DOCUMENT RESUME

ED 427 410	EA 029 643
AUTHOR	Morris, Don R.
TITLE	Structural Consequences of Retention Policies: The Use of Computer Models To Inform Policy.
PUB DATE	1997-11-00
NOTE	20p.; Paper presented at the annual conference of the Florida Educational Research Association (42nd, Orlando, FL, November 1997).
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Academic Persistence; *Computer Simulation; *Dropout Research; *Dropouts; Elementary Secondary Education; Longitudinal Studies; *School Holding Power; *School Policy; Student Attrition; *Student Promotion

ABSTRACT

This paper reports on a longitudinal study of the structural effects of grade retention on dropout rate and percent of graduates qualified. The study drew on computer simulation to explore the effects of retention and how this practice affects dropout rate, the percent of graduates who meet required standards, and enrollment itself. The computer results were then compared to data collected during a period of high retention pursued by the Dade County Florida school district in the 1980s. Model results agreed with empirical studies, thus demonstrating that retention-form patterns have consequences over time, and that computer simulations can be instrumental in understanding the complex nature of those consequences. Three major points arise from the simulations concerning the sharp changes in the behavior of the selected variables at the beginning and following the end of the retention policy: (1) it is important to recognize the existence, origin, and shape of patterns of variable behavior; (2) retention effects lingered long after the policy ended--the graduating classes' quality drops rapidly for 5 years following the end of the policy; and (3) policymakers must consider the old policy's residual effects when implementing new retention policies. (Contains 5 figures, 9 notes, and 43 references.) (RJM)

Structural Consequences of Retention Policies: The Use of Computer Models to Inform Policy

Don R. Morris

Dade County Public Schools

Prepared for the
Florida Educational Research Association
Conference in Orlando

November, 1998

Structural Consequences of Retention Policies: The Use of Computer Models to Inform Policy

Don R. Morris
Dade County Public Schools

This study is a longitudinal analysis of the structural effects of grade retention on dropout rate and percent of graduates qualified, using computer simulations of retention policy and a comparison of the simulated output to time series data from an urban school district. The simulations show that strong and unanticipated variations occur in the behavior patterns of the variables of interest, and that these variations persist for long periods, well beyond the termination of the retention policy. Comparison of these results with the time series school district data reveals strong resemblances to the empirical results of retention.

A new wave of grade retention is beginning. The rhetoric has been escalating for some time. At a meeting with the nation's governors on educational standards in March of 1996, President Clinton declared his position to be "No more social promotions" (Cannon, 1996). Such talk marks the start of a new round of acceptability for grade retention policies. From Chicago, the nation's third largest school system, where in 1990 retention was regarded as a "last resort" (Olson, 1990), we hear that "Under the current administration ... the previously condoned policy that academically challenged students should be promoted out of concern for their self-esteem quickly lost favor" (Poe, 1997). In Dade County, Florida, the nation's fourth largest school system, the school board moved, in a strong show of a no-nonsense stand, to approve a variety of tough new requirements, including a lifting of the ban on kindergarten and first grade retention, permitting elementary schools to retain students twice without higher approval (Mailander, 1996). Across the country, there is a renewed interest in retention as a major tool in the effort to raise academic standards: "The get-tough stance of holding students back if they cannot show they can do grade-level work has become part of the ongoing movement for tougher academic standards for students nationwide" (Lawton, 1997).

It has all happened before. A decade ago, high retention rates were a national phenomenon of a magnitude that prompted scholars such as Shepard and Smith (1989) to warn of the effects of retention on students. Partly as a result of such reactions, and partly because no tangible positive results from retention were forthcoming, retention as a policy fell out of favor at the end of the 1980s (Olson, 1990). Possibly there are lessons to be learned from this past experience that will help in understanding and assessing the effects of the current policy trend. Because it occurs in a system highly structured in space and time, the retaining of students causes ripples and disturbances that persist for years in a variety of significant variables following the introduction and/or the termination of a strong retention policy.

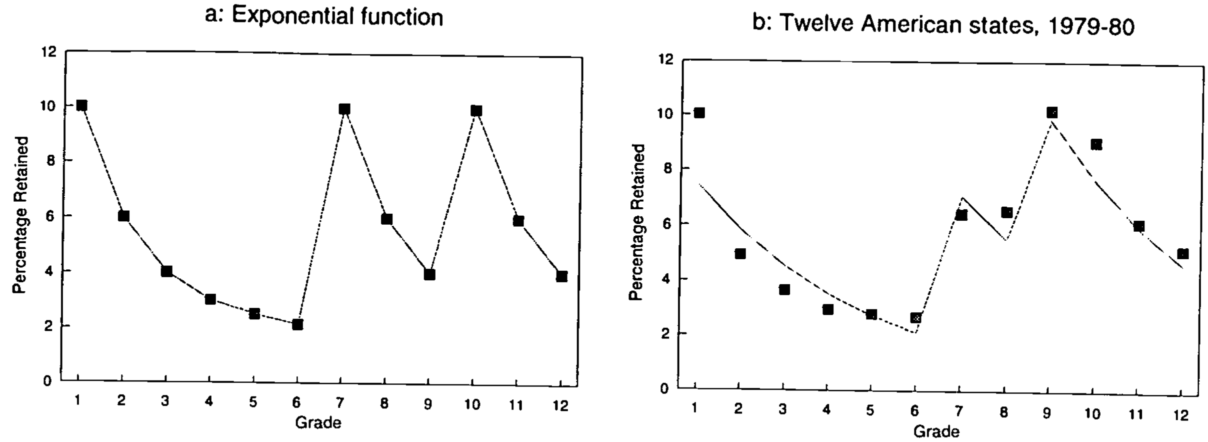
Although the literature on student retention is substantial, little is said about patterns of rates across grades or over time. No one, judging from the literature, anticipates any further consequences simply because retention occurs. The only aspects of retention worthy of note are taken to be the direct effects on students: remediation (or its absence, see Holmes, 1989), dropout caused by retention (e.g., Grissom & Shepard, 1989), and possibly detrimental self-image (but see Kohn, 1994). There is no mention of structural analyses in surveys of the literature (Holmes, 1989; Holmes & Matthews, 1984; Jackson, 1975), nor does an inspection of the abstracts from Holmes' (1989) bibliography uncover any allusions to such a macroanalytic perspective.

However, these aggregate, structural effects of retention are important for purposes of decision making and policy. In part, they can be deduced logically. Assume for the moment that retention has no effect other than detaining students in the same grade for another year. That is, there is no increase in remediation and no change in the *rate* at which students drop out. The result will then be a modest increase in the number of students enrolled, that will build to some maximum and then remain for as long the policy is in force. There will be an accompanying increase in the number of dropouts, and consequently an increase in the proportion of graduates who meet standards. For a school district, if retention becomes a permanent policy, then we should expect an uneventful transition to a system that has a somewhat higher overall enrollment, and a little higher average age at graduation.

