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ABSTRACT

The Model Accounting Plan (MAP) is a demographic accounting system designed to meet three major goals related to improving planning, evaluation, and monitoring of special education programs. First, MAP provides local-level data for administrators and parents to monitor the progress, transition patterns, expected attainments, and associated costs of students in special education. Second, MAP facilitates the aggregation of local data to inform decisions about special education at the state and national levels. Finally, the project has encouraged positive change in the way that data for special education are reported and used. Two articles arising from the project are appended. They are: "A Demographic Accounting System to Inform Educational Policy: Genesis, Dissemination, and Limited Acceptance" (Robert Rossi and Phyllis DuBois) and "Computer-Generated Educational Data: Nuisance or Opportunity?" (Phyllis DuBois and Robert Rossi). (PB)

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Project MAP: Model Accounting Plan for Special Education

Final Report

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April 1989

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Executive Summary

The American Institutes for Research (AIR) developed the Model Accounting Plan (MAP), a demographic accounting system to meet three important goals related to improving planning, evaluation, and monitoring of special education programs:

1. MAP provides local-level data for administrators and parents to monitor the progress, transition patterns, expected attainments, and associated costs of students in special education. MAP is based on a four-dimensional 9 x 9 x 3 x 4 matrix that differentiates status by type of handicap, age, instructional setting assignment, and post-graduation attainment. It also includes cost estimates based on national-level data.

2. MAP facilitates the aggregation of local data to inform decisions about special education at the state and national levels. MAP includes a management information system to ensure that any school system can use MAP and that everyone collects the same data. Data in three widely different forms were examined to determine the feasibility of aggregation of data in MAP. Aggregation is possible but, as is true with any aggregation, it can be done only as finely as its poorest, or least descriptive, data source.

3. The project has encouraged positive change in the way that data for special education are reported and used. Numerous meetings and conversations have been held with administrators, special education teachers, and other educators in California; descriptions of MAP have been appeared in newsletters; articles about MAP have been published in two journals. Two other journal articles have been submitted for publication, one on invitation. All requests for additional information have been answered with demonstration diskettes and MAP reports.

Our experience in developing MAP has led to the following recommendations:

- Data quality can only be ensured at the local level, and so it is at this level that staff development resources to improve data systems must be allocated.
- Efforts must be made to capture the imagination of local school personnel and to motivate them to improve their skills in collecting and using data.
- Data requirements need to be made more consistent at the national and state levels.

The Model Accounting Plan demonstrates the feasibility and usefulness of a demographic accounting system applied to special education. Acceptance and support from local-level educators is critical for such a system to realize its potential.

Introduction

For Project MAP—Model Accounting Plan—the American Institutes for Research (AIR) developed a demographic accounting system to monitor the transitions of special education students, both in school and after departure. During the three years of project funding by the Office of Special Education Programs (OSEP), Department of Education, AIR has focused on three key goals:

1. to develop a system to provide local-level data for administrators and parents on the progress, transition patterns, and expected attainments of their special education students

2. to facilitate the aggregation of local data to inform decisions about special education at the state and national levels

3. to encourage positive change in the way that data for special education students are reported and used

In this report we discuss our activities related to each of these goals.

Goal One

Develop a system to provide local-level data for administrators and parents on the progress, transition patterns, and expected attainments of their special education students

From the outset, our goal has been to provide data on special education students to extend knowledge and inform decision-making at the local level. We learned that the twice-a-year pupil counts are done almost solely to meet state and federal requirements; for most school districts and larger units (e.g., SELPAs—Special Education Local Plan Areas—in California), pupil-counts are neither used nor perceived as useful. We felt that the data could be made useful and set about developing an accounting system that would transform these entirely collected data into useful information for educational program planning, goal-setting, and monitoring. The demographic accounting system we developed, termed the Model Accounting Plan (MAP), has met our goal.

Demographic Accounting System: An Overview

A demographic accounting system minimally requires that the status of a population be measured twice: at the beginning and at the end of a standard period, such as a year. What is important is that the status of *all* members of the population present at the beginning of the period be accounted for at the end of the period In carrying out a series of these "accounts" (e.g., for successive years), the population whose status must be measured at the end of each period is comprised of two groups: (1) those persons who were present at the initial time point and have remained continuously in the population, and (2) any persons who entered the population after the initial time point and were present at the start of one of the accounting periods included in the series.

The MAP for special education is a demographic accounting system that minimally requires two status-measurements of students enrolled in special education programs (e.g., at the start of two successive school years). All students present at the beginning of the period, in this case Year 1, must be accounted for at the end of the period, in this case Year 2. The information gathered in this way (i.e., at these two time points) on classroom assignments or levels of achievement describes the patterns of educational experience and educational performance that were followed by these students during the one school year.

If carried on over time, i.e., for several successive years, this system of accounts can describe the patterns of experience and performance followed by special education students during their public school careers If extended beyond the school setting, to the worlds of work and independent living, such a system can describe the relationships between in-school attainments and post-school experiences. MAP is thus a powerful tool for assessing the efficacy of special education programs in terms of the transition process.

Demographic Accounting System: Specifics

The individuals included in a demographic accounting framework may be divided into categories, or states, based on descriptive information, such as instructional setting. A particular sample of these individuals may be represented by the proportions p_i, where i describes the various categories or states of the framework. A row of p_i's is a vector of proportions and may be denoted by V.

By accounting for the movements of students into, out of, and within special education programs, and after graduation, one can establish **transition probabilities**: measures of the likelihood with which individuals move among states of the system within the specified period. For example, for students enrolled in Resource Programs (RPs), we can use the transition probability to estimate the likelihood of their remaining in RPs, moving to Specific Instructional Services (SISs), or being mainstreamed the next year. Students moving from state i at the beginning of the period to state j by the end of the period are described by the proportions p_{ij}. For instance, if 10 of 50 students in a Self-Contained Class (SCC) move to an RP, the transition probability is .2, since 10/50 = .2. A matrix of all the p_{ij}'s, denoted by the symbol P, thus shows the transitions made by all students included in the accounting during the period covered by the account.

Expected attainments are derived from transition probabilities by multiplying the matrices (Ps) developed each year for several years in a row—the number of years for which matrices are available thus determines the period over which expectancies may be estimated. This limitation poses a serious constraint on any demographic accounting system, however, namely that the power of the system is dependent on a potentially long-term data collection requirement. A solution to the problem would be to determine through empirical test the stability of the transitions for any matrix P. If found to be stable from one year to the next, expected attainments could be obtained through successive multiplications or powers of a single transition probability matrix, with multiplication starting from a base year and continuing for one or more years into the future. For example, to determine the proportion of students described by vector V who will be in various states after n years, one calculates VP^n, the distribution at the start times the matrix of transition probabilities raised to the power n.

The MAP Matrix

After deciding to develop such a system, we had to decide

- what sample to use
- what time periods to monitor
- what education-related states to include
- what tests to perform to establish the stability of transitions over time

to organize, develop, and validate a sufficient database for the accounting framework.

