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ABSTRACT

This paper discusses two approaches that are well adapted to school district enrollment forecasting and related planning studies. The author focuses in turn on two enrollment forecasting methods--the Analytical Simulation Approach, and the Modified Cohort Survival Approach. After briefly describing each forecasting method, he presents a short case study that illustrates the use of that method for enrollment forecasting. (JG)

ENROLLMENT TRENDS, IMPLICATIONS AND FORECASTING TECHNIQUES

Institute on Coping with Declining Enrollment

NATIONAL ACADEMY FOR SCHOOL EXECUTIVES

AMERICAN ASSOCIATION OF SCHOOL ADMINISTRATORS

February 23, 1977

Las Vegas

Harold L. Finch

FOREWORD

Throughout American history the business of elementary and secondary education has been a growth industry, and particularly so since the end of World War II. Until recently growth had become a way of life for many of today's school administrators--a continuing spiral of more students, more buildings, more budget. When enrollments began to decline it was not surprising, then, that many districts across the country were suddenly caught up in the state of being overbuilt, overstaffed and hardpressed to maintain fiscal stability.

For those districts that are unprepared for further change, the worst may yet lie ahead. For some, the problems associated with declining enrollments and revenues will be intensified; for others, ironically, enrollment surges in direct contrast to the national trend will become a major cause for concern. However, for the prepared, the next several years will present unprecedented challenges and opportunities for self-renewal and revitalization.

It is possible for elementary and secondary school administrators to be prepared--to be able to anticipate enrollment changes with acceptable planning accuracy even in this decade of change. This report is dedicated to that end.

Harold L. Finch
Executive Vice President
Johnson County Community College

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INTRODUCTION

Elementary and secondary enrollments in the United States rose by eleven million (44%) during the 1950's.* This growth trend continued in the 1960's, but at a slower rate with a ten year increase of nine million (26%). To many, the first sign that the postwar K-12 enrollment boom was about to bust came in the fall of 1970 when the percentage increase nationally was less than half that of any prior increase in recent history. Although the cessation of growth a year later and the subsequent decline caught many educators by surprise, this significant reversal was predictable many years in advance.

The Enrollment Bust - Why?

The first clue that the current decline was forthcoming came as early as the mid-1930's. Before and during the Depression, birth rates dropped steadily from 25.1 per 1000 population in 1925 to a near low of 18.7 in 1935--25 percent in ten years.* The economic environment and the storm clouds of World War II on the horizon were not conducive to family planning. As a result of the low number of births in the mid-1930's, a relative scarcity of young adults twenty to thirty years hence could have been anticipated with a high degree of confidence. The U.S. Census in 1960 indeed proved the merit of this supposition. Further it could have been reasoned with assurance that since young adults have the highest propensity for procreation, this "shortage" of persons in

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* Source of educational data: U.S. Department of Health Education and Welfare, *Digest of Education Statistics 1975 Edition,* Tables 28 and 29. Source of birth rate data: U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States 1970,* Table 53.

the mid-20 age range in 1960 would begin to have a significant depressing effect on birth rates in the 1960's. And finally, it would follow that the scarcity would take the form of reduced enrollments in the elementary grades in the 1970's (Figure 1).

Thus as much as 40 years ago it was possible to foresee the current enrollment decline emerging as a second generation product of the Depression baby bust. The date and magnitude of the fall could not have been forecast with preciseness at that time; however, the enrollment shift and the approximate timing could have been anticipated--certainly to a degree that would have prevented much of the surprise and trauma of the late 1960's.

