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A Proposed Staffing Formula for Virginia's Academic Libraries

Formulas and standards play a needed role in the allocation of library resources, but it is difficult to devise formulas that accurately reflect the various factors that shape a library's needs. This report summarizes the means by which a subcommittee of the Virginia Library Advisory Committee devised a proposed staffing formula for its academic libraries. The subcommittee charged with devising a new formula reviewed past efforts as a means of determining criteria any new formula should meet. Based on this review and on its own research, the committee devised a draft formula, which is discussed.

THE USE of formulas and standards to allocate or to evaluate resources for academic libraries has received a good deal of attention in recent years. This particular pendulum seems to describe a larger arc than most, with formulas sometimes popular in both theory and practice and at other times mentioned rarely, and then only critically.

Since there are strong arguments to be made both for and against the use of objective bases for determining levels of acquisitions, staff, or funding, this ambivalence is understandable. On the one hand, formulas are seen as objective and apolitical, and as a means of ensuring continuity and rational planning. On the other hand, formulas are criticized for their procrustean tendency to ignore significant local differences and for the danger that they may actually be used more as ceilings, which set maximum resource levels, than as floors, with unfortunate results, especially when enrollments decline.[1,2] These dangers are sometimes avoided by the use of standards explicitly intended to determine minimal resource levels rather than formulas that would determine allocations with some precision.

Although formulas and standards to determine collection levels have received the most attention, there has been no lack of effort to devise objective means to determine staffing levels, as well. While the Association of College and Research Libraries has declared that "As such factors (e.g., the number of library units, collection size, and circulation volume) vary widely from one institution to another, no single model or formula can be provided for developing an optimum staff size," it has outlined in a general sense qualitative criteria for what should be expected of a library staff.[3] Other agencies have not been so reluctant about formulas, and it is interesting that all of the formulas devised to date have been developed to serve states or large city systems of higher education, a level where the need for an apolitical and equitable approach is most keenly felt.

New York City and the states of New York, Colorado, Washington, Oregon, Florida, and California have all experimented with staffing formulas, though it is not clear from the literature that all have been applied.[4-8] All of these formulas have used enrollments as a key input to the formulaic equation, but beyond this similarity they have differed in a number of significant ways. Some attempt to determine levels for

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technical services, public services, and administration while others directly determine the bottom line; some use different constants or different factor weights depending on the level of the institution whose staff is being determined, in effect establishing different formulas for community colleges, four-year colleges, and universities; and some use faculty levels, collection size, or acquisitions rates as input factors while others disregard these parameters. Finally, some, but not all, of the formulas reflect the diminishing demands of larger enrollments or other parameters on library resource levels, establishing sliding scales for the relationships between input parameters and staff levels.

The state of Virginia has used a series of formulas as library staffing guidelines for budget requests from institutions of higher education. It should be emphasized that the current guidelines are indeed guidelines and are not applied rigidly. Adjustments to the guideline staffing levels are made on both the state and the local levels. In making adjustments to the guideline levels, a general consideration has been given to the recognition that their strict application would yield too few positions for the larger institutions and for community colleges with more than one campus.[9,10] Those in present use are based on formulas developed by the CUNY system and are supplemented by a prescription that the ratio of nonprofessionals to professionals should be 3:2. Nonstudent library positions for each campus are derived as follows:

Community colleges:
STAFF = 3 + Student FTE/500 + Faculty FTE/50
Four-year colleges:
STAFF = 9 + Student FTE/400 + Faculty FTE/40
Comprehensive universities:
STAFF = 9 + Undergraduate FTE/400 + Graduate FTE/100 + Faculty FTE/35

The state's two ARL institutions do not use these formulas but instead determine their funding requests by comparisons with the size of the staffs in the ARL libraries that are their peers in terms of collection size. The result, then, is that there are four yardsticks that affect staff levels.