These are the common sense conclusions, but they do not tell the whole story, as will be demonstrated in this paper. One way to move beyond the logic of common sense is to examine the organizational structure, and the impact it has on variables over time --that is, to examine the patterns of *behavior* in variables that are generated by the structure. Structure (the organization or system) determines how variables change over time (their behavior), and events (changes in behavior) are snapshots that record the patterns in those changes. A school district's enrollment may be viewed as the sum of students moving through the grades from kindergarten or first grade to graduation. This progression of clients comprises the school system's structure. Retaining students in grade causes changes in that structure. Many variables --e.g., the magnitude of the enrollment itself, the number dropping out, the percent of students who meet required standards at graduation-- undergo changes solely as a result.

Taking structure and its role in shaping the behavior of variables into account is an important aspect of understanding and working with problems of policy. Ideally, information about changes in variables and the structures that cause those changes would come from longitudinal data, but as Monge (1995) has observed: "the field of organizational science has almost no information about how variables behave over time" (p. 272). Despite the fact that retention has been around as long as age-graded mass education, there is no indication of research that I have been able to find, of its effects on structure, or the resulting behavior of variables that it might reasonably be expected to affect, over time.

I have thus turned to computer simulations to explore the effects of retention. Dynamic modeling provides the tools to represent structure, and to understand how it determines the behavior of variables. Retention, I will argue, is a straightforward and quite useful application of this approach, effectively addressing questions concerning the effect retention has on the "time prints" of aggregate variables such as the dropout rate, the percent of graduates who meet required standards, and the enrollment itself. I will present simulations of retention generated by a computer model of a school district, and use them to evaluate some accepted expectations about retention, and to introduce some new ones. Then I will tentatively compare model results to data collected during a period of high retention pursued by an urban school district in the 1980s.



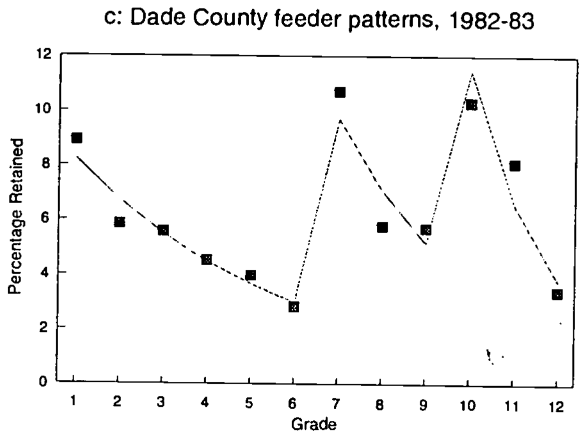


Figure 1 Retention rate patterns across grades

Panel a shows the pattern of an exponential decay function applied to a 6-3-3 grade configuration, displayed at dimensions similar to those spanned by the data sets shown in accompanying panels. The symbols represent the value of the function at each grade. Panels b and c show the mean retention rates by grade (the symbols) and the semi-log OLS regression fits (the lines) for 12 American states in 1979-80, and 24 feeder patterns of the Dade County Public Schools in 1982-83, respectively. Source for Panel b is Morris, 1993, and Panel c is adapted from Morris, 1991.

The Effects of Structure on Retention

A basic cross-sectional retention pattern

Although the literature on the structural impact of retention is limited, certain cross-sectional patterns have been identified in some fairly broad-based empirical data. Morris (1993) proposed a formal model to explain the pattern of retention rates across grades 1 to 12 observed in data from a number of American states. In essence, an exponential (decay) equation was found to fit the mean rate at two different points in time. Figure 1a shows the basic pattern produced by applying the exponential equation independently to each educational level.[1]

That basic pattern is a representation of the idea that a pool or group of students at risk of academic failure would, upon entering an instructional level, be retained at a constant rate at the end of each year of the level. As a result, the number available for retention, and consequently the number retained, would decrease exponentially throughout the level until all were retained or time in the level came to an end. Deviations of specific grades from the pattern are assumed to reflect local variations of policy such as promotion-gate testing and/or changing grade configurations. The assumption driving the exponential model is that the retentions result from students failing to meet standards that are reasonably consistent over time and across grades and being held back by teachers who apply those standards in a reasonably uniform way. District or school policy is subsumed in the rate, assumed constant across grades, at which students are identified and retained.

Figure 1b is a graph of the mean retention rates by grade from 12 American states in 1979-80, taken from Morris (1993). Figure 1c is a graph of the mean retention rates by grade for the 24 feeder patterns of the Dade County school district in 1982-83. The symbols in both 1b and 1c roughly reflect the same exponential pattern as the ideal generated in 1a, most clearly across the elementary grades, but also at the higher levels. The pattern shown in 1b was found to hold also for the state data in 1985-86. The exponential pattern was also shown to appear in the retention rates reported by the Dade County school district from 1982 through 1990 (Morris, 1991).

The peak or highest point of an exponential curve most commonly coincides with the start of an educational level. Shepard and Smith (1989) have noted that although multiple retentions are relatively common, "Many districts have policies against double retentions within the same level of education" (p. 8). Even where multiple retentions occur in the same level, retained students are usually regarded as eligible for further retentions at the next level, so that the process of assessment for retention begins anew at the next level and a new exponential curve is produced, peaking at the first year of the level. The major exception to this pattern is found in the middle peak, which is often observed at 7th grade. Differential staffing often begins at 7th independently of change in level (see McPartland, Coldiron, & Braddock, 1987; Braddock, Wu, & McPartland, 1988). A peak here when 7th is not the first grade of the level implies that in addition to simply making the same students again liable to retention, some students may have difficulty in adjusting to changing classes (see Morris, 1993, 1996a).

A grade configuration of 6 elementary, 2 middle, and 4 high school grades (denoted 6-2-4) was found to be the best fit to the states' data in both years by regression methods. This fit is graphed in Figure 1b, where the regression results are represented by the line. However, Morris (1993) found evidence of a process of changeover from junior high to middle school configurations in the state data between 1979 and 1985. In the Dade district a junior high (6-3-3) grade configuration was dominant in the early 1980s, as the graph in Figure 1c shows. The regression fit (given by the line) to the data (the symbols) was to that configuration. However, the Dade district was also undergoing a change from the 6-3-3 configuration to a middle school (5-3-4) configuration during the 1980s (see Gomez, 1992).

The retention pattern over time

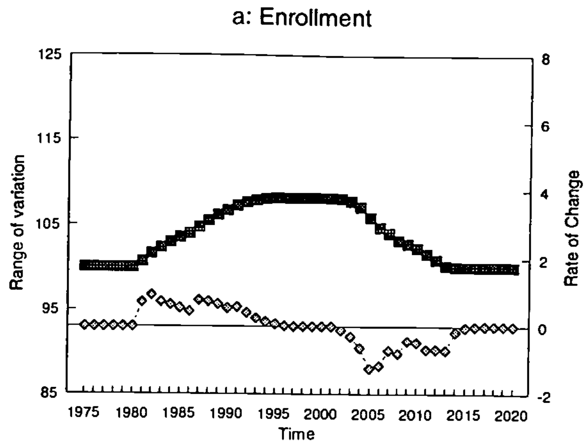
Modeling a school system. A school district steps students *by cohort* through common experiences in an organized way, one year at a time. This simple fact is so obvious and familiar to our experience that it is taken for granted. Grades, examined cross-sectionally as described above, channel cohorts through time, and over-time consequences *must* follow from these cross-sectional patterns. Because they are age-graded and highly structured in their organization of students, school districts are well suited to longitudinal analyses, furnishing a relatively unambiguous and highly controlled environment within which "social experiments," such as the abrupt initiation and termination of high retention policies, can be and in fact often are carried out. Models are an excellent way to investigate the impact of such experiments, simulating their cumulative effects from year to year.