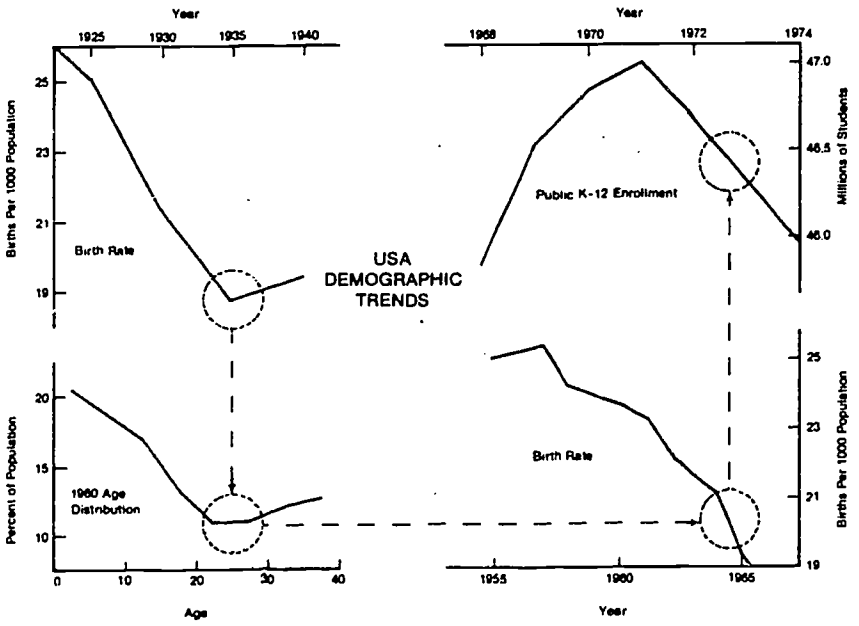

Figure 1. Low birth rates during the 1930's (upper left) resulted in relatively few young adults in 1960 (lower left), which in turn lowered birth rates in the 1960's (lower right) thereby inducing a drop in elementary-secondary enrollments in the 1970's (upper right).

Implications for the Future

Since it is possible to establish basic cause and effect relationships between past demographic conditions and current enrollments, it should not seem unreasonable that forecasts can be made today that would identify significant school attendance patterns many years ahead--even into the twenty-first century. While school buildings currently on the drawing board must be planned for future generations as well as those of today, the kind of lead time that educational decision makers *really* need is five to ten years. And where enrollments are changing rapidly good projections for the *coming* year may be the most critical need, especially in the areas of staff, curriculum and budget planning and development. Through careful application of sound principles of demography together with insightful interpretation, meaningful and useful enrollment forecasts can be made--and can be an important, if not vital, planning tool for today's school administrator.

ENROLLMENT FORECASTING/CASE STUDIES

Enrollment forecasting processes vary widely as to purpose, application, theory, flexibility and analytical complexity. It is therefore incumbent upon the user to consider carefully the needs and special characteristics of the district before designing or selecting a methodology or approach to be used. In some cases a highly technical, sophisticated capability may be required; in others, a simplistic procedure may be adequate, or even preferable. This paper focuses on approaches that the writer has found to be pragmatic and well adapted to elementary and secondary school district enrollment and related planning studies. Other approaches are omitted because of the limited scope of this paper, and not necessarily because of their inapplicability to educational forecasting.

Regardless of the approach selected, the first step is to identify all potential users (e.g., superintendent, business manager, personnel director, curriculum director, board of education, district architect) and to learn of their needs as they relate to enrollment forecasts. The methods, scope and information to be generated then should be designed to be responsive to the individual user's expectations as balanced against the needs, resources and priorities of the district as a whole.

Projections by Attendance Center

Studies which require enrollment forecasts for each individual attendance center generally call for a relatively high degree of demographic and analytical sophistication in order to account for population shifts and trends *within* the district. Studies of this type typically would be employed by large districts as a tool to aid in the redistricting of attendance centers and similar sub-district analysis and planning activities. For users concerned primarily with forecasts at the district level and interested only in general distribution trends within the district, consideration should be given to the approach presented in the next sub-section, *Projections at the District Level*, p. 7.