In search of a better means for determining staff needs, the Library Advisory Committee of the State Council of Higher Education in Virginia appointed an ad hoc Subcommittee on Staffing to investigate alternative approaches. This subcommittee proceeded to review the literature, to outline goals for a revised approach, and to make recommendations for a new formula. As a means of discovering how staff were actually performing the various library functions and how needs were being met in the differing colleges, the subcommittee sent a survey to the library directors of the thirty-nine state academic institutions in July 1978. The general conclusion of the survey was that few institutions fulfill the guidelines and that the number of existing positions is no greater than what is needed, and is apparently less in many cases. This conclusion was based on both subjective data (the assertion by the great majority of directors that their staffing levels were insufficient to provide adequate service) and objective data, most notably the demonstration that many library service points were unattended during long portions of library hours, that some libraries could offer no reference service during certain hours, and that student labor was being enlisted for functions that should probably be assigned to full-time professional or paraprofessional staff.[11]

GOALS FOR FORMULA CONSTRUCTION

Since the number of positions called for by the official guidelines had not been funded, the subcommittee thought that it would be unreasonable to conclude that the present formulas were overly generous until the staff levels they called for had been fully funded and the results of this practice determined. Because the problems unearthed by the survey seemed to have been more severe in the smaller institutions and because those same institutions were more seriously understaffed with respect to the current guidelines, the subcommittee also determined that its formula should reflect, not the existing distribution of staff across institutional types, but the distribution called for by current guidelines. Together, these observations served as the bases for the first of six precepts that the subcommittee adopted for its work:

1. The new formula should call for essentially the same staff levels within each type of institution as is called for by current guidelines, both for the system as a whole and within each type of institution.

The first precept grows out of considerations that may be peculiar to the Virginia situation. The remaining five of the subcommittee's precepts, however, grew out of an examination of what functions a staffing formula should serve and out of a review of how previous formulas have succeeded or failed in meeting their goals. Accordingly, a step-by-step discussion of the subcommittee's self-imposed guidelines may provide a convenient means of examining the entire question of what makes for a good staffing formula. Each of the remaining precepts is therefore listed and discussed below.

2. A staffing formula should be based on unambiguous, readily available statistical measures.

None of the advantages of a formula—convenience, objectivity, the hope that levels set by formula will be subject to less special pleading than levels set by other means—applies if the input parameters are ambiguous or cannot be readily obtained. Ideally, input parameters should be drawn from data already collected, such as HEGIS (Higher Education General Information Survey) statistics.

3. A staffing formula should be based on factors that measure demands on the library, and not on internal processes within the library's control.

In order to promote efficiency and to retain its credibility, a formula must not be based on any procedural elements within the control of the library administration. It would be possible, for example, to base a formula in part on the length of time devoted to authority searching and cataloging per new title, or on the number of catalogs maintained, or on the number of service desks regularly staffed. But such a formula could establish a feedback loop from questionable library procedures to staffing levels, perpetuating existing staff levels and rewarding inefficient practices. On the other hand, if a library's staff level is determined by external demands, more efficient libraries will be rewarded for their economies. Instead of having their "idle" staff taken away by an intrusive bureaucracy,

they will be free to assign any staff time gained through efficiencies to new service uses.[12]

Some potential factors fall on the border line between "demand" and "process" factors, but must be rejected in any event because they do not satisfy the second precept. Circulation counts, for example, are not calculated in the same way in every library; some libraries count renewals as equivalent to first-time circulations, while others do not. Moreover, circulation volume is partly an outcome of library policies, such as the length of circulation periods or the extent of the library's reliance on reserve reading.

4. If possible, there should be a single formula, rather than a series of formulas, applied to different institutional types.

This precept is based on the goals of conceptual clarity and ease of application for a formula and reflects a belief that the important sources of variation among types of institutions are not necessarily more significant than the sources of variation among institutions of the same type. The precept is also based on the observation that institutions can change categories. If a four-year college is upgraded to a comprehensive university and finds that its formula-driven staff level has dramatically changed, this is an indication that the formula imposes arbitrary and inappropriate staffing levels. This unfortunate tendency is exacerbated if multiple formulas are heavily based on the use of different additive constants (rather than different factor weights, or multipliers). The use of constants tends to homogenize staffing levels within institutional types, carrying the risk that smaller institutions within a type will be overstaffed while larger institutions are relatively deprived.