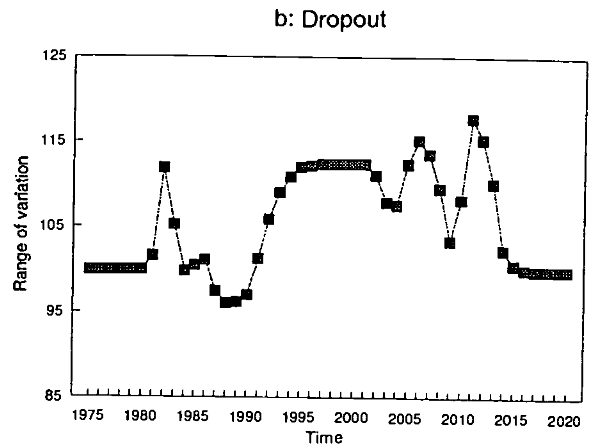
The model used to produce the simulations to be displayed here is a basic chain model of a school system, with a simulated enrollment being channeled through 12 grades to conventional outcomes. It is a system dynamics model created using STELLA software (see Hannon & Ruth, 1994, esp. ch. 4). The model processes students through the grades, and as it does so, they are divided into groups. The groups are created by dividing and then subdividing again a fixed enrollment (or source) entering the model at first grade (there are no other points of entry for enrollees). The initial groups created upon entry are of at-risk and not-at-risk students. The not-at-risk group is essentially a placeholder group for determining the percentages. The at-risk group is further subdivided into retained and not-retained groups at a rate which defines the strength of the policy applied. Branching from the retained group is a further subdivision to accumulate the numbers remediated (if any), with the remainder channeled on through as non-qualified graduates (i.e., students who graduate without meeting the standard requirements) or dropouts. At the end of each of the educational levels one and two (elementary and middle) all retained but not remediated students are returned to the at-risk group and are again liable to retention.

The model produces three kinds of student outcomes. One outcome is the dropout. This outcome begins at the 9th grade for those students who are retained and continues through the 12th grade. The dropout outcome for those at-risk students who are not retained is from the 10th through the 12th grades. As a simplification, there is no dropout from the not-at-risk group, nor from the remediated group. The other outcomes are qualified and unqualified graduates. Qualified is defined as meeting all current standards. It is assumed that all at-risk students who are not specifically remediated graduate unqualified, and all not-at-risk students graduate as qualified. Students are remediated by being channeled into a remediation group from the retention group, and once remediated, remain so. Students retained at grade 12 continue an additional year and then graduate. Finally, the model's time range is in model years, set to run from 1970 to 2020.

Model outcomes and commonsense expectations. Figure 2 shows the outcomes of the model when retention is introduced while keeping dropout and remediation constant at pre-retention rates. The retention policy is introduced all at once in the (model) year 1978 and terminated all at once in 2000, allowing the policy time to achieve an equilibrium under which the new retention rate is stabilized. Prior to 1978 the model runs in equilibrium with a zero retention rate, and after that time the model returns to the previous condition of zero-retention equilibrium.

The graphs in Figure 2 are referenced to the values of the initial equilibrium, which constitutes the baseline. That is, for all variables presented, the baseline is indicated by the value 100. Swings around that value then have the same interpretation in all the graphs: they represent the percent increase above or decrease below the zero-retention baseline. The magnitude of the swings is a function of the proportion of students at risk relative to the whole, and the size of the dropout rate. For the baseline runs, a hypothetical district of 37.5 percent at-risk students is used, with an ongoing dropout rate of one-fourth of that at-risk population (producing an overall dropout rate of 9.4 percent). The runs are produced by retaining 35 percent of all at-risk students who have not yet been retained, in each grade of a level.





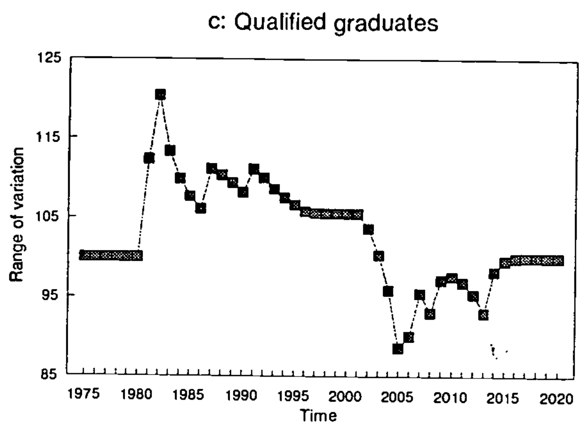


Figure 2 Computer simulations of the effect of retention on enrollment, dropout, and percent of graduates who meet standards.

Panel a displays the variation in overall enrollment (square symbols) in response to a retention policy begun in 1978 and ended in 2000. The diamond symbols in Panel a represent the acceleration function, the rate at which the enrollment changes, and is referenced on the right vertical axis. Panel b shows the dropout rate, and Panel c the percent of graduates who meet prevailing standards. All variables except the acceleration rate are referenced to the baseline value of 100 (representing the equilibrium value when retention is zero).

Consistent with common sense, some *a priori* expectations are borne out. The upper curve (square symbols) of Figure 2a shows that the overall enrollment rose about 8.1 percent as a result of retention. The increase in dropout (panel b) stabilizes at 112.4 percent. Panel c displays the change in the percent of graduates who meet current standards (the ratio of not-at-risk to total graduates, hereafter called qualified graduates or QG), stabilizing at 5.5 percent above the baseline at the high retention equilibrium. Bear in mind that the underlying rates do not change. Rather, QG stabilizes at a higher rate because the number dropping out rises to a new level, and dropout rises because the number of at-risk students increases due to retention.

Dynamic effects of the exponential pattern. Some of the results shown in Figure 2 are not revealed by common sense logic. The dropout rate, graphed in Figure 2b, jumps sharply to 111.9 percent of the equilibrium 5 years after retention is introduced, then falls just as quickly to 96.0 percent of equilibrium 5 years after that, before climbing 16 percentage points in 8 years to a new equilibrium 12.4 percent above the original. When the policy is terminated in 2000, the variable executes 2 major oscillations over the 15 odd years following termination of policy in swings of 7 or more percentage points. The variable peaks at 15.2 percent above the original equilibrium 5 years after the policy's end, and 17.8 points above it 11 years after, before returning finally to the original equilibrium 16 years after retention was ended.

In Figure 2c, the QG rate peaks at 120.4 percent of the pre-retention equilibrium 5 years after the policy is introduced, and displays further disturbances before settling down to a new equilibrium in 1996, 9 years after the policy began. The variable's behavior following the ending of the policy is equally turbulent. Two years after termination, the qualified graduate rate drops quickly to a low of 88.6 percent of the original equilibrium 5 years after the policy's end. QG takes another dip, falling 7 percent below the original equilibrium, 13 years after the policy is terminated. The variable does not return to its original level until 16 years after the end of retention.