Our pilot-test site was Fremont Union High School District (FUHSD), a California SELPA with approximately 9000 secondary students, 1099 of them in special education. We included records for all special education students enrolled as of December 1984 and December 1985 and those who graduated in June 1985, using one year as the time period for monitoring. For education-related states, we focused on five instructional settings for special education:

- Self-Contained Class
- Resource Program
- Specific Instructional Service
- Other Special Education Setting (to account for students enrolled in special education schools and home instruction programs)
- Unknown Special Education Setting (to account for omissions in source data files, e.g., students who were assigned a special education status code of "enrolled," but who had no setting assignment in the data base)

We also included two exits from special education programs that were available directly from the database at the pilot-test site:

- Mainstream
- Dropout

Finally, we assisted the pilot-test site in conducting a follow-up study of the 1985 June graduates, to describe their attainments to date of having engaged in the transition from high school to the world of continuing education and work. As a result of this activity, we included two post-graduation states in our matrix:

- Graduate—in school or work
- Graduate—not in school or work

The five instructional settings and four exits provided nine status categories. With accounting for status at the beginning and end of a year, a 9 x 9 square matrix of 81 cells (P_{ij}) resulted.

We then grouped handicapping conditions according to similarities of their transition probabilities, creating three categories:

- Orthopedic Disability—including orthopedically handicapped and other health impaired
- Learning Disability—including specific learning disability, severe language handicap, and hard of hearing
- Retardation or Severe Sensory Disability--including educationally mentally retarded, trainable mentally retarded, developmentally disabled, visually handicapped, deaf-blind, deaf, speech impaired, seriously emotionally disturbed, and autistic

Log-linear analyses were run to determine the (statistical) significance of taking into account these handicapping conditions, age, gender, and ethnicity in deriving the estimated transition probabilities. Age was found to be the only statistically significant factor, so we examined the similarities of the transition paths for students of single-year ages in the range 12-21 years and established four age categories:

- 12-15 years
- 16 years
- 17 years
- 18-22 years

Retaining handicap-group in our matrix on conceptual grounds, our original 9 x 9 matrix (instructional setting or exit category at start and instructional setting or exit category at end) was now a 9 x 9 x 3 (handicapping condition) x 4 (age) matrix. For each cell of the matrix, we used observed frequencies (i.e., actual transition rates derived from pilot-test data) when the total number of cases for that row was more than 30 individuals—a large enough number so that he derived probabilities would be meaningful. The log-linear analysis provided estimated transition probabilities based on a statistical model fitted to the observed data. In cases where the row totals based on observed pilot-test cases alone were too small—i.e., less than 30—we followed special procedures. We used an average of observed and estimated frequencies when the row totals were between 10 and 30 actual cases, and we used estimated frequencies based on the log-linear model when the row totals based on actual cases were less than 10.

The result was a four-dimensional 9 x 9 x 3 x 4 matrix that differentiates status by

- type of handicap
- age
- instructional setting assignment
- post-graduation attainment

We developed an interactive computer program to generate educational expectancies, allowing educators and parents to look at different instructional placements to compare a student's prospects for graduation or dropout and to give an indication of how well programs are meeting specific needs.

As stated earlier, underlying our use of single-period transition probabilities to estimate the expected attainments was the assumption that the transition estimates would remain constant from one year to the next. During our second year, we replicated our work at the pilot-test site (including the follow-up study of recent-year graduates) and derived transition probabilities for a second year, December 1985 to December 1986. The results showed no statistically significant differences in the transition patterns for the pairs of years studied, and so justified the use of a single pair of years for determining transition patterns and expected attainments over a longer period than that observed.

Cost Estimates

One of the important aspects of special education at the local level is cost. Administrators need to know how many special education students they have and what their transition patterns and expected attainments are; they also need to know the cost implications of those patterns. To provide local-level information on costs, we added **cost estimates** for various handicaps and instructional settings. Because the cost estimates are a new feature since our Phase Two report, we describe them in detail below.

To incorporate these cost data into MAP, we used national-level data from Decision Resources Corp (1988) to derive costs for each handicapping condition. We multiplied the appropriate cost estimates times the p-values of the likely end-states for students in each year and took the sum: this is the estimated yearly cost. We summed over years to give interim and final total-cost estimates, so that, for example, if a particular student has a fifty-fifty chance of being in an SCC or RP in the next year, we multiplied the cost estimates for his or her handicap in each of these settings by .5 and took the total as the estimated yearly cost for that student. Although our cost estimates based on national data must be regarded as crude estimates when applied to transition patterns in a community, they nevertheless provide useful examples of the power of an accounting system such as MAP. For the pilot-test site, the addition of these national cost data allows MAP to make projections of yearly and total costs for individuals and groups, as well as projections of likely progress through the different instructional settings and one year out of high school.

To obtain the cost estimates, we used the following data:

Average Per-Pupil Cost of Special Education, 1985-86

The following chart shows average special instructional costs per student by disability and program type. It excludes the cost of related services, support services, and the regular education the students receive. Students in resource programs spend, on average, 24 hours a week in regular education and six hours in the resource room. Among those in self-contained programs, 15 percent spend no time in regular education; the rest spend an average of 8.5 hours per week in regular education.

Handicapping Condition	Self-Contained Class	Resource Program
Speech impaired	$ 7,140	$ 647
Mentally retarded	4,754	2,290
Orthopedically impaired	5,248	3,999
Multihandicapped	6,674	No cases
Learning disabled	3,083	1,643
Seriously emotionally disturbed	4,857	2,620
Deaf	7,988	No cases
Deaf-blind	20,416	No cases
Hard of hearing	6,058	3,372
Other health impaired	4,782	No cases
Autistic	7,582	No cases
Visually impaired	6,181	3,395
Across all conditions	$ 4,233	$ 1,325

Source: *Decision Resources Corp.*

For the "no cases" entries under Resource Program (RP), we took one half of the value for Self-Contained Class (SCC), our rationale being that for many of the others, the RP amounts are approximately half of the SCC estimates. (We could not pro-rate costs on an hourly basis because there are fixed costs evidently associated with, e.g., accommodating deaf-blind students at all.) For Specific Instructional Service (SIS) data, we made an hourly pro-rating, using RP data as a base. For example, if speech impaired students in an RP cost about $647 for six hours in the resource room, we estimated that SISs, which are usually one-hour "pull-out classes" at the secondary level, should be about one third the amount, or about two hours per week. Pro-rating was appropriate for SIS because built-in costs are part of the RP estimates; e.g., pulling out a deaf student for six hours in a room will likely cost no more than pulling the same student for two hours. For "Other Special

Education Setting" and "Unknown Special Education Setting," we used mean estimates across all the settings for each handicap in these cases.

Adding these data, we obtained these values:

Average Per-Pupil Cost of Special Education

Handicapping Condition	Mean of Other Values	SIS	SDC	RPs
Speech impaired	$ 2,667	$ 216	$ 7,140	$ 647
Mentally retarded	2,602	763	4,754	2,290
Orthopedically impaired	3,527	1,333	5,248	3,999
Multihandicapped	3,708	1,112	6,674	3,337
Learning disabled	1.758	548	3,083	1,643
Seriously emotionally disturbed	2,783	873	4,857	2,620
Deaf	4,438	1,331	7,988	3,994
Deaf-blind	11,342	3,403	20,416	10,208
Hard of hearing	3,518	1,124	6,058	3,372
Other health impaired	2,657	797	4,782	2,391
Autistic	4,212	1,264	7,582	3,791
Visually impaired	3,569	1,132	6,181	3,395

These data were then used together with the *p*-values of the likely end-states, and the sum was the estimated yearly cost. We included a 5% yearly adjustment for inflation in our over-time projections.