Analytical Simulation Approach*

This approach is built around a process of simulating the total population of the district via high speed computer. Each person's demographic characteristics--sex, age, place of residence--are recorded in computer memory. The predicted lives of these persons are then simulated for the coming year. In each neighborhood and age group, some will die. Actuarial

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* Theoretical and analytical concepts utilized in this simulation forecasting approach will be presented with more technical detail in the NASE Institute Workshop, February 23, 1977.

rates are used as the basis for analytically simulating deaths. Births are effected taking into account prevalent fertility rates as they apply to the age of each of the potential mothers of the district. Residents will move away, some will move to other neighborhoods and some will move into the district. These movements are simulated by employing current trends in migration propensity factors for each age group and neighborhood. Likewise, land use is simulated. Some areas within the district are "allowed" to grow to accommodate utilization of undeveloped land. Tracts which are zoned for park or industrial development are programmed not to accept in-migration.

The analytical simulation process is straightforward. To illustrate, assume that 375 women, 24 years of age in 1975 lived in a specified neighborhood (Figure 2). Also assume that it is known that the following events will take place in the coming year: 15 will move out of the neighborhood, 32 will move in, 1 will die, and 38 will give birth. By simple arithmetic

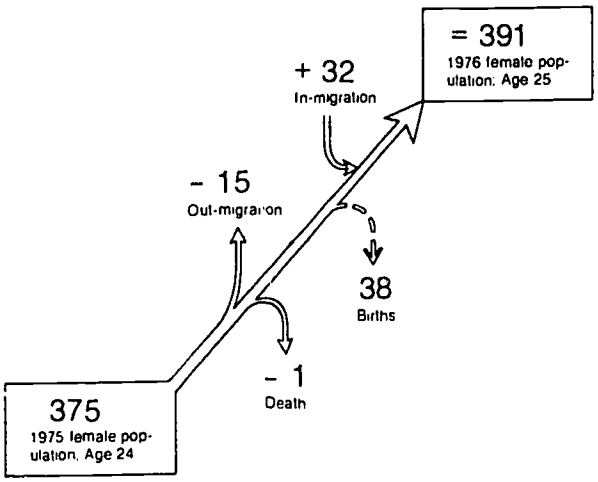

Figure 2. Sample calculation. Birth, death and migration data are obtained via empirically derived algorithms.

it is predicted that one year later, the number of women 25 years of age living in the neighborhood will be 391 (i.e., 375-15+32-1=391). The simulation process is then continued one year at a time by allowing each age group to become one year older. The procedure is continued for as many years as called for in the forecast.

Case Study - Shawnee Mission USD

An enrollment forecast study of a suburban Kansas City school district was conducted in the fall of 1972 using the analytical simulation approach.*

District: *Shawnee Mission Unified School District 512*

Superintendent: *Dr. Arzell Ball*

Location: *Shawnee Mission, Kansas*

Attendance Centers: *49 elementary (K-6), 10 junior high (7-9) 5 senior high (10-12)*

Enrollment: *44,026 at time of study*

Enrollment History: *Rapid growth since World War II through the 1960's (resulting in the construction of 36 elementary schools during the 10 year period of peak growth); declining enrollments in recent years.*

A primary purpose of the study was to determine the need for additional facilities and to analyze possible redistricting strategies to attain more effective space utilization. The district and adjacent portions of the county were divided into 33 areas generally conforming to census tract boundaries for the purpose of collecting and grouping fundamental demographic data. A computer model was developed to analyze quarter-quarter sections one-sixteenth of a square mile in area. These areas and the attendant population projections were then grouped in various ways around attendance centers to study the impact of boundary changes on future enrollments.

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* The study was jointly sponsored by Shawnee Mission USD 512 and Johnson County Community College, Overland Park, Kansas.

One of the results of the study was a pledge by the Board of Education to not hold a building bond issue for at least five years (Figure 3). The findings also paved the way for the closing of two elementary schools (additional closings currently are under consideration).

A comparison of actual and forecast enrollments for the district as a whole follows:

Year	Actual Enrollment	Three Year Projection
1972	44,026	-
1975	41,369	41,027

Within the district, enrollments for each of the high school service areas when adjusted for boundary changes have closely followed the shifts projected in 1972.

Projections at the District Level

For users primarily concerned with enrollment forecasting for the purpose of increasing their effectiveness in district-wide budgeting, staffing and facility planning, the approach outlined below frequently yields savings that far outweigh the cost of analysis.