These sharp deviations of the variables from their baseline values, immediately following the introduction of the retention policy and again following termination, are a function of students being returned to the at-risk pool following the last grade of the level and again becoming eligible for retention at the next level. When viewed cross-sectionally at any year, the resulting shape of the retention rate across grades forms exponential decay patterns like those shown in Figure 1a. The deviations of the variables about the baselines that appear in Figure 2, panels b and c, are the effects of this cross-sectional pattern as it plays out over time. To see this, consider panel a of Figure 2. Note that the shape of the enrollment (upper) curve is neither symmetric nor smooth. The unevenness of the increase and decrease is the result of variations in the rate of change in the enrollment. That rate of change is graphed in a second curve (representing the acceleration function), appearing below the enrollment curve in Figure 2a, and referenced to the right vertical axis. Acceleration is positive when the enrollment is increasing, negative when it is decreasing, and zero during periods of equilibrium. Note the shape of the acceleration curve; it mimics the pattern shown in Figure 1a --first directly, then in reverse.[2]

The variables shown in the subsequent panels of Figure 2 in turn mimic the pattern of the acceleration curve. The wide swings in the values of the Figure 2 variables are a function of the across-grades exponential pattern portrayed in Figure 1 as it plays out over time. The pattern in the quality-of-graduates graph (2c) is close to being a duplicate of the rate-of-change pattern in 2a. The dropout changes shown in 2b are less directly affected by the acceleration pattern, but the pattern of peaks and valleys can be clearly discerned. An important feature of these variations is the length of time that elapses before they cease. Once the policy is stopped, another 15 years is required to completely restore the baseline equilibrium, and fluctuations remain large 5 to 10 years after termination of the policy.

Retention in Practice: An Example

Empirical verification of the long-term structural effects of retention is difficult. Finding appropriate data is a challenge. The Dade County Public Schools (DCPS) provides one possible case for analysis. First, in compliance with Florida legislation aimed at enforcement of academic standards, DCPS undertook a strong policy of grade retention during the 1980s, including basic skills tests, mandatory retention in grade, and more credits to graduate, plus passing a test for graduation (in force after 1984).

Second, a clear change in the policy can be identified. In 1987, confronted with mounting opposition to side effects of the policy, the school board introduced rules that made it so difficult to continue retentions at the elementary and middle levels that the policy was effectively nullified within the district. In 1990 the state repealed the basic skills testing that drove the reform

(Morris & Hanson, 1993).

Third, there is little evidence of remediation, simplifying the situation. The objectives of the academic reform legislation (as measured by results on a nationally normed test) were not met in Dade County. Throughout Florida, the fact seems to be that the high retention policies of the 1980s resulted in little or no demonstrable remediation of at-risk students. The study of retention in DCPS elementary grades over this period undertaken by Morris and Hanson (1993), the opinion expressed in the report of the Governor's Commission on Educational Reform (1990), remarks by former DCPS superintendent Joseph Fernandez (Olson, 1990)[3], and comments by Florida Commissioner of Education Betty Castor (Firing Line, 1992), all support this conclusion.[4]

Finally, there are some data available that might be compared to model results. The local community college has released data for DCPS students' performance on its entrance exams, and the district has published aggregated dropout rates in its annual *Profiles* since 1986-87. Unlike the case for remediation, the dropout data show that the earlier assumption made for the model runs shown in Figure 2-- that retention does not directly contribute to dropout-- is rather clearly violated. There is strong indication that the retention practices of the 1980s resulted in higher dropout rates in Florida and in Dade County. In 1984, a Dade County grand jury "blasted the school system for its high dropout rate" (Shaw, 1988), and in 1986 the state enacted substantial dropout prevention legislation.[5] Moreover, research evidence has been building for some time that grade retention contributes to the dropout rate (Roderick, 1993; Grissom & Shepard, 1989; Eckstrom, Goertz, Pollack, & Rock, 1986; Wehlage & Rutter, 1986).

The comparisons

Given the foregoing information concerning DCPS, several changes were made in the model settings to make it conform more closely to DCPS conditions. No remediation was introduced into the model, but an addition to the dropout rate due specifically to retention was incorporated, and the at risk pool was raised to 60 percent. One other major adjustment was necessary. In 1983, the state of Florida passed major new legislation aimed at strengthening standards at the high school level, the result of which was that retention at that level continued, even though the elementary and middle level rates dropped sharply in 1987. Consequently, while the retention policy is ended in the model at 1987 for the two lower levels, it is allowed to continue at a decreased rate in the senior grades (9 through 12).[6]

These were the only modifications made in the model for the comparison to the DCPS data. The relevant model results were found to occur under different grade-level configurations and under systematic variations of the rate of dropout added and tied to the retention rate. The resulting patterns displayed for comparison are thus considered robust, under the assumption that the ending of the retention is reasonably abrupt, as it was in the Dade case.

The graphs in Figures 3 and 4 show a change in the range of the horizontal axis. The displays cover the period 1985 through 1995, the period for which data is available for the variables from the Dade district. The vertical axis also shows a change; it displays the rates of the variables as they are conventionally measured.

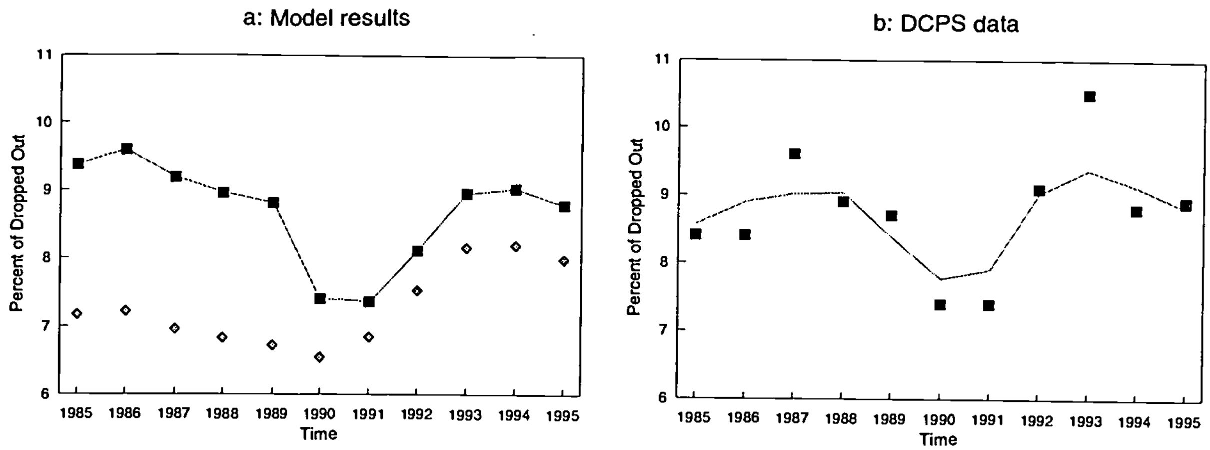


Figure 3 Dropout rates

Panel a shows simulated dropout rates generated by the model. The square symbols represent the rate with added dropout due to student reaction to being retained, and the line simply connects the symbols. The diamond symbols represent the rate under the assumption that being retained does not contribute to the dropout rate. Panel b displays the DCPS dropout rate for grades 9-12 (the symbols). The line is a scatterplot smooth summarizing the trend. Source for Panel b data is Office of Educational Accountability, 1986-1996.