Illustration of MAP Sequences

To illustrate the process involved in using MAP, a typical sequence of entering data is shown below. For this illustration, let us assume that a high school special education teacher wants to plan for the enrollment of 25 learning disabled students. It is anticipated that 15 will go in a self-contained classroom and 10 into the resource program.

As soon as the teacher calls up the system, the following screen appears.

H = Help

Age to start?

Because most of the students will be 14 years old, the special education teacher types in 14 and presses Return.

H = Help

Individual (I) or Cohort (C) Analysis ?

The teacher types in C for Cohort and presses Return.

H = Help

(1) Autistic
(2) Deaf
(3) Deaf-Blind
(4) Hard of Hearing
(5) Learning Disabled
(6) Mentally Retarded
(7) Multihandicapped
(8) Orthopedically impaired
(9) Other Health Impaired
(10) Seriously Emotionally Disturbed
(11) Speech Impaired
(12) Visually Impaired

Which Disability to Consider?

The teacher types in 5, to indicate learning disabled, and presses Return.

Numbers of Students in the following Instructional Settings?
(NOTE: Total students with this disability is 25)

(1)	Self-Contained Class	(0)
(2)	Resource Program	(0)
(3)	Specific Instructional Service	(0)
(4)	Other S. E. Setting	(0)
(5)	In S.E., Setting Unknown	(0)
(6)	Mainstream School Setting	(0)

The teacher types 15 next to Self-Contained Class and 10 next to Resource Program. Note that the screen reminds the user that 25 students should be accounted for. After the teacher presses Return, the system begins making projections based on the data collected from the pilot-test site. If the teacher wishes to have paper copies of any of these projections, pressing the Print key will produce a copy of the information on the screen. Below is the projection for the 25 students one year after enrollment (after their freshman year).

AT AGE 15 -- 1 Year(s) Later
DISABILITY = (5) Learning Disabled
STUDENTS (Ss) WITH THIS DISABILITY = 25

Proportion in a Self-Contained Class	40.3%	(Ss =10)	
Proportion in a Resource Program	24.9%	(Ss = 6)	
Proportion in a Specific Instructional Service	1.4%	(Ss = 0)	*
Proportion in Some Other S. E. Setting	1.7%	(Ss = 0)	*
Proportion in S.E., Setting Unknown	0.0%	(Ss = 0)	
Proportion in a Mainstream School Setting	26.1%	(Ss = 7)	
Proportion Dropped Out of School	5.5%	(Ss = 1)	
Proportion Graduated and at School or at Work	0.0%	(Ss = 0)	
Proportion Graduated but Not at School or at Work	0.0%	(Ss = 0)	

Estimated Yearly Costs—$ 46,112.81
Estimated TOTAL Costs to This Point—$ 46,112.81

*** Press Any Key to CONTINUE ***

* One student apportioned over more than one setting

The teacher can see that 10 students will probably remain in SCCs; six will remain in RPs; seven will be mainstreamed, one is likely to drop out of school, and the remaining two are likely to be in some other special education setting. Estimated yearly costs for the 25 learning disabled students are $46,113. The teacher presses any key to see the next screen, continues on for three screens, and stops to study the results in four years, after the students' senior year.

AT AGE 18 -- 4 Year(s) Later
DISABILITY = (5) Learning Disabled
STUDENTS (Ss) WITH THIS DISABILITY = 25

Proportion in a Self-Contained Class	13.4%	(Ss = 3)	
Proportion in a Resource Program	15.4%	(Ss = 4)	
Proportion in a Specific Instructional Service	3.0%	(Ss = 1)	
Proportion in Some Other S. E. Setting	1.6%	(Ss = 0)	*
Proportion in S.E., Setting Unknown	0.3%	(Ss = 0)	*
Proportion in a Mainstream School Setting	29.7%	(Ss = 7)	
Proportion Dropped Out of School	13.2%	(Ss = 3)	
Proportion Graduated and at School or at Work	20.5%	(Ss = 5)	
Proportion Graduated but Not at School or at Work	3.0%	(Ss = 1)	

Estimated Yearly Costs—$ 22,627.41
Estimated TOTAL Costs to This Point—$ 147,593.80

*** Press Any Key to CONTINUE ***

* One student apportioned over more than one setting

The teacher now sees that five will probably have graduated and gone on to school or work; one will have graduated but not have gone on to school or work; and three will have dropped out. Of the remainder, only three will remain in the self-contained class; seven will have been mainstreamed. Four will be in an RP, one in a SIS, and one in an unknown special education setting. At this point the estimated yearly costs are $22,627.

To look at costs for other students, for example, for three mentally retarded students, the special education teacher could begin the process again.

Summary: Goal One

Our Model Accounting Plan provides local-level data for administrators and parents: it can be used to monitor the progress, transition patterns, expected attainments, and associated costs of special education students. MAP is future-oriented: it not only gives educators a history of their special education students but it provides a means for them to see where those students are headed and what the associated costs and needs are. It helps parents understand the likelihood of their special education students reaching certain goals or following certain patterns. It does not predict with certainty, but it shows patterns for similar students and similar situations, providing critical information and helping to inform decisions about students and programs.

Goal Two

Facilitate the aggregation of local data to inform decisions about special education at the state and national levels.

Some school districts and SELPAs in California already have sophisticated data collection systems; for them, it is relatively simple to transfer data into MAP to obtain transition patterns, expected attainments, and cost estimates. Other sites lack the systems or the software to collect and retain special education data. To make MAP accessible to such sites, we developed a turnkey management information system (MIS) that we could distribute free to schools districts. The MIS is an application of Paradox, a data base manar ment program for IBM or IBM-compatible personal computers.

The MIS has a menu structure based on seven tasks:

1. **Create records** for students in special programs. Data that can be collected include basic information about the student, e.g., name, ID, address, telephone, birthdate, ethnicity, language; and special education data, e.g., instructional service, handicap, teacher, residence district, program status, and dates of IEP approval, annual review, previous evaluation, and triannual evaluation. These fields can be customized for each site.

2. **Update student records.** Changes can be made to records already created.

3. **Make back-up copies.** Copies of information can be made for a hard disk, a floppy diskette, or tape.

4. **Analyze student records.** With the specification of two dates, transition patterns can be analyzed. (This task is in prototypic stage.)

5. **Create reports of student records.** Four major types of reports can be generated: reports by SELPA (or intermediate educational unit); setting within a SELPA; district; and student reports: active students, discharged students, history of changes to an individual record, status of an individual student, and status of students in a district. Within each type of report, data can be organized by handicap and age; instructional setting and age; ethnicity; licensed care institutes (LCI) or foster homes and limited-English speaking (LEP) or non-English speaking (NEP).

6. **Transfer records.** Data from files created with the MAP MIS system can be transferred into several formats for use with other software packages (e.g., dBase, Lotus 1-2-3).