Modified Cohort Survival Approach*

In many ways, the modified cohort survival approach is a scaled down, less complex version of the previously described analytical simulation method. It too simulates the life of a defined population but limits its scope of analysis to school-age cohorts. Kindergartners are first projected based on empirically derived birth-dependent algorithms. They

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* Theoretical and analytical concepts utilized in this cohort survival approach will be presented with more technical detail in the NASE Institute Workshop, February 23, 1977.

Study Shows School Facilities Adequate for 5 Years

By Bill Anderson
A Member of The Star's Staff

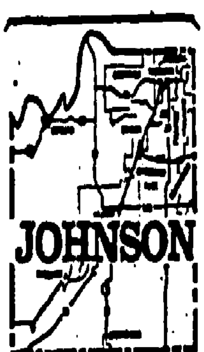
A report that shows continued declining student enrollment rules out a bond issue for the next five years in the Shawnee Mission school district, the district administration said today.

"No bond issues for new schools will be needed for at least five years," Dr. Herbert Bruning, associate superintendent for planning, said today in a report on a demographic study.

The report which will be submitted to the school board tonight is a detailed analysis of a study financed jointly by the school district and the Johnson County Community College.

Original data, submitted to the board last fall, showed only a general decline in student enrollment throughout the 1970s with dips and rises occurring through the year 2000, Bruning said.

"The data clearly indicates that under present conditions we will see a surge in enrollment by 1980," Bruning said.



"Previously this is all the study indicated.

"Now we know that if migration and home-building patterns remain relatively stable, there will be no need for additional buildings within the next five years," Bruning said the administration staff will report tonight at the district's offices, 7235 Antioch, Overland Park.

The five high schools will have some enrollment increase through the 1974-75 academic year and then level off by 1976, the report said. The 10 junior high schools will have increases only through next year (1973-74) and then slight decreases through 1976.

The enrollment hikes in the junior and senior highs can be accommodated by "minor boundary changes for a few junior and senior high schools for 1973-74," Bruning said.

Elementary schools show decreases continuing and changes are anticipated for them, Bruning said.

The report concedes probable "significant increases in enrollment" at five of the 85 schools—Rosehill and Shawanee elementary, Hillcrest and Trailridge junior highs and South Senior High School.

Completion of Oak Park School at 95th and Quivira, the district's 51st grade school, and continued bussing of students from the Rosehill attendance area into Brookridge should take care of pressures on elementary schools there, the report said. Changes in attendance boundary areas for the two junior highs and South High School will accommodate expected increases in those areas. "Current boundaries are being studied and recommendations will be forthcoming to the board," Bruning said.

The demographic study reveals an enrollment decline over the entire district from its 44,636 as of Sept. 15 to 41,027 through the 1975-76 year.

Broken down into the district's five attendance areas, enrollment through the 1975-76 academic year shows a decline in the North area from 8,100 to 7,186; in the East area, a fall from 7,291 to 5,979; in West, a decrease from 10,430 to 9,912; in South, a decline from 9,346 to 9,082 and in the Northwest area a rise from 8,790 to 8,878.

"The scientific data is what has been needed for us to plan effectively rather than our being stampeded into a building program without adequate facts," said Walter Hiersteiner, board president who proposed the demographic study in October, 1971.

Hiersteiner praised the report as a significant scientific tool and praised the co-operation of the community college with the school district as an illustration of a good educational environment in the community.

The $33,000 demographic study was authorized early last year. It was funded with $11,700 in school district funds and the remainder by the college.

It was directed by Dr. Harold Finch, who was dean of the college's development institute and who since has been promoted to executive dean.

"I'm not aware that any other school district can achieve this kind of planning," Bruning said. "Such scientific and sophisticated data for long-range planning allows us to reduce changes in use of school facilities every year and also enables us to make more efficient use of school buildings."

Dr. Arnell Ball, superintendent, hailed the report as illustrating how long-range planning can be meaningful to taxpayers as well as educators.