Dropout. The data on dropout from DCPS is displayed in Figure 3b. Systematic and comparable dropout data in Dade dates from 1985-86, when the state interest in the problem began to grow and monies became available for large-scale prevention efforts. The DCPS 9-12 grade dropout figures published by the district are given by the symbols. The line is a scatterplot smooth that summarizes the overall shape of the data. It traces out a "time-print" for comparison.

In Figure 3a, the square symbols represent the model dropout rate (pooled across the entire 9-12 enrollment to correspond to the published dropout rate). As noted earlier, some of the dropout is directly caused by retention (i.e., students drop out because they have been retained), and some was there all along, increasing as the number of at risk students in the system increases. The dropout in Dade dropped sharply in 1990, several years after the end of the policy, and also in the model. An increase in 1992, following that drop, is also duplicated by the model results. This produces a time-print for the model results that closely resembles that of the data (the exceptionally high DCPS rate in 1993 may be a distortion resulting from dislocations due to Hurricane Andrew; see Office of Educational Accountability, 1994, p. xiii).

The pattern from 1992 to 1995 is of some additional interest. An examination of the model results indicate that the increase in dropout after 1991 is due to an effect discussed earlier --dropout change caused by the retention policy itself. The diamond-shaped symbols in Figure 3a represent the simulation of the dropout rate under the assumption that retention has no direct effect on dropout. The continuation of retention in senior high (and so dropout due to it) adds to the magnitude, but the increase occurs under both conditions. This is the "ripple effect" observed in Figure 2b, revealing the effect of the simple mechanics of retention on dropout, independently of any causal effect retention may have on the decisions of students to drop out. The implication is that, since the same pattern of post-1992 increase in dropout is observed in the DCPS data, we are observing there an effect of the elementary and middle school retention policy that was curtailed 5 years earlier.

Changes in the percent of qualified graduates. The duplication in the model of the rise in the DCPS dropout rate after 1991 is one example of the model's potential in identifying and sorting

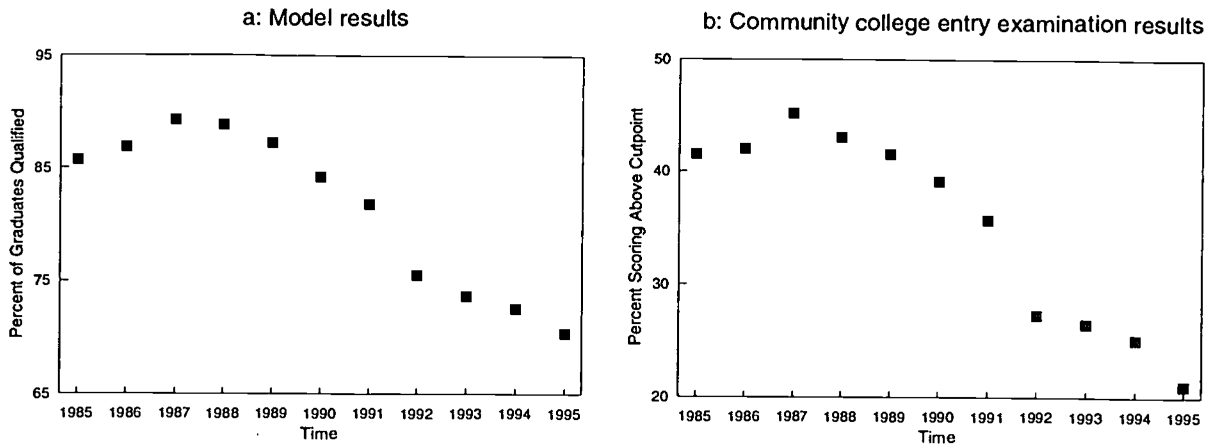


Figure 4 Percent of graduates meeting standards

Panel a shows model generated data on the percent of graduates meeting contemporary standards. The variable represents the number of graduates not-at-risk divided by the total number of graduates. Panel b displays the percent of DCPS graduates applying for admission to the Miami-Dade Community College who score above the cutoff on entrance examinations. Note that the vertical axes are not of the same range. Sources for Panel b are Belcher and Downing, 1990; Rich, 1992; Belcher, 1993; Office of Postsecondary Education, 1994-1996.

out the causes of the effects of retention. The model results shown in Figure 3a indicate that the rise --that particular behavior in the dropout rate-- was primarily a response to the structural effects of retention. It would have occurred whether retention had had any direct impact on students' decisions to drop out or not. Another example of a structural effect of retention that is independent of a direct effect on students occurs in a comparison of model results to a second set of DCPS data, the change in the percent of students who are qualified at graduation (QG). A large drop in that variable following the abrupt ending of retention is observed in Figure 2c (between the years 2000 and 2005) representing model results due to retention alone. The presence of dropout resulting from student reaction to being retained may affect the magnitude of the drop in QG, but not its occurrence.

The graph in 4a shows the results from the model adjusted for the DCPS conditions. The symbols represent the percent of graduates qualified (the ratio of not-at-risk students at grade 12 to the total number graduating, times 100), over the years 1985-1995. Between 1987 and 1992, the percentage drops approximately 14 percentage points.

In Figure 4b, a measure of the percent of qualified graduates from DCPS behaves in a similar manner. The Miami-Dade community college has issued several reports giving the annual percent of DCPS graduates applying for admission who score above the college's cutoff on their entry-level placement examinations, and consequently require no remedial courses (Belcher & Downing, 1990; Rich, 1992; Belcher, 1993).[7] The data from these reports, supplemented by data from state publications, are graphed in 4b. The pattern in the data corresponds to the model results exceptionally well. The reader will note that the scales of the two graphs (4a and 4b) differ; the percentages in 4a are determined by the model settings, which are rough estimates of the total students graduating, inferred from other data. The community college applicants, on the other hand, constitute a subset of graduates that excludes those who went on to major colleges and universities, which in effect raises the percent-at-risk factor of the group. Here as with the previous comparisons, it is the patterns and not the magnitudes that are of interest.

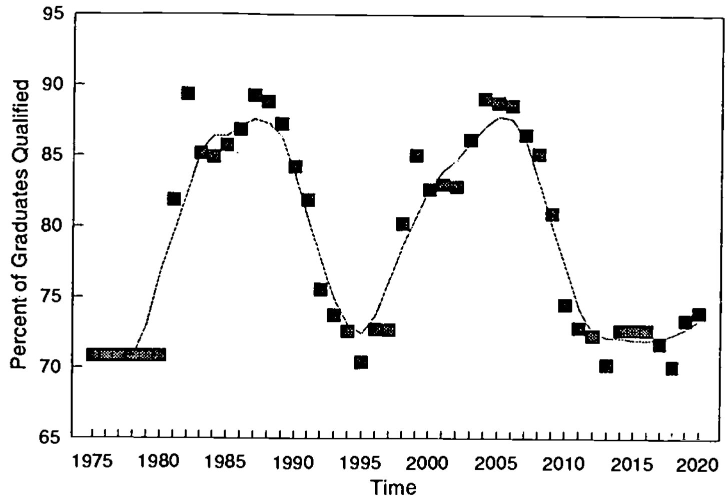


Figure 5 Change in percentage of qualified graduates in two successive standards reforms

Symbols indicate the percentage of graduates qualified in a simulation of two high-retention periods (1978 to 1987 and 1997 to 2006). The line represents a 5-year moving average.