7. **Leave.** The user can exit from the MIS.

For the MIS, we developed pop-up help screens that make it easy to use and a "plain-English" manual with step-by-step instructions. The MIS is program-specific, so information for up to five programs can be kept for each special education student. It enables sites to prepare all kinds of group and individual reports, including those needed for pupil-counts, and makes MAP accessible to any site that has an IBM or IBM-compatible personal computer. For speed in data processing at sites with several thousand special education students, we recommend IBM or IBM-compatible personal computers operating on an 80386 microprocessor.

Example of MIS Sequence

When users begin to use MAP's MIS, the first screen they see identifies Project MAP and includes information about the grant and funding agency. Next they are given a choice of the seven tasks described above (i.e., Create, Update, Backup, Analyze, Report, Transfer, Leave). To illustrate the process involved in creating a record, a typical sequence of entering data is shown below. For this illustration, let us assume that a high school aide is entering data for one student.

The aide chooses **Create** from the seven tasks, presses **Enter**, and sees the message "Setting up tables." Then this data screen appears:

```
[F2] — post records,  [F3] — previous student,  [F4] — next student,
[F5] — assign ID,  Esc — Cancel entries,  Ctrl-U — Undo last change

                         Student Data Entry
----------------------------------------------------------------------
              Student ID:
   Last Name*First Name:
                 Address:
        City, State ZIP+4:
               Telephone:                    LCI/Foster Home?

Ethnicity:                                       Language:
Birthdate:               Sex:        Handicaps:              NEP/LEP:
                                                 1  2  3  4
----------------------------------------------------------------------
   Grade:      Residence District:             Program Status:

Dates:  (mm-dd-yy)
            IEP Approval:                    Annual Review:
     Previous Evaluation:               Triannual Evaluation:
----------------------------------------------------------------------
```

The aide types in all of the information that is available, presses **Enter**, and sees the following screen.

[F2] — post records, [F3] — previous student, [F4] — next student,
[F5] — assign ID, Esc — Cancel entries, Ctrl-U — Undo last change

---

Parent:
Address:
City, State ZIP+4: Phone:
Language:

Parent:
Address:
City, State ZIP+4: Phone:
Language:

Instr Set	DIS Serv	Teacher	School/Jurisdiction	Dates Start	End

---

The aide types in all of the information about the student's parents and the student's various instructional settings, teachers, schools, and dates involved. Then the aide can either create more records or go to one of the other tasks. The data entered for each student is added to that for other students, enabling the aide to produce reports on individual students or on groups, e.g., by handicap and age, by instructic..al setting, by ethnicity, and by LCI and LEP categories. The aide can also order analyses of the type described in the MAP sequence earlier.

Aggregation of Data

Having developed a means for sites to report data easily, we focused on ways to aggregate data from a variety of sources. We gathered data from three very different data sources: Fremont Union High School District, Yolo County, and Merced County in California, where data are kept in widely varying ways. For example, in Merced, each student has two or three programs with beginning and end dates, and counts are made within students. One code is used for graduation, and drop-outs are recorded. In FUHSD, more exit codes are used, e.g., withdrawal for marriage or withdrawal for pregnancy. Each student has a special education code describing the special education services he or she receives. When services are terminated, no new code is added. The student record merely shows the discharge date. We worked with the Merced data to make it compatible with the FUHSD data already in the system, for instance collapsing FUHSD's exit categories.

Our work convinced us that aggregation is possible so long as it is clear (1) whether a student is in special education and (2) if in special education, what instructional setting the student is in. It is assumed that age and handicap are available for all students. The only "cost" of aggregation is that the degree of specificity in describing the accounting framework—whether it is a 9 x 9 x 3 x 4 or a 20 x 20 x 20 x 20—will always be no greater than is permitted by the "poorest" or least descriptive data source. If the poorest data have too few categories and are too grossly combined, they probably should be excluded from attempts at aggregation.

States are required to aggregate data. There are pros and cons. On the "pro" side is the fact that in principle, the more data available, the finer the matrix so that, for example, single years of age or specific handicapping conditions can be examined in detail. The resulting information can increase accountability and aid planning for individual students, local programs, and national policies. On the "con" side is the fact that any data collection requires time and effort, particularly if standards are set for all sites. Staff training may be needed. Aggregation requires that everyone collect the same data in the same way.

Summary: Goal Two

To make MAP more accessible to schools that lack systems for collecting data systematically, we developed a management information system based on the Paradox software. Easy to use, it helps ensure that any school system can use MAP and that everyone collects the same data. We also examined data from three diverse SELPAs to determine the feasibility of aggregating data in MAP and found that it was possible. As with any aggregation, it can be done only as finely as its poorest, or least descriptive, data source.

Goal Three

Encourage positive change in the way that data for special education students are reported and used

During the course of this project, we have spent a considerable amount of time "out in the field," talking with teachers, special education directors, administrators. and others about data collection for special education students: what data are currently collected and how they are used; what data needs are not being met and how we might address those needs. We visited or otherwise met with educators in San Bernadino, San Diego, Simi Valley, Santa Clara County, Yolo County, Merced, ElDorado County—in short, from northern California to its southern tip, in large city districts and small rural ones. We attended their meetings, discussed the problems associated with their data, and listened to their concerns.

We gained a thorough understanding of the problems, and we believe that MAP addresses those problems. We have made our system available to school systems at no cost; we have offered assistance to districts that wish to implement it. We have disseminated information about MAP in many forms. We describe those below.

Dissemination

Throughout the project, we have sought opportunities to tell people about MAP and to encourage them to try using the system. We have placed descriptions of MAP in a variety of newsletters and have had two journal articles published about MAP (in *Social Indicators Research* and *The Journal of Special Education*). All information has included instructions for obtaining the demonstration diskette and project reports. In this last phase of MAP, we have continued to disseminate information about MAP and provided free copies of the demonstration diskette, the manual, and other information to interested persons. For example, we provided information on MAP for *Summary of Literature and Outreach Findings on Student Follow-Through Systems* (Stern et al., 1988), a background report for the Education Transition Center of the California State Department of Education. Supporting materials are in *Materials for Outreach Activities on Student Follow-Through Systems.*

We sent information to the Department of Educational Accountability, Montgomery County Public Schools in Rockville, Maryland, and we were listed in their *Level 4 Task Force Report*. One person, having received our demonstration diskette and other materials, asked for permission to publicize the system to others at a California special education conference, permission we were happy to grant.

At the request of the Social Science Research Council, we recently wrote an article about MAP for the *Journal of the American Statistical Association*. T: ed "A Demographic Accounting System to Inform Educational Policy: Genesis, Dissemination, and Limited Acceptance," the article focuses on educational policy issues that are raised by an accounting system of this type. A copy of the article is in Appendix A. In addition to the JASA article, we have submitted an article on MAP to the journal *Educational Technology*; it is included as Appendix B.

Perceived Problems in Dissemination and Implementation

The JASA article reflects our experience that MAP is difficult to implement because of two problems, which we believe other accounting systems for special education will encounter. We describe those problems below.