"At this point we know we won't need a bond issue for at least five years," Ball said. "Just a few years ago we couldn't predict the decline in enrollment we are now experiencing."

"This news should also be gratifying to patrons," the superintendent said, "when it is noticed school taxes declined last year and additional property tax relief may be forthcoming from a new state aid school financing formula."

The school district's operating levy dropped last year to $5.32 on the $100 assessed valuation from a 1971 levy of $5.48.

Forecast of an ability now to handle enrollment the next five years without additional schools contrasts with board members' apparent dilemma a year ago when it was widely believed the district would have to "bus or build."

Available information at that time indicated a need for new schools in the West and South areas at the same time empty classrooms would be developing in the older and more stable North and East areas.

New schools would require bond issues with the likelihood of negative votes from those patrons in areas where schools were not needed. On the other hand, bussing from the newer areas to older schools would solve the problem but would be an abandonment of the neighborhood-school concept.

"Even with a general decline, enrollment in a few areas of the district will continue to increase," he said. "At various times the board of education will need to decide the best methods of enrollment distributions, consistent with maximum educational benefits and efficient use of facilities.

"At the present time it would appear that with minor changes in enrollment distribution, pupils can be properly housed in current and planned (Oak Park School) facilities through the next five years," Bruning said.

Projections

Projected enrollment figures in the Shawnee Mission District through the 1975-76 school year reveal the five high schools will increase in attendance from the current 10,027 to only 10,843; the 10 junior highs will drop from 10,889 to 10,284 and the elementary school enrollment will decline from the present 22,700 to 20,000.

The breakdown by high schools and their attendance areas:

High School Area	Current Enrollment	1975-76 Enrollment
North	1,911	1,860
Junior Highs	2,326	1,767
Grade Schools	4,263	3,609
East	1,910	1,489
Junior Highs	1,763	1,467
Grade Schools	3,618	2,963
West	2,286	2,118
Junior Highs	2,331	2,344
Grade Schools	5,637	5,270
South	2,367	1,927
Junior Highs	2,391	1,972
Grade Schools	4,606	4,162
Northwest	1,963	2,079
Junior Highs	2,278	2,544
Grade Schools	4,592	4,235

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Figure 3. Reprint, The Kansas City Star, January 22, 1973.

then are followed analytically through school one grade and one year at a time taking into account the net effect of dropouts, deaths and migration to and from the school system.

To gain insight into enrollment patterns *within* the district, attendance center projections can be made by applying past allocation patterns to the forecasts for the district as a whole. The resultant attendance center enrollments should not be interpreted as predictions, but rather as projections of past and current distribution trends. It should be borne in mind that such sub-district projections will require future adjustments to compensate for unforeseen changes in attendance center boundaries and bussing policies and other such actions by the administration and board of education.

In actual practice, district level forecasts based on the modified cohort approach generally have proven to be as useful and reliable as those generated by the more complex analytical simulation approach.

Case Study - Buhler USD

An enrollment study was conducted in December 1976 for a small but growing school district in central rural Kansas using the modified cohort survival approach.

District: Buhler Unified School District 313

Superintendent: Robert Burkholder

Location: Reno County, Kansas

Attendance Centers: 6 elementary (each housing different grade levels or combinations of grades K-8), 1 high school (9-12)

Enrollment: 2,063

Enrollment History: Sustained growth continuing into the 1970's--current enrollment up 5 percent over previous year.

A primary purpose of the study was to determine the need and timing for the construction of additional facilities to alleviate overcrowded classroom conditions. A computer analysis was made and district enrollments were projected through 1981 at the kindergarten level, 1982 for grade one students, and so on in this fashion through 1991 for the senior high level.

Based on the results of the study, district planners should prepare for an extended period of continued expansion. An unexpected finding was that the thrust of growth would undergo an immediate shift from grades 7-12 to grades K-6, which in recent years had been stable. In the early 1980's the upper grades are expected to again resume a substantial and sustained increase in enrollment (Figure 4). A computer generated summary sheet is included in the Appendix.