5. The formula should achieve a close statistical fit with existing staffing levels.

This precept does not speak to the total number of positions that the formula should call for (precept 1), but rather to the desired statistical relationships between actual and formula-predicted staff levels. The precept proceeds from the assumption that factors that influence the effective use of library staff—initiative, careful management, or even mismanagement—are probably ran-

domly distributed across types of institutions and across individual institutions. If this is true, then a formula that closely correlates with existing staff levels will succeed in introducing rationality and in rewarding efficiency, and will do so without imposing a systematic redistribution of staff based on any arbitrary theory about which institutions require more staff.

6. The formula should be based on a balanced variety of parameters, and should not be too heavily dependent on enrollment levels or on other measures highly correlated with enrollments.

Both a desire for an accurate formula and political pragmatism provide rationales for this precept. It is unrealistic to believe that any one input parameter can be relied on to yield valid staff levels for academic libraries whose environments vary in so many other important respects. Certainly the greatest demands within an academic library system do not always come from the departments with the highest enrollments. Politically, it is unwise to endorse a staff formula that is heavily based on a parameter whose future levels are unknown, with either a steady state or absolute decreases a realistic possibility.[13]

PROPOSED VIRGINIA FORMULA

Given the constraints outlined above, the subcommittee identified a set of parameters that reflect demands on the library and for which unambiguous statistics are readily available. The following factors were identified: undergraduate FTE, graduate student FTE, faculty FTE, volumes held, volumes added (gross), and the number of distinct library sites that serve *either* a physically discrete campus *or* a professional program.

Undergraduates, graduates, and faculty are common input parameters for staffing formulas. They clearly represent external demands on the library. For most state systems, including that of Virginia, funding for colleges and universities is based in large measure on enrollments, so that a staffing formula with this basis is apt to be generally in line with overall institutional funding. Each of the three factors measures a somewhat different facet of external demand, not only because graduate students and faculty

make heavier demands on the library but also because the proportion of graduate students and faculty on campus is a useful index of the overall nature of the academic enterprise. That is, large graduate enrollments and high faculty-to-student ratios may be useful indexes of a strong research orientation that will place heavy demands on the library.

The remaining factors are not so commonly used in staffing formulas. Perhaps the custodial role, rather than that of direct service, is easily overlooked in library planning because it has little appeal. In any event, the human resources required to maintain large collections and the buildings that house them, to shelf-read, periodically to move, and to provide reference access to large numbers of books are not to be discounted. Baumol and Marcus, in their well-known study, have shown that collection size bears the single strongest statistical relationship to staff levels, a finding that Metz and Halstead have independently replicated.[14-16]

The relationship between additions to the collection and staff is obvious. The number of new titles added to the collection is a chief determinant of needs for technical services staff. Gross volumes added (rather than net, which would reflect discards) was chosen as the most appropriate, readily available statistic to measure this factor.

The selection of sites as the final factor stemmed from the fact that one of the most common criticisms of the previous Virginia formulas had been their insensitivity to this parameter.[17] Apart from the fact that dispersion of library sites increases overall user demand, keeping each site open and operating calls for a certain minimum fixed expenditure of human resources.