Problem: difficulties in getting data. Our experience in enlisting the cooperation of educational decision-makers in developing and pilot-testing MAP has been positive; top administrators have been supportive and enthusiastic. Resistance has come mainly from those who must collect the data and enter it into the system: they are less helpful. They do not see the value of the ata being collected; they resent the paper work already mandated for special education—Individualized Educational Plans (IEPs), documentation of conferences and telephone contacts with parents, and annual pupil-counts. Their resistance applies not only to MAP but to any similar system. MAP requires no additional data except for the post-graduation follow-up, which is essential only if schools and policy makers want it. The other data required for MAP are or should be already collected for the pupil-counts.

This problem can be solved, we believe, only by helping special education teachers and other staff members realize the value of the data that MAP (or a similar system) can produce. With training in how to collect and use data, special education teachers and staff would be more cooperative, as they see the "why" and "how" for data collection.

Problem: communication problems at the local level. In talking with numerous California SELPAs to assess needs, we found that relationships between data processing staff and teaching and program administrative staff are often hostile. The data processing people see information as their top priority, and they sometimes fail to see the implications of those data needs on program activities. The teaching and administrative staff see instruction as their top priority, and they often underestimate the value of technology in general and computer-generated information in particular. The mutual distrust between data processing staff and teaching and program administrative staff and, in many cases, the physical distances separating their workplaces, affects both communication and the quality of data.

We believe that this problem can also be ameliorated by staff training and other efforts to develop collaboration and cooperation. As program implementers begin to see the value of information, they will be more willing to help gather accurate data for the data processing staff and to use the resulting reports. As the data processing staff gains a greater understanding of the programs and demands on the time of the teaching and program administrative staff, they will find additional ways to make the information meaningful and useful.

Good communication and positive attitudes can make a difference. We found that at both Fremont Union High School District and Merced County Schools, communications were good and interest was high. The FUHSD local school board welcomed the data, staff cooperated willingly, and, at Merced, parents even became involved, in gathering follow-up information on graduates.

Summary: Goal Three

We have undertaken a number of steps to encourage positive change in the way that special education data are reported and used. We met with special educators at widely varying sites across California; we attended meetings; we wrote articles; we offered our demonstration diskette and other information free to any interested persons. We have recently submitted two more articles to journals, and when they are published, we expect to receive additional requests for information, which we will honor. We will continue our efforts to promote positive changes in data collection and use.

Recommendations

We have three recommendations or observations, based on our experience in developing and disseminating MAP:

1. **Data quality must begin and end at the local level.** If those data are not gathered carefully and accurately, any aggregation at the state and national level will be meaningless. If those data are accurate, valuable information can be gained for planning programs, allocating resources, and helping special education students. To promote attention to data at the local level, school personnel must be convinced that the data are useful. MAP or a similar system can help analyze their data in meaningful ways so that teachers, parents, administrators, and Boards of Education can see what it happening to their students, what their future achievements are likely to be, and what resources are needed. If it is evident at the local level that special education data are useful, data collection will be carried out with enthusiasm and care.

2. **Efforts must be made to capture the imagination of local school personnel and to motivate them to improve their skills in collecting and using data.** They can be encouraged to use existing data for local benefits, such as in conferring with parents, preparing newsletters about school activities, and reporting to Boards of Education. Administrators need to be more comfortable with data interpretation; local capabilities need to be developed.

3. **Data requirements need to be made more consistent at the national and state levels. Schools perceive the data requirements as changing and capricious, lacking continuity or solid rationales.** A national conference could be held every five years or so to discuss data elements needed to inform policies and programs, with Congressional hearings or some other forum for public discussion and review. Local personnel could be invited to express their ideas, concerns, and needs so that they would feel a vested interested in obtaining meaningful information.

Our experience with MAP has made us confident that a demographic accounting system is feasible and useful. We recognize the critical importance of acceptance and support from local-level educators for such a system, and we envision an aggregation of data that could make vital contributions to special education policies at the state and national level.

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Appendix A

Article Submitted to the *Journal of the American Statistical Association*—

"A Demographic Accounting System To Inform Educational Policy:

Genesis, Dissemination, and Limited Acceptance"

A Demographic Accounting System to Inform Educational Policy: Genesis, Dissemination, and Limited Acceptance

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Authors' Footnote

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ABSTRACT

Federal programs are developed with an eye to overall goals and policies, and they rarely include specifications for data that could illuminate the policy makers as to the success or failure of those goals and policies and provide program implementers with data related to improving effectiveness. Our case study focused on Project MAP: Model Accounting Plan for Special Education, a demographic system we developed which monitors the placements and transitions of special education students and provides cost estimates for various handicaps and instructional settings. MAP operates on IBM-compatible computers available in most school districts, is simple to implement, and is most informative if a minimal amount of data is collected beyond that already mandated by the federal government. Our efforts to disseminate it at no cost have had only limited success, and we suggest that the reasons are related to difficulties in getting data and poor communication. We believe that these issues need to be addressed before accounting systems like MAP can be widely adopted and effectively used.

Key Words

accountability

special education

transitions

cost estimates

FEDERAL POLICY AND LOCAL IMPLEMENTATION

As funding for federal programs has increased into billions of dollars, the demand for accurate accounting and accountability has also increased. Congress—and taxpayers—want to know where the money is being spent and with what results. Specifically they are interested in: What works? What did it cost? What are its political benefits? Can it be implemented in my district? Unfortunately the legislation for these programs seldom translates goals into data requirements that can meet accounting and accountability needs. As programs operate and additional needs are identified, reporting requirements are added, often without significantly improving the quality of the resulting data. At the local level, the implementers, busy with program activities, often fail to see any connection between reporting requirements and program goals. They resent the time and energy required for gathering and reporting data, and they become increasingly frustrated as the requirements change. The national focus (where the money is appropriated) is on goals; the local focus (where the money is spent) is on operations.

Consider the following example. Drug use is a national concern. In responding to the problem, Congress passes legislation to fund local programs to reduce drug use among high school students. A drop-in center is proposed for a local community; the goal is to provide information about drugs and their harmful effects. An application is made and the program is funded. Tied to the funding is a requirement for evaluation data. Having appropriated the money, Congress wants to know how well the center does in meeting its goals. The program is hard to describe: the staff members can count the number of students who come in and add up the numbers of activities provided. They sense that they are making a difference in the students' behavior, but they cannot document it by merely counting the number of students served. What is needed is quality data for the decision-makers, so that they can tell if the program is effective.

In education, results are particularly difficult to measure. By contrast, programs in such areas as health and labor are easier to quantify. Education involves complex processes that may require several years to produce discernible effects. Socioeconomic factors and other background and contextual factors can have significant effects on program outcomes, making it difficult to disentangle their effects from those due to the programs. Furthermore, many programs are unable to provide hard data on whether they meet the broadly stated national goals that have been set for them.

PROBLEMS IN GATHERING DATA ON SPECIAL EDUCATION

The Department of Education program Education for the Handicapped nicely illustrates the data problems that occur with many federal programs. Educational programs for handicapped students were given an appropriation of almost $2 billion in FY 1989: $1.8 billion in state grants and $0.2 billion in special purpose funds. The state grants were then given to local education agencies to provide services for handicapped students which were above and beyond those provided for nonhandicapped students. Funds were administered through the Office of Special Education and Rehabilitation Services. The relevant questions for the special education programs are:

- What do the services cost and how they compare to the costs of programs for nonhandicapped students?
- What are the effects on students: Will they be able to move into regular classrooms? Will they be able to get jobs they after graduate or leave the public school system?