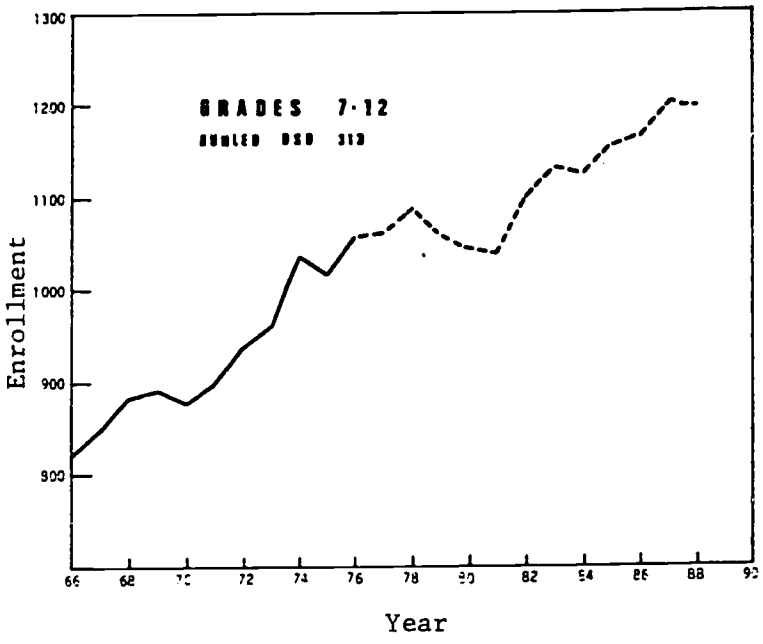

Figure 4. Past and projected enrollments for Buhler grades 7-12. Rate of growth of the past decade is expected to resume in 1982 after a five year period of stabilization.

ENROLLMENT OUTLOOK

Total elementary-secondary enrollments are projected to continue to decline for the nation as a whole. However birth rates have been on the upswing since 1973 throughout much of the country which will bring about an upturn in lower elementary grade enrollments in the next several years. School planners will need to monitor birth rates to determine whether this recent trend will be sustained. Planners also should be alert to the fact that enrollment patterns can vary widely from district to district and region to region (Figure 5). Education is in a critical period from the standpoint of enrollment change; therefore, administrators and boards of education will need to evaluate and refine their plans and planning processes from time to time in the months and years immediately ahead.

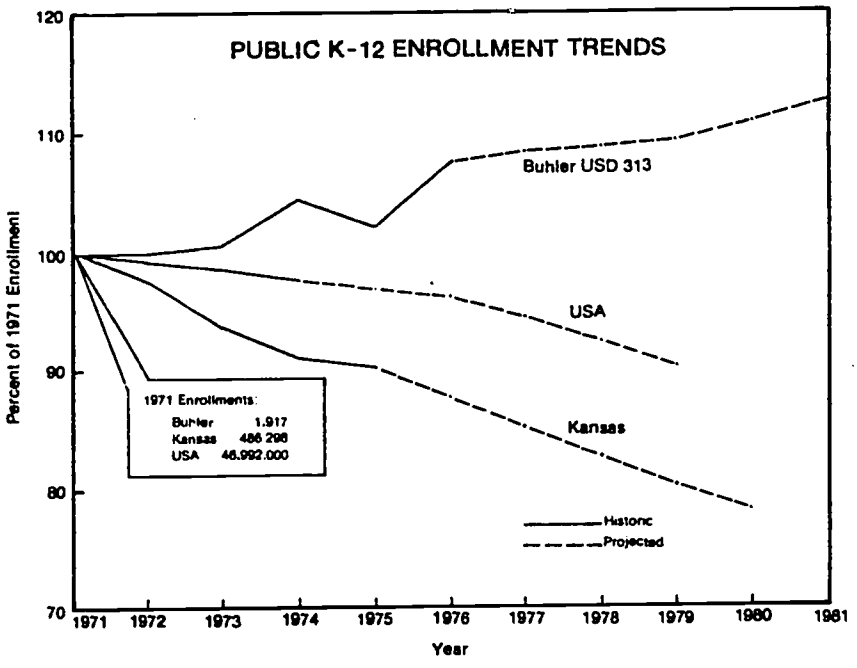

Figure 5. This ten year comparison of three national, state and district enrollment trends illustrates wide differences that face local school planners, administrators and boards of education. (Analysis and projections by the author, Harold L. Finch.)