Another round of retention

DCPS is one of the districts facing a high retention policy for the second time in a decade. New Florida law again mandates retention in first, second and fifth grades, contingent on reading scores, and the statutes are effective as of July 1, 1997. In August, 1997, the school board voted to modify the Pupil Progression Plan to conform to the legal requirements (Lim, 1997), to take effect in the 1997-98 school year. If the implications of the model results presented in Figure 2 are accepted, the new policy will be in force before the effects of the last have dissipated.

Figure 5 shows the result of the simulated effects of two successive retention policies on the percent of graduates qualified, using the model settings that produced the results presented in Figures 3 and 4. Assumptions for the model are expanded to include the idea that the future will resemble the past, and a second high-retention policy is added beginning in 1998, to run for the same duration as the last. This produces a new, larger pattern of two consecutive surges in the percent of graduates qualified. By themselves, the symbols appear chaotic and without pattern. However, when smoothed with a simple 5-year moving average, a clear cyclical pattern emerges.

Conclusion

The dynamic modeling employed here to analyze retention may be regarded as a form of qualitative methodology, but not in the sense usually thought of in the social sciences, where the term qualitative ordinarily refers to verbal description alone. Dynamic systems modeling is closer to the qualitative methods used in mathematics, where slopes, derivatives, equilibria conditions, and the like are used to extract information about the behavior of a system of equations (for an idea of the latitude of meaning attached to the term qualitative in the field of system dynamics compare Aracil & Toro, 1989, with Wolstenholme & Coyle, 1983). Computer models make possible the investigation of important characteristics of complex systems, despite shortcomings of data and/or the presence of complexities and nonlinearities that make more exact analyses impossible. Even where it is not possible to predict or meaningfully estimate the magnitude of the dropout rate from a given retention policy, for example, it may prove equally valuable to be able to predict that an increase in dropout will occur *as a result of the policy alone*, X years after its start, or that given a known dropout rate Y, about Z part of any apparent improvement in the percent of qualified graduates will be due solely to the effects of the policy itself. Such models, and the insights they yield, are relevant to policy making, to the conduct of research, and to the enterprise of theory construction.

Policy: Retention as patterns

That retention forms patterns of exponential curves across grades has been established in empirical research. Model results demonstrate that these exponential patterns have consequences over time, and that simulations can be instrumental in understanding the very complex nature of those consequences. Three major points arise from the simulations concerning the sharp changes in the behavior of the selected variables at the beginning and following the end of the retention policy. First is the recognition of the existence, origin, and shape of patterns of variable behavior. Just knowing, for example, that the percentage of graduates who meet standards will increase with the retention rate and remain higher for the duration of the policy, regardless of whether retention leads to greater remediation, or to higher dropout, is a counterintuitive result of the simulations that is of value both to decision makers and to researchers.

Second, the effects of retention are felt long after the policy is terminated. The "quality" of the graduating class drops rapidly for 5 years following the end of the retention policy, as the stored up reserve of retainees moves through the system. Similarly, fluctuations in dropout that follow the ending of high retention policies stem from structural effects. These variations occur *regardless* of whether any replacement reform is instituted to address the behavior of those variables. Finally, consider the implications when a new policy follows before old effects disappear. Any policies that follow a retention policy and are intended to redress its perceived failures may be inappropriately blamed for the delayed effects of the retention policy, or given credit as the case may be. In short, the model's more counterintuitive abstract results constitute important information for policy makers.

Research: Patterns as explanation

The agreement between model results and the limited empirical data presented seems to support the use of simulations. Based on the similarities of *pattern*, there appears to be strong support for the proposition that the underlying variable behavior revealed by the model is genuine, and that the causes of that behavior --given retention-- are structural. The emphasis in this paper has been on the structure of the system as a cause of variable behavior over time, and therefore on predicting pattern, rather than exact magnitudes.

How are these similarities to be interpreted? The model predicts a variable's *relative* value under specified circumstances. The strength of a simulation model lies in its ability to simplify complex situations sufficiently to gain a general abstract understanding of the phenomenon under investigation. In the final analysis a successful modeling effort means making enough links from that abstract result to what is actually observed to be confident that the model's results adequately represent underlying principles. I know of no convincing statistical procedures to accompany such a comparison short of careful collection of time-series data deliberately designed to test for the presence of such patterns. The model's role is to generate hypotheses and guide efforts to collect such data.

Theory: Explanation as dynamics

Models such as the one presented here may also be viewed as stepping stones to a more dynamic theory. Figure 5 holds out a tantalizing indication of a cyclical process, growing out of the empirical evidence of retention policy. This is consistent with popular views of retention. "The collective educational wisdom on the promotion-retention issue seems to cycle every few years back and forth between the two alternatives," writes Lawton (1997). She also describes the last few swings of that cycle: "In the 1970s, social promotion was in vogue. During the 1980s, the standards-raising movement made retention more appealing. By 1990, though, New York City and Chicago were revising district policies in order to encourage promotion . . . . Now, the pendulum is swinging back."[8] What is lacking is a mechanism to drive the cycle.

That mechanism is a feedback loop. Retention is one of three outcomes available for dealing with students at risk of failure. They can be remediated, held back, or passed on without remediation. For that sizable minority of students for whom remediation efforts consistently fail, the other two outcomes show a pronounced tendency to alternate over time. In the early phases of a reform reacting against social promotion, retention may be viewed as the first necessary step in implementing reform, and as such an indicator demonstrating that the reformers are serious about improving standards.[9] When indicators such as retention are used symbolically, to allay fears or demonstrate progress, and they are not followed by real progress (i.e., evidence of substantial remediation), there is a strong temptation to press them long after the reform has lost its credibility. Ultimately the policy's legitimacy fails, and the system is "reset" by an opposing reform with a new set of goals and a renewed level of public acceptance. These concepts have been developed in further detail elsewhere (Morris, 1994; 1996b). The point here is that they may be understood as constituting a feedback loop which makes the process self-perpetuating. With greater complexity, embracing feedback and nonlinearity, the modeling process can contribute in important ways to the theory-building process (Hanneman, 1988).

Summary: Modeling for policy and research

There is growing agreement in some corners of the research community that "computer modelling is a technology whose time has come" (Moe & Shotts, 1995, p. 88), but most educators seem to be at a loss to identify ways in which that technology can be actually applied either to policy making or to basic research. The retention topic serves as a means of demonstrating the value of that approach. Within an educational system highly structured by age-grading, it has the result of producing over-time patterns that are significant but rarely noticed. By initially avoiding the complexity introduced by major feedback effects, which produce indirect consequences that are difficult to identify and to understand, retention is a good example of an effective "low level" application of computer modeling in applied research. In presenting a structural view of retention, this study has attempted to demonstrate one avenue that computer modeling can open to our knowledge of the behavior of retention and similar variables over time.