Unfortunately, a means for answering these questions has not been established. To provide data about the services provided, Congress mandated "pupil counts," a twice-yearly report intended to inform administrators about the enrollments of students in different types of programs (e.g., self-contained classes, resource programs, regular classroom), by type of handicap (e.g., speech impaired, mentally retarded, orthopedically impaired, learning disabled), age, and ethnicity. Each local education agency (LEA) reports the counts for its programs to the state; each state aggregates the data and provides a report to the federal government. In theory, this form of program monitoring promotes program effectiveness. In practice, the types and quality of data compiled have little value for assessing effectiveness for two reasons:

1. The pupil-count system places little emphasis on keeping track of students' progress after they leave special education programs. In many jurisdictions, if a student moves from a self-contained special class into a regular classroom, the records for that student are deleted from the database. In other jurisdictions, when

changes are made in student records, they are simply written over the original information, destroying the historical record on student performance.

2. The pupil-count system is not designed to relate information on enrollments from one year to the next. Each time a count is taken, the current status of students is reported. Changes in student status over time, e.g., whether a student is moved into the mainstream program or continues in a special education assignment, are not required and not reported.

The pupil counts are difficult, time-consuming, and, at least according to the small sample of special education personnel we interviewed in California, of limited value. The data requirements are interpreted in different ways in different places, we were told, and the resulting counts are used for reporting requirements and little else. Despite the limitations of the pupil-count, it is the only annual data reporting required for special education programs by the federal government.

The pupil-count system illustrates the situation found with other funding: those who fund programs fear that the appropriated money is not being spent for good purposes. Those who implement those programs are annoyed that they must take the time to gather data that they neither want nor use. Caught in between are the bureaucrats who must carry out the federal mandate and who know how it is regarded at the local level.

A CASE STUDY: PROJECT MAP

Aware of the problems inherent in the pupil-count system for reporting data on students receiving special education services and cognizant of the need for accurate data for planning programs and monitoring progress, we at the American Institutes for Research decided to seek a solution. The senior author lead the effort. The solution developed by Dr. Rossi and his AIR colleagues was MAP—Model Accounting Plan for Special Education—which was funded by a three-year grant from the Office of Special Education Projects (OSEP) of the Department of Education and was based on a demographic accounting framework.

A Demographic Accounting Framework

First proposed by Sir Richard Stone (1971), the concept has been used in a variety of contexts, including studies of labor force participation and population dynamics. McMillan and Land (1979) and Russ-Eft and her colleagues (1981) explored demographic accounting in relation to education. When applied to educational systems, a demographic accounting framework estimates population stocks and flows (e.g., enrollments, graduations, other withdrawals) through various settings (e.g., grade levels, instructional programs) over time. It then integrates this information on population stocks and flows to describe patterns of educational performance and the ways in which these patterns change over time. The resulting data can inform school-level decisionmaking and can be aggregated for use at higher administrative levels.

To develop MAP, AIR staff constructed a large-scale computer database containing in-school and post-graduation data on special education students and created a turn-key management information system for microcomputers that produces the data matrices suitable for transitional analysis. The MAP accounting framework consists of a four-dimensional matrix that differentiates transitional status by type of handicap, age, instructional setting assignment, and post-graduation attainment. Powers of the transition probability matrix, starting with a base year and continuing for one or more years into the future, are used to derive expected educational attainments by a particular age. The system was pilot-tested with data for approximately 11,000 special education students at three California sites.

MAP operates on IBM-compatible PCs and was written in Paradox[1], a data base management program. MAP can be customized at each site. Fields are already established; schools can add teachers names, handicaps, grade, ethnicity, language, residence district, program status, instructional setting, designated instructional services, school, and jurisdiction. MAP is program-specific, storing information for up to five programs for each special education student. MAP's main menu structure is based on eight tasks (e.g., creating a record); it is easy to use, with pop-up help screens and a "plain-English" manual with step-by-step instructions. The program provides support for one data collection effort beyond that needed for pupil-counts: a follow-up of recent-year graduates. MAP automatically performs all analyses of the compiled data, whether transitional analyses or tabulations required by the pupil count system, in response to menu selections.

[1] Paradox Relational Data Base, Rel. 3.0. Scotts Valley, CA: Borland International.

MAP: Basic Pupil Data, Estimates of Transitions Paths, and Per-Pupil Costs

MAP enables local school personnel to use their administrative data base for generating pupil-counts, preparing up-to-date class lists, and compiling accurate histories of individual students over time and across academic years, and as a means for estimating transitional paths. In addition, because MAP includes data on the average per-pupil cost of special education, it can project the costs for providing services of each program type to students with each handicapping condition.

For example, a high school principal who knows that 25 learning disabled students will be entering from a feeder junior high school can compare those students to current students with similar handicaps and determine what programs they are likely to need and what the costs of those programs will be. Figure 1 shows the MAP data for the 25 learning disabled students one year after entering.

(insert Figure 1: Projections for 25 Learning Disabled Students: 1 Year after Enrollment)

MAP can continue to make projections for succeeding years, provinding information about probable placements and costs. Figure 2 shows the MAP data for the same 25 learning disabled students four years after entering.

(insert Figure 2: Projections for 25 Learning Disabled Students: 4 Years after Enrollment)

These data are valuable in monitoring and reporting current program activities, allocating resources for future programs, and providing more accurate information to parents about the likely outcomes for their children in these programs.

RECEPTION TO PROJECT MAP

Having developed an inexpensive, easily implemented solution to a commonly recognized problem, we disseminated information about it in a variety of ways: journal articles[1], reports[2], newsletters, computer networks, conference

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1 Rossi, R. J. (in press), "Demographic Accounting for Special Education," *Social Indicators Research.*

AT AGE 14 -- 1 Year(s) Later
DISABILITY = (5) Learning Disabled
STUDENTS (Ss) WITH THIS DISABILITY = 25

Proportion in a Self-Contained Classroom	40.3%	(Ss =10)	
Proportion in a Resource Program	24.9%	(Ss = 6)	
Proportion in a Specific Instructional Service	1.4%	(Ss = 0)	*
Proportion in Some Other S. E. Setting	1.7%	(Ss = 0)	*
Proportion in S.E., Setting Unknown	0.0%	(Ss = 0)	
Proportion in a Mainstream School Setting	26.1%	(Ss = 7)	
Proportion Dropped Out of School	5.5%	(Ss = 1)	
Proportion Graduated and at School or at Work	0.0%	(Ss = 0)	
Proportion Graduated but Not at School or at Work	0.0%	(Ss = 0)	

Estimated Yearly Costs—$ 46,112.81
Estimated TOTAL Costs to This Point—$ 46,112.81

* One student apportioned over more than one setting

Figure 1: Projections for 25 Learning Disabled Students: 1 Year after Enrollment. Data are shown as they would appear on the computer screen. Estimated yearly costs are based on "Annual Per-Pupil Cost of Special Education, 1985-86," from Decision Resources Corporation.

