	42	759	17.7	547	12.7	296	6.9	62	59	3213	26.6	2454	20.3	2381	19.7	153	127	32	6	13	25	2398
2	1	49	910	18.2	540	12.8	340	6.9	71	79	4012	26.7	3116	20.8	2376	19.8	164	133	14	-17	4	59	2104
3	0	1	18	18.0	17	15.0	6	6.0	1	11	275	22.8	219	18.3	194	16.2	17	13	5	1	0	6	1758
4	2	92	1687	17.9	1202	12.8	542	5.9	134	145	7493	26.5	5791	20.5	5551	19.6	334	273	51	-10	17	90	2220
5	0	0	0	0.0	0	0.0	0	0.0	22	15	561	25.6	561	25.3	738	19.4	56	52	16	14	2	5	2062
6	1	1	36	18.0	35	18.0	14	7.0	11	7	443	24.6	411	22.8	304	16.9	20	18	2	0	1	4	2275
7	2	2	77	19.3	77	19.3	44	11.0	12	2	374	23.7	371	26.5	259	18.5	15	15	1	2	0	3	2081
8	0	7	112	16.0	107	15.3	35	5.1	5	5	305	30.5	297	29.7	211	21.1	13	20	2	10	1	3	2775
9	2	5	136	19.4	112	16.0	52	7.4	10	13	624	27.1	613	26.7	452	19.7	45	46	23	23	3	4	2545
10	0	0	0	0.0	0	0.0	0	0.0	22	0	515	23.4	467	21.2	409	18.6	32	27	10	5	1	0	2120
11	0	1	24	24.0	25	24.0	15	15.0	6	3	286	31.8	269	29.9	213	23.7	19	22	10	13	0	1	2054
12	5	16	365	18.3	355	17.0	151	7.7	88	56	3531	25.3	3389	25.2	2585	19.3	204	201	70	67	3	20	2271
13	0	3	46	15.3	45	15.3	10	3.3	9	6	371	24.7	337	22.5	268	17.9	34	34	19	15	0	5	1919
14	1	1	33	16.5	33	16.5	12	6.0	13	5	435	24.2	213	12.1	309	17.2	14	19	-4	-6	0	0	1993
15	0	4	67	16.8	32	8.0	17	4.3	14	4	437	24.3	273	15.2	314	17.4	19	15	2	-2	0	1	2034
16	0	1	13	13.0	13	13.0	3	3.0	2	0	45	22.5	25	12.5	31	15.5	4	3	2	1	0	1	1912
17	0	0	0	0.0	0	0.0	0	0.0	9	2	220	20.0	157	14.3	169	15.4	13	10	4	-1	1	1	2327
18	1	2	63	21.0	63	21.0	27	9.0	10	25	335	23.9	764	21.8	606	17.3	74	72	41	37	1	14	2076
19	1	5	93	16.3	73	11.7	33	8.3	8	3	224	22.4	204	20.4	163	16.3	12	11	2	1	2	[illegible]	2362
20	3	16	323	17.1	262	13.8	112	5.9	65	55	2549	23.6	1979	18.1	1363	17.1	174	155	56	47	4	25	2087
21	10	124	2397	17.9	1320	13.6	321	6.9	297	235	13597	25.8	11158	21.2	[illegible]	19.0	712	629	187	114	29	135	2206
22	3	1	53	14.5	53	14.5	34	8.5	5	3	181	22.6	144	18.0	147	18.4	3	6	0	-2	1	0	2271
23	0	4	72	18.0	54	13.5	24	6.0	0	8	225	28.1	162	20.3	141	17.6	9	3	1	0	0	2	1957
24	0	19	586	30.8	570	30.0	315	16.6	0	65	2682	35.9	2580	36.8	1622	23.5	71	70	2	1	17	25	2667
25	2	0	24	12.0	24	12.0	12	6.0	15	0	419	27.9	404	26.9	323	21.5	15	11	0	-4	1	0	2549
26	15	148	3137	15.2	2525	15.5	1307	8.0	307	319	17104	27.3	14345	23.2	12233	19.5	313	724	190	99	48	162	2284

TABLE =3 - 22
COST(IN TURKISH LIRAS)

PROVINCE= ESKISEHIR ([illegible]) NO.OF MUNICIPALITIES=21 NO. OF SCHOOLS= 41

*1. CASH EXPENDITURES

A	B	C	SUBTOTAL	D	TOTAL
24623286.08	4837720.80	2415100.00	31876106.88	3083968.00	34960074.88

*2. PRORATED COST

E	F	SUBTOTAL	G	TOTAL
2849729.02	701528.88	3551257.90	338476.53	3889734.44

*3. CURRENT COST *4.UNIT COST PER STUDENT

H	I	TOTAL	J	K
35427364.78	3422444.53	38849809.32	1327.91	1632.84

*5. UNIT COST PER CLASS HOUR

L	M	N	TOTAL	O	P	Q	R
30.78	9.06	4.43	44.29	37.61	33.81	27.76	25.50

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