Notes

Author's note: The work reported in this paper is not related to my duties for the Dade County Public Schools, and the district bears no responsibility for the contents. Comments may be directed to DonR.Morris@worldnet.att.net.

[1] The exponential function is expressed mathematically as $y' = k+c(1-p)^X$, where y' is the predicted retention rate and X indicates time in period, in school-years. The k, c, and p are positive constants that represent the minimum rate, the initial rate less the minimum, and the inclination of the curve, respectively, and p never exceeds unity.

[2] Tracing the path of retained students through the system can be tedious. There are three different "shocks" that occur at the beginning and end of any large-retention policy when abruptly introduced and/or terminated. Upon introduction of the retention policy, students are retained in more or less equal numbers (since there is constant entry and no exit until 9th grade when dropout begins) in every grade. The first effect of retention, therefore, is immediate, quickly increasing the number of at-risk students enrolled in the system. After a year's drop in number graduating, students then leave the system in greater numbers with increasing dropout. In the meantime, the year after the retention policy began, the newly enlarged last grade of middle school is returned to the at-risk pool and the retention for first year of senior high increases again, accompanied by another cascading increase in dropout from the still larger retained pool. Finally, the students initially retained in the last year of elementary school were returned to the at-risk pool at first year of middle school and generated a peak there the year following the introduction of the retention policy. Several years later these students generate another peak at senior high, and add to the cascade of dropout over the ensuing several years, before the system smooths out at the new equilibrium with a higher overall enrollment. Similar reasoning applies at the termination of the retention policy, when the process reverses.

[3] Fernandez's comments came upon ending the mandatory retention in the New York City schools. Olson quotes him as saying that "the district's 'promotional gates' program suggested that it had 'no appreciable value in fostering student advancement.'" While Fernandez was referring to the New York City school system, of which he had recently become chancellor, he had taken essentially the same position earlier in Dade County. Fernandez had left DCPS only months before making the quoted comments, and had been instrumental there in bringing about the Florida district's early rejection of the retention policy in 1987, three years before the state rescinded the legislation.

[4] There is little evidence to indicate that retention has resulted in remediation anywhere, despite frequent claims of success in early stages of retention policies. To the contrary, two meta-analyses of the research on retention reported that on the whole retention seemed to have a negative effect on achievement (Holmes, 1989; Holmes & Matthews, 1984), and that effect appears to increase over time (Reynolds, 1992; Holmes, 1989). When remediation due to retention is introduced into the model runs, dropout and percent of graduates not-at-risk increase or decrease appropriately, but do not change the pattern of behavior of those variables. If the remediation rate is small, this suggests there will be difficulty in detecting it; disturbances in the variables caused by the retention will all but guarantee that small remediation effects will be lost among the larger fluctuations. Moreover, any remediation of retained students coming late in the retention program will most likely show up most in the years following the termination of the policy. This is an interesting implication exposed by a dynamic approach to the study of retention, but it is beyond the scope of this paper. For an elaboration of a similar point, see Morris (1994).

[5] In the model runs, the results for the years prior to those graphed in Figure 3b indicate that the number of DCPS dropouts climbs quickly to a very high peak in 1982, drops rapidly, and does not rise that high again. This fits well with the timing of the Dade grand jury. Unfortunately, district data from this early period are not available for comparison to the model's results.

[6] Not only did retention rates continue in the upper grades after 1990, but they were more volatile, in the sense that grade-to-grade relationships varied from year to year. This is thought to be explained by the fact that the senior level retention rates differ from those in the lower levels, since classification in a grade is dependent upon the number of credits, and is more easily changed, even during the course of the year (see Morris, 1991), coupled with the fact that the promotion-gate tests (which drove up the retention rate at 10th grade), could be retaken as often as

students who scored poorly chose to do so. After 1990, the test was renamed and moved to the 11th grade, shifting the retention rate surge.

[7] Despite the fanfare about standards in the 1980s, there is no direct and reliable measure of the percent of students who met all standards at the time of graduation in Dade. True, the state successfully defended in court its intent to use the results of a criterion referenced test in 10th grade to determine fitness for graduation, and the legislation was in force from 1984. However, although students who could not pass the test by the 12th grade were to receive a certificate of completion in lieu of a standard diploma, the percentage of Dade graduates who received anything other than a standard diploma never exceeded 2 percent.

[8] In an influential article, Cuban (1990) has argued persuasively against the pendulum and the cycle as adequate descriptions of the educational reform process. Given his arguments and the evidence to which they point, I agree; I have elsewhere commented on the futility of using historical sequences of innovations to seek such patterns (Morris, 1997).

[9] In their discussion of the high retention rates prevalent in the early 1980s, Shepard and Smith (1989) noted the strong public support for retention and went on to note that district administrators and policy makers alike advocated retention by and large for symbolic reasons, to "project a tough public image and increase the support of a community worried about declines in achievement" (p. 222). If the emphasis is on individual learning and teacher skills rather than uniform standards, then the indication of successful implementation is likely to be the opposite of retention, a rising promotion rate. Karweit (1992) has also commented on the political nature of the alternation between retention and promotion: "Throughout the years, toughening or loosening the standards has reflected the political and reform climate of the particular period" (p. 1114).

References

Aracil, J. & Toro, M. (1989). Generic qualitative behavior of elementary system dynamics structures. In P. M. Milling & E. O. K. Zhan (Eds.), *Computer-based management of complex systems: Proceedings of the 1989 international conference of the System Dynamics Society*, pp. 239-245.

Belcher, M. J. & Downing, S. (1990). *Who's prepared for college? Results of a five year study of recent high school graduates taking Miami-Dade's basic skills placement tests.* Research Report No. 90-04R. Miami, FL: Miami-Dade Community College, Office of Institutional Research. (ERIC Document Reproduction Service No. ED 328 317)

Belcher, M. J. (1993, January). *Prepardness of high school graduates for college: A statewide look at basic skills tests results for 1990-91.* Information Capsule No. 92-01C, Office of Institutional Research. Miami, FL: Miami-Dade Community College.

Braddock, J.H., Wu, S., & McPartland, J.M. (1988). *School organization in the middle grades: National variations and effects.* Center for Research on Elementary Schools. Report 24. Baltimore: The Johns Hopkins University.

Cannon, A. (1996, March 28). Governors talk tough on school standards. *The Miami Herald.*

Cuban, L. (1990). Reforming again, again, and again. *Educational Researcher, 19* (1), 3-13.

Ekstrom, R.B., Goertz, M.E., Pollack, J.M., & Rock, D.A. (1986). Who drops out of high school and why? Findings from a national study. *Teachers College Record, 87*, 356-373.

Firing Line. (1992, January 16). *A report card for schools.* Telecast transcript #927, distributed by Southern Educational Communications Association, Columbia, SC.

Gomez, J. J. (1992, August). *Evaluation of the middle school project. Second interim report: The period of intermediate education.* Miami, FL: Dade County Public Schools.