AT AGE 17 -- 4 Year(s) Later
DISABILITY = (5) Learning Disabled
STUDENTS (Ss) WITH THIS DISABILITY = 25

Proportion in a Self-Contained Classroom	13.4%	(Ss = 3)	
Proportion in a Resource Program	15.4%	(Ss = 4)	
Proportion in a Specific Instructional Service	3.0%	(Ss = 1)	
Proportion in Some Other S. E. Setting	1.6%	(Ss = 0)	*
Proportion in S.E., Setting Unknown	0.3%	(Ss = 0)	*
Proportion in a Mainstream School Setting	29.7%	(Ss = 7)	
Proportion Dropped Out of School	13.2%	(Ss = 3)	
Proportion Graduated and at School or at Work	20.5%	(Ss = 5)	
Proportion Graduated but Not at School or at Work	3.0%	(Ss = 1)	

Estimated Yearly Costs—$ 22,627.41
Estimated TOTAL Costs to This Point—$ 147,593.80

* One student apportioned over more than one setting

Figure 2: Projections for 25 Learning Disabled Students: 4 Years after Enrollment. Data are shown as they would appear on the computer screen. Estimated yearly costs are based on "Annual Per-Pupil Cost of Special Education, 1985-86," from Decision Resources Corporation.

contacts, and conversations with educators and state agency personnel. We sent demonstration diskettes and manuals free to any interested person who requested them. The response has not been encouraging. We believe that the reasons for this apparent resistance are two-fold and are instructive for others who wish to address similar problems.

Difficulties in Getting Data

Decision makers recognize the potential value of MAP and have responded enthusiastically to it. At sites where we have asked for data and cooperation in trying out the system, the top administrators have been enthusiastic and supportive. The resistance has come from those who have to implement the program, those who must collect the data and those who must enter it into the system. We have found it difficult to convince these implementers that the system can be beneficial: they do not recognize its possible use, and they are skeptical of its results. They are reluctant to take on any data collection tasks not already required, even if, like the follow-up of graduates, the tasks would produce useful information.

This reluctance is understandable in light of the paperwork and data collection already mandated for special education programs. In addition to their regular tasks of planning, providing, monitoring, and evaluating instruction, the special education teacher and other staff involved (e.g., school psychologist, speech therapist) must prepare an Individualized Educational Plan (IEP) for each student who receives services. The IEP details the students' needs and outlines an educational program to meet those needs. The IEP is developed each school year, reviewed with the student's parents during an individual conference, and revised as necessary. The special education teacher must also keep records of all contacts with parents, through both telephone calls and conferences. In addition to tracking the IEPs, coordinating other special education services, and issuing the usual report

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Rossi, R. J. and Wolman, J. M. (1988), "A Model Accounting Plan for Special Education," *The Journal of Special Education, 21(4), 57-73.*

2 Rossi, R. J. (1987), *Project MAP Year One Final Report: Pilot-test of the Model Accounting Plan and Preliminary Results of Expectancy Analyses.* Palo Alto, CA: American Institutes for Research.

Rossi, R. J. (1988), *Project MAP: Model Accounting Plan for Special Education: Phase Two Final Report,* Palo Alto, CA: American Institutes for Research.

cards, the teacher and school must also report the pupil-counts twice a year. Although some of the resulting data are useful, this paperwork takes valuable time away from activities directly involving students. And even though the follow-up of graduates is a relatively trivial task, it too adds to the burden.

To solve this problem, special education teachers and other staff members must be convinced that it is worthwhile for them to collect the small amount of additional data that MAP requires. Staff time must be provided, either from the special education staff or from the LEA staff. Special education teachers and other staff must begin to see the value of the data they already collect and observe the constructive use of the information. This change in attitudes will have to come from staff training and improved practices. Too often, federal and state data requirements are changed for what seem to be capricious reasons, requiring minor changes in reporting but resulting in an attitude of "What now?" at the local level. Consistency in requirements and clear rationales for each data request will increase cooperation.

Communication Problems at the Local Level

In many school settings, the computing staff is separate from the teaching and program administrative staff, often in buildings some distance from one another. We have noted that the teaching staff tends to be somewhat intimidated by the data processing staff. Understandably, teachers put students first; information needs are farther down on their list of priorities. Their computer knowledge is primarily related to classroom applications; they are less familiar with data reporting systems. Teachers sometimes fail to understand how technology can help them; they often do not know how to specify what information they need and why. By contrast, the data processing staff put information at the top of their list of priorities; they do not always appreciate the impact that information needs can have on programs. The data processing staff are sometimes impatient with teachers' lack of technological expertise and their perceived lack of appreciation for strict data collection practices. This hostility affects both communication and the quality of data.

To solve this problem, both teaching and data processing staffs need to develop collaborative attitudes. Teachers must become more appreciative of the value of computer-generated data, learning to use it to enhance their work. Data processing staff must become more student-centered, developing data and systems that assist teachers without making misunderstood or unreasonable demands. This solution, like that for the problem of gathering data, requires increased staff training, improved communication, and changed attitudes.

We have evidence that good communication and positive attitudes toward data collection can make a difference. In developing MAP, we worked with two California jurisdictions (Fremont Union High School District and Merced County Schools), and there communications were good and interest was high. The local board was eager for the data, the staff invested their time freely, and, in one case, parents volunteered to conduct the survey of recent-year graduates.

The two problems—difficulties in getting data and poor communication between the teaching and data processing staffs at the local level—must be addressed before MAP or any other accounting system can be implemented successfully. We will continue to promote our system and to investigate ways to increase its use, but staff development must be provided and communication must be improved. This communication must start at the top, where federal policy makers need to articulate their data needs for policy decisions, and continue through the middle level, where those requirements can be communicated and monitored, to the local level, where they can be carried out and, more important, provide useful information to improve programs and services.

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Appendix B

Article Submitted to *Educational Technology*—

"Computer-Generated Educational Data:

Nuisance or Opportunity?"

Computer-Generated Educational Data: Nuisance or Opportunity?

Phyllis A. DuBois
Robert J. Rossi

Technology is a vital part of nearly every classroom in America today. Students use computers for simulations, data analysis, drill and practice, word processing, and many other learning-based activities. In some classrooms, students use interactive videos and other sophisticated technological equipment. Teachers use computers to develop lessons and maintain records. Outside the classroom, in the principal's office or the superintendent's office, computers are used to produce documents such as school bulletins and newsletters and to gather data such as attendance figures and budgets required by the "higher ups" at the district, county, state, or federal level. The data meet requirements, not needs, and are seldom used for analysis and projections.

Data for special education are a case in point. As part of the funding for special education initiated by the Education for All Handicapped Children Act, P.L. 94-142, the federal government mandated annual "pupil counts," tallies of students in special education each year. Most schools dutifully take the counts on schedule, report their numbers, and forget about them, considering it a time-consuming task useful only for obtaining funds.