The use of physical sites as an input parameter does raise problems of definition that require careful negotiation. Sites are only ambiguously a "demand" factor, as the establishment of a new site often represents a policy decision made by the library administration. Certainly any staffing formula should not encourage the undue proliferation of branch libraries. The subcommittee sought to solve this dilemma by defining a site, for the purpose of the formula, as "any physically separate campus of the same institution, or a physically separated location

TABLE 1

RATIO OF INPUT PARAMETERS TO STAFF LEVELS

	Undergrad. FTE	Grad. FTE	Faculty FTE	Holdings	Volumes Added	Sites
Universities	77:1	19.1:1	7.9:1	7863:1	447:1	0.021:1
Four-year colleges	160:1	8.8:1	11.3:1	8043:1	415:1	0.052:1
Community colleges	210:1	—	14.8:1	4400:1	274:1	0.152:1
Entire system	120:1	13.2:1	9.9:1	7203:1	406:1	0.053:1

Note: There are five universities, ten four-year colleges, and twenty-four community colleges in the Virginia system.

of a professional school responsible for its discipline offering within the institution and for earning separate accreditation."[18]

In deriving weights to relate the input parameters to staff levels, the subcommittee made no effort to establish empirically the precise contribution that each makes to the use of staff time. Two approaches to this type of solution are possible, but each has serious flaws. Time study analyses can be and have been used to determine the relationship of various factors to time expenditure, but this requires very careful and expensive studies whose outcomes inevitably depend on key issues of interpretation.[19] Statistical analysis poses an alternative methodology that, while useful, is ultimately limited by the extreme multicollinearity among library measures, where correlations among collection size, enrollments, faculty size, and other parameters are often as high as 0.90.[20] The subcommittee did in fact experiment with the use of ridge regression, a form of multiple regression that takes explicit account of multicollinearity, and was able to derive a formula with highly satisfactory "goodness of fit" to existing staff levels. Several draft formulas developed in this manner satisfied all of the subcommittee's precepts, but this approach was ultimately rejected because the weights it yielded were wildly counterintuitive and would therefore be generally unpalatable and politically unacceptable. No formula could be found through this means that did not include at least one *negative* coefficient, seemingly punishing a library for the size of its constituency or of its collection.*

The methodology actually used was an in-

*Kendon Stubbs, associate director of the University of Virginia Library and a member of the subcommittee, was responsible for the analysis of the capabilities and limitations of ridge regression.

teractive trial-and-error process of finding the factor weights that would yield a formula most in line with the subcommittee's goals. First consideration went to satisfying precepts one and five, calling for a formula that would give each category of institution about the same total level of staff as the old formula while achieving a high statistical fit with existing staff levels for individual institutions.

The information in table 1 provides the basis for manipulating the weights to meet the various constraints. The table reflects the ratio of each input parameter to the number of library staff, within each category of institution and for the thirty-nine colleges and universities as a whole.

Using these data as a basis for adjusting the weights (which in this formula take the form of denominators), the subcommittee arrived at the formula given below:

Library staff = Undergraduate FTE/ 1,000 + Graduate FTE/100 + Faculty FTE/33 + Volumes Added/5,000 + Holdings/22,000 + (2) Sites

For any given parameter, a heavy factor weighting (small denominator) will yield more positions for those institutions for which the ratio of the parameter to staffing is high, while making a smaller contribution to staff levels for those institutions for which the same ratio is low. To the extent that a formula assigns staff on the basis of undergraduate enrollments or faculty, then, the smaller institutions will benefit. The relationship is reversed for the weighting of holdings and acquisitions, which benefits universities and four-year colleges at the relative expense of community colleges. The use of graduate enrollments as an input factor benefits universities more than four-year colleges, and, of course, adds nothing to li-

brary staff for community colleges. The use of sites counterbalances the differential effects of graduate enrollments on universities and four-year colleges, as heavier weighting for sites will contribute relatively more staff to the four-year colleges than to the universities.

Note that the very methodology used for deriving the weights makes it impossible to defend them on grounds other than that they supply a satisfactory mathematical solution. That is, while it may be possible to argue that graduate students affect library needs ten times more than do undergraduates, such an argument would be strictly post hoc. The particular weights chosen will have to stand or fall on the extent to which the formula they yield is acceptable.