SUPERINTENDENT'S CHECKLIST

- ☐ The last decade and the next constitute one of the most tumultous periods in terms of enrollment shifts ever faced by the Western World. Is our preparation adequate?

- ☐ Total enrollments for grades K-12 will continue to decline nationally; however, the number of lower elementary students will begin to rise as the result of increasing births in recent years. How does this relate to my district?

- ☐ Do I have knowledge and understanding of district enrollment trends and implications? Is my insight into enrollments sufficiently timely to act--rather than to react?

- ☐ Are district planners keeping a watchful eye on the principal causes of enrollment growth and decline--in-migration, out-migration and birth rate? Is the recent upturn in numbers of births being monitored?

- ☐ Are district planners and patrons alert to the fact that while national and regional enrollment trend data are helpful to local planning, district trends may be markedly different?

- ☐ Enrollment forecasting processes vary widely as to purpose, application, technique and complexity. Was our selection based on the unique needs and characteristics of the district?

- ☐ Knowledgeable and imaginative analysis and interpretation of enrollment projections is no less important than having quality forecasts. Do we recognize this in actual practice?

- ☐ Do district planners have an understanding of the dynamics of demography complemented by a sound knowledge about the school district and are these traits applied with a good measure of common sense?

- ☐ Do we up-date our enrollment forecasts each year?

- ☐ An effective enrollment analysis and planning capability doesn't cost--it saves. Does our planning activity reflect this principal?

APPENDIX

SAMPLE PRINTOUT, DISTRICT PROJECTIONS
(Case Study - Buhler USD 313)

	73-74	74-75	75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92
**********																			
K-6 DISTRICT TOTAL																			
**********																			
KINDERGARTEN	111	113	135	122	114	112	120	133	140										
FIRST	101	116	111	156	129	121	119	127	141	149									
SECOND	144	115	122	125	172	143	134	132	140	156	165								
THIRD	134	147	111	132	128	176	146	137	135	143	160	169							
FOURTH	135	149	155	123	144	140	192	159	150	147	156	175	184						
FIFTH	151	147	146	169	130	152	147	202	167	158	155	164	184	194					
SIXTH	175	168	154	154	181	139	163	158	216	179	169	166	176	197	208				
SPECIAL STUDENTS	14	10	8	20	15	15	15	16	16										
SUBTOTAL	965	965	942	1001	1013	998	1036	1064	1105										
**********																			
7-9 DISTRICT TOTAL																			
**********																			
SEVENTH	169	193	163	164	161	189	145	170	165	226	187	177	174	184	206	218			
EIGHTH	179	185	197	183	177	174	204	157	183	178	244	202	191	188	199	222	235		
NINTH	184	183	192	205	189	183	180	211	162	189	184	252	209	197	194	206	229	243	
SPECIAL STUDENTS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
SUBTOTAL	532	561	552	552	527	546	529	538	510	593	615	631	574	569	599	646			
**********																			
10-12 DISTRICT TOTAL																			
**********																			
TENTH	141	185	169	188	199	183	177	174	205	157	183	178	244	203	191	188	200	222	236
ELEVENTH	157	138	166	166	179	190	174	169	166	195	150	174	170	232	193	182	179	191	212
TWELFTH	130	153	129	151	156	168	179	163	159	156	183	141	163	160	218	181	171	168	179
SPECIAL STUDENTS	0	0	0	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
SUBTOTAL	428	476	464	510	535	542	531	507	531	509	517	494	578	596	603	552	551	582	628
**********																			
K-12 AGGREGATE																			
**********																			
DISTRICT TOTAL	1925	2002	1958	2063	2075	2086	2096	2109	2146										