At the American Institutes for Research (AIR), we were interested in how technology might serve educators at the local level; how the computer might be an analysis tool for local program management. Wouldn't it be helpful, we thought, to have a way for educators to be able to see

- the **path** that their students were most likely to follow through their educational system—the special services they would need and for how long
- the **likely outcomes** for their students—how many could be expected to graduate and how many would probably drop out
- the **estimated costs** for educating their students—not just for this year but four years from now, or six, or ten

We decided to try to develop such a system. Focusing on special education, we obtained a grant from the Office of Special Education Programs, Department of Education, and produced MAP—Model Accounting Plan—a microcomputer-based system that does chart the paths, likely outcomes, and estimated costs for special education students in a school district. The resulting data can also be combined with that from other sites to produce reports for counties, states, or the federal government. Here's how it works.

Demographic Accounting System

MAP is a demographic accounting system to monitor special education students: their placements in different instructional settings and their transitions as students in moving from one instructional setting to another or as graduates or dropouts from school. MAP is based on a demographic accounting framework first proposed by Sir Richard Stone (1971). A demographic accounting system requires that you measure the status of a population at least two times: at the beginning and end of a standard period, such as a year. What is important is that the status of all members of the population present at the beginning of the period be accounted for at the end of the period. In carrying out a series of these "accounts" with special education students, this means at Year 2, you measure the status of all students who were in special education during Year 1 and are still in the program.

What information do you collect? You include all of the information you think might be of interest—without creating a burden. For special education, where pupil-count data already must be maintained and reported, we used the following:

- **instructional setting**—where students receive special education services, for example, a Self-Contained Class or Resource Specialist Program
- the **exits** from special education—where students go after leaving special education, such as moving to a mainstreamed classroom, dropping out, and graduating
- the **handicapping condition**—what disabilities students have, such as orthopedically handicapped, learning disability, speech impaired

We also wanted basic data on students, such as language, age, gender, ethnicity. We worked with a nearby high school district, and because they already collect all of the above information we needed, no additional data collection was needed.

The individuals to be included in a demographic accounting framework are divided into categories based on the descriptive information, such as instructional setting. The categories are placed in a matrix, with values for Year 1 and Year 2. For example, for special education students in three types of instructional settings (Self-

Contained Class, Resource Program, and Specific Instructional Service), the matrix might look like this:

[insert Figure 1. Structure of the MAP]

Suppose that of 30 students in a self-contained classroom in Year 1, 15 remained there in Year 2. The 15 would go in the top left box. You would fill in the other boxes and then use these numbers to estimate **transition probabilities**, the likelihood with which students move from one instructional setting to another. You obtain these by dividing the number of students in each instructional setting at Year 1 into the individual totals moving from there to another setting by Year 2. For example, if 15 of 30 students in a self-contained classroom move to a Resource Program, the transition probability for this transition is 15/30 or .5. .

The matrix we developed was a four-dimensional one, with categories for instructional settings and exits at Year 1 and Year 2, handicapping conditions, and age. We designed a computer program that could calculate transition probabilities for each of the cells in this 9 x 9 x 3 x 4 MAP matrix. We used the transition probabilities to measure **expected attainment** for particular ages up to 22, for example, the likelihood that students will have graduated and be at work by age 21. The estimates resulted from the multiplication of the matrix for one or more successive years. We designed and pilot-tested our system; we also determined transition rates for a second pair of years to see if the actual rates were stable over time and supported our use of powers of a single-period matrix for projecting attainments. (They were.) We added cost estimates based on Decisions Resource Corporation data (1988) for each handicapping condition, so that the system could project costs.

We now had a system that could show the **path** that special education students were likely to follow, their **likely outcomes**, and the **costs** associated with those programs. We wanted school sites to use MAP, and schools that already had management information systems for special education could use it. However, we found that many sites lacked an MIS to store and update student information without destroying the historical record for each student, so we developed a system based on Paradox software that runs on an IBM or IBM-compatible computer. It is easy to use, has pop-up help screens, and enables the user to gather all of the data needed to maintain individual student records and to develop pupil counts for

		Year 2		
		SCC	RP	SIS
	SCC			
Year 1	RP			
	SIS			

Figure 1. Structure of the MAP

federal reporting. At present it includes MAP—the accounting methodology and expectancy projection capability—in prototypic form.

A MAP Sequence

To illustrate how MAP works, assume that a high school principal wants to plan for 25 learning disabled students who will enroll in the fall. All 25 will be about 14 years old at the time of enrollment. The principal enters their age, indicates they are a group, and specifies their disability (one of 12 choices). On the screen illustrated below, the principal enters the instructional setting in which each of the 25 students will probably be placed: 15 in SCC and 10 in RP.

Numbers of Students in the following Instructional Settings ?
(NOTE: Total students with this disability is 25)

(1)	Self-Contained Class	(0)	15
(2)	Resource Program	(0)	10
(3)	Specific Instructional Service	(0)	
(4)	Other S. E. Setting	(0)	
(5)	In S.E., Setting Unknown	(0)	
(6)	Mainstream School Setting	(0)	

Figure 2. Sample MAP screen for instructional setting.

The principal obtains these projections for the following year:

AT AGE 15 -- 1 Year(s) Later
DISABILITY = (5) Learning Disabled
STUDENTS (Ss) WITH THIS DISABILITY = 25

Proportion in a Self-Contained Class	40.3%	(Ss =10)	
Proportion in a Resource Program	24.9%	(Ss = 6)	
Proportion in a Specific Instructional Service	1.4%	(Ss = 0)	*
Proportion in Some Other S. E. Setting	1.7%	(Ss = 0)	*
Proportion in S.E., Setting Unknown	0.0%	(Ss = 0)	
Proportion in a Mainstream School Setting	26.1%	(Ss = 7)	
Proportion Dropped Out of School	5.5%	(Ss = 1)	
Proportion Graduated and at School or at Work	0.0%	(Ss = 0)	
Proportion Graduated but Not at School or at Work	0.0%	(Ss = 0)	

Estimated Yearly Costs—$ 46,112.81
Estimated TOTAL Costs to This Point—$ 46,112.81

*** Press Any Key to CONTINUE ***

* One student apportioned over more than one setting

Figure 3. Sample MAP screen with projections.

At this point, the principal can see that 10 will probably stay in the self-contained class, six will be in the Resource Program, seven will be mainstreamed, one will probably have dropped out of school, and the remaining two are likely to be in some other special education settings. The estimated yearly costs for the 25 learning disabled students are $46,113. The principal can continue to look at projections for two, three, or four years later.

Uses of Data

Like any data analysis system, the quality of MAP data depends on the quality of its raw data. If a school district has only three hearing impaired students and data for only one year, for instance, the MAP projections for hearing impaired students are likely to be suspect. However, if the school district aggregates its data with that from another similar district, the data become more reliable and useful. If it collects data for several years, it begins to get an accurate picture of its students, its programs, and its costs.

How might the principal described above use MAP data? Parents could be given a better sense of their children's future: what other students with similar disabilities have done; how such students have performed in various instructional settings. Boards of Education could gain information about special education programs: what results are most likely; what costs are involved. Teachers could work with the principal to consider the implications of the data: for example, what might be done to prevent special education students from dropping out.

Our experience with MAP has convinced us that educators can gain valuable information from a system that can chart paths, likely outcomes, and costs. It is our hope that MAP is a harbinger of the increased use of technology for informed decision making in education.

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