The formula does seem to meet the specified criteria quite well. It is a single formula (precept 4) and it is based on demand factors (precept 3) for which statistical measures are readily available (precept 2). The formula is not wholly based on enrollments, but on a balanced set of inputs, which satisfies precept 6. In fact, if one divides the total count on any parameter by the formula denominator to see how many staff positions that parameter determines, one discovers an interesting symmetry between the three parameters describing the academic constituency of the library and the three that pertain to its internal work load. Fifty-one percent of predicted staff is determined by the academic constituency: 11 percent by undergraduates, 12 percent by graduate students, and 28 percent by faculty. Forty-nine percent is determined by library measures: 8 percent by acquisitions, 31 percent by holdings, and 10 percent by sites. (The relative weights of each factor appear to have a different degree of importance if comparisons are confined to any one type of institution; from the point of view of a community college making comparisons to its peers, the formula is heavily "driven" by student and faculty counts, while for the larger institutions volume counts and acquisitions appear to be more salient.)

The formula calls for very nearly the same staff levels as were dictated by the former guidelines (precept 1), as table 2 shows.

The statistical relationships between the formula and existing staff levels are also

TABLE 2
STAFF LEVELS CALLED FOR
BY OLD AND NEW GUIDELINES

	New Formula	Former Guidelines	Percentage
Universities	673	677	99.4
Four-year colleges	263	267	98.5
Community colleges	270	275	98.2
Totals	1,206	1,219	98.9

high (precept 5). Table 3 shows the correlations between the formula-driven staff levels and two measures of current staff, one taken as part of the subcommittee's 1978 survey and one based on a preliminary analysis of the latest HEGIS data.

TABLE 3
CORRELATIONS BETWEEN
FORMULA AND CURRENT LEVELS

	1978 Survey	Preliminary HEGIS
Universities	0.9996	0.9986
Four-year colleges	0.9465	0.9657
Community colleges	0.9801	0.9858
Overall	0.9939	0.9965

DISCUSSION

One reason that formulas have come in and out of fashion may be an excessive desire on the part of those who apply them to see a formula as an authoritative dictum that will make decisions in a nearly automatic way, combined with a reluctance to understand the problems a formula seeks to address and the logical problems a formula must solve.[21] Such a rigid attitude toward any formula will limit its transportability from one situation to another or its ability to be adapted over time to accommodate changing realities.

There are at least three ways in which, if put into practice, the formula discussed here may require adjustment for particular circumstances. Recent practices in Virginia have led to staffing levels for the senior institutions that more or less met the formula-driven levels, while the community colleges have been staffed below formula. The Virginia subcommittee sought to reaffirm its support of the overall levels called for by the former approach by constraining its formula to predict the same number of positions in each category as the previous guidelines had called for. A later decision

that the trend in staff allocation had been a healthy one and the subcommittee's decision incorrect would necessitate a revision of the formula (specifically, a greater weighting for collection parameters and less weight for enrollments).

It may also be necessary to adjust the formula if it is applied to an institution larger than those found in Virginia. If applied to the library system of one of the nation's largest universities, the formula might predict an inappropriate number of positions, necessitating some sort of adjustment of weights, such as the introduction of sliding scales.

Finally, it is critical to bear in mind that any formula cannot reflect all of the many

kinds of unique needs that individual institutions may have. The Virginia subcommittee sought to address this issue when it noted that "there are certain library activities the Subcommittee feels are appropriate to acknowledge as non-quantitative factors not reflected in the formula which play a significant role in establishing good staff levels. A particular example is the responsibility to maintain a notable rare books and archives collection which carries with it a heavy demand for library staff. Accordingly, the formula should apply only to functional staffing areas. Requests for additional staff in support of auxiliary functions may well be legitimate and should be recognized on a case-by-case basis."[22]

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20. Baumol and Marcus, *Economics of Academic Libraries*, p.85–86.
21. Watkins, "Standards for University Libraries," notes that "according to Clapp, [the Clapp-Jordan formula] was published only as a basis for discussion," though its critics may have viewed it as a much more definitive statement (p.198).
22. Scott, *Report of the Subcommittee on Staffing*, p.29.