Governor's Commission on the Reform of Education. 1990. *Reforming education in Florida.* Tallahassee, FL: Unknown.

Grissom, J. B. and Shepard, L. A. (1989). Repeating and dropping out of school, in L. A. Shepard & M. L. Smith (Eds.), *Flunking grades: Research and policies on retention,* (pp. 34-63). Philadelphia: The Falmer Press.

Hanneman, R. A. (1988). *Computer-assisted theory building: Modeling dynamic social systems.* Newbury Park, CA: Sage.

Hannon, B. & Ruth, M. (1994). *Dynamic modeling.* New York: Springer-Verlag.

Holmes, C. T. & Matthews, K. M. (1984). The effects of non-promotion on elementary and junior high pupils: A meta-analysis. *Review of Educational Research. 54*, 225-236.

Holmes, C. T. (1989). Grade level retention effects: A meta-analysis of research studies, in L. A. Shepard & M. L. Smith (Eds.), *Flunking grades: Research and policies on retention* (pp. 16-33). Philadelphia: The Falmer Press.

Jackson, G. B. (1975). The research evidence on the effects of grade retention. *Review of Educational Research, 45*, 613-635.

Karweit, N. L. (1992). Retention policy. In M. Alkin (Ed.), *Encyclopedia of educational research* (6th ed., pp. 1114-1117). New York: Macmillan.

Kohn, A. (1994, December). The truth about self-esteem. *Phi Delta Kappan*, 272-283.

Lawton, M. (1997, June 11). Promote or retain? Pendulum for students swings back again. *Education Week on the Web.*

Lim, G. (1997, August 28). School plan could raise students requirements. *The Miami Herald.*

Mailander, J. (1996, March 24). Board set to act on school reform. *The Miami Herald.*

McPartland, J.H., Coldiron, R., & Braddock, J.H. (1987). *A description of school structures and classroom practices in elementary, middle, and secondary schools.* Center for Research on Elementary and Middle Schools. Report 14. Baltimore: The Johns Hopkins University.

Moe, T. M. & Shotts, K. W. (1995). Computer models of educational institutions: The case of vouchers and social equity. In R. L. Crowson, W. L. Boyd, and H. B. Mawhinney (Eds.), *The politics of education and the new institutionalism.* Washington, DC: Falmer.

Monge, P. R. (1995). Theoretical and analytical issues in studying organizational processes. In G. P. Huber and A. H. Van de Ven, (Eds.), *Longitudinal field research methods: Studying processes of organizational change.* Thousand Oaks, CA: Sage.

Morris, D. R. (1997). Adrift in the sea of innovations: A response to Alexander, Murphy, and Woods. *Educational Researcher, 26* (4), 22-26, 30.

Morris, D. R. (1996b). Institutionalization and the reform process. *Educational Policy, 10*, 427-447.

Morris, D. R. (1996a, April) *An investigation of the peaking of retention rates at the transition to middle level.* Presented at the American Educational Research Association Conference, New York, NY.

Morris, D. R. (1994, November). *Is real progress in education being concealed by the operation of the reform process? Some insights from a system dynamics simulation.* Presented at the Florida Educational Research Association conference in Tampa.

Morris, D. R. (1993). Patterns of aggregate grade-retention rates. *American Educational Research Journal, 30*, 497-514.

Morris, D. R. (1991, April). *Structural patterns and change in grade retention rates: An aggregate analysis of data from a large urban school district, 1982-1989.* Presented at the American Educational Research Association Conference, Chicago, Illinois.

Morris, D. R., & Hanson, M. K. (1993). Consequences of reform: Retention rate fluctuations in Dade County. In S. Bacharach & R. Ogawa (Eds.), *Advances in research and theory of school management and educational policy* (Vol. 2, pp. 121-157). Greenwich, CT: JAI Press.

Office of Educational Accountability. (1986-1996). *District and school profiles*. Miami, FL: Dade County Public Schools.

Office of Postsecondary Education Coordination. (1994-1996). *Readiness for college*. Tallahassee: author.

Olson, L. (1990, May 16). Education officials reconsider policies on grade retention. *Education Week on the Web.*

Poe, J. (1997, July 1). For students, a summer of drills. *The Chicago Tribune.*

Reynolds, A.J. (1992). Grade retention and school adjustment: An explanatory analysis. *Educational Evaluation and Policy Analysis, 14*, pp. 101-121.

Rich, J. C. (1992, Feburary). *Performance of public high school graduates on Miami-Dade basic skills tests updated for Fall 1990 and Fall 1991.* Information Capsule No. 92-01C, Office of Institutional Research. Miami, FL: Miami-Dade Community College.

Roderick, M. (1993). *The path to dropping out: Evidence for intervention.* Westport, CN: Greenwood.

Shaw, C. (1988, February 25). Fewer high-school kids drop out. *The Miami Herald.*

Shepard, L., & Smith, M. (Eds.). (1989). *Flunking grades: Research and policies on retention.* New York: Falmer Press.

Wehlage, G. G., & Rutter, R. A. (1986). Dropping out: How much do schools contribute to the problem? *Teachers College Record, 87*, 374-392.

Wolstenholme, E. F., & Coyle, R. G. (1983). The development of system dynamics as a methodology for system description and qualitative analysis. *Journal of the Operations Research Society, 34*, 569-581.

EA 029643

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

ERIC®

REPRODUCTION RELEASE
(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: Structural Consequences of Retention Policies: The Use of Computer Models to Inform Policy

Author(s): Don R. Morris

Corporate Source: Dade County Public Schools

Publication Date: Nov., 1997

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following three options and sign at the bottom of the page.

The sample sticker shown below will be affixed to all Level 1 documents	The sample sticker shown below will be affixed to all Level 2A documents	The sample sticker shown below will be affixed to all Level 2B documents
PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 1	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 2A	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 2B
Level 1 ☑	Level 2A ☐	Level 2B ☐
Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g., electronic) *and* paper copy.	Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only	Check here for Level 2B release, permitting reproduction and dissemination in microfiche only

Documents will be processed as indicated provided reproduction quality permits.
If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

Sign here, → please

Signature: Don R. Morris	Printed Name/Position/Title: Dr. Don R. Morris, Coordinator	
Organization/Address: 1500 Biscayne Blvd., Ste. 225 Miami, Florida 33132	Telephone: 305-995-7531	FAX: 305-995-7571
	E-Mail Address: donr.morris@worldnet.att.net	Date: 1/12/99

(over)

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, or, if you wish ERIC to cite the availability of the document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents that cannot be made available through EDRS.)

Publisher/Distributor:
Address:
Price:

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant this reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name:
Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

However, if solicited by the ERIC Facility, or if making an unsolicited contribution to ERIC, return this form (and the document being contributed) to:

ERIC Processing and Reference Facility
1100 West Street, 2nd Floor
Laurel, Maryland 20707-3598

Telephone: 301-497-4080
Toll Free: 800-799-3742
FAX: 301-953-0263
e-mail: ericfac@inet.ed.gov
WWW: http://ericfac.piccard.csc.com

EFF-088 (Rev. 9/97)
PREVIOUS VERSIONS OF THIS FORM ARE OBSOLETE.