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ABSTRACT

The way that department heads interpret the effort required by college faculty to teach classes was studied with a national sample of 491 department heads in 25 major U.S. universities. Based on the responses of department heads, a model was developed to relate the effort required to teach a class to the level, size, instructional mode, and discipline of the class. As a validation measure, the model was applied to faculty responses to a typical faculty activity form. The relationship of effort to the variables was investigated by developing linear models. All of the variables were found to make a difference in the amount of effort required to teach a class. In the perceptions of the department heads, as enrollment increases, effort increases but at a decreasing rate. Additionally, as the anticipated effort to teach a class or a group of classes increases, the time spent increases but at a decreasing rate. The relative time spent on a class by an individual with more than one class is proportional to the relative effort to teach the class. It is argued that evaluation of faculty resources should be based on effort required rather than on time devoted to given tasks. (SW)

# FACTORS IN TEACHER ASSIGNMENTS: MEASURING WORKLOAD BY EFFORT

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Mary Corcoran
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(Editor, AIR Forum Publications)

## Abstract

This study examines what department heads perceive to be the component parts in making assignments to faculty members. The paper argues that it is imperative to evaluate faculty resources based on effort required rather than on time devoted to given tasks. Based on a national survey of 491 department heads in twenty-five major universities in the United States, the authors investigate how department heads interpret effort required to teach classes and how this effort varies by discipline (Biglan taxonomy), by class level, by number of students, and by type of instructional technique. The results are validated against reported time expenditures from a faculty activity analysis.

Acknowledgments

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# FACTORS IN TEACHER ASSIGNMENTS:

# MEASURING WORKLOAD BY EFFORT

Funding formula! Measurement of faculty effort! Sunbathing by students, especially women. These three phenomena are especially noticeable to administrators in the spring of the year; just as certainly as spring follows winter one can expect a questioning of the figures and formula involved. So far as teacher assignments and workload are concerned, cost considerations and computerized accounting systems focus attention on the use of faculty resources in instructional activity. If one could measure the amount of faculty activity for instructional duties, then it might be possible to determine the appropriate staffing level for the institution (Bolton, 1965), to protect teachers from unfair demands (Kilpatrick, 1967), to focus on investigating instructional quality (Hicks, 1960), and perhaps to avoid the external imposition of "arbitrary" formulas to which the institution would have to adjust (Shay, 1974). A good overall review of these issues has been presented by Gross (1979).

While other efforts have reviewed the components of instructional activities (see Yuker, 1974; Goodwin, 1970; and Stecklein, 1968 and 1974; for extensive reviews), this research concentrates on <u>effort</u> required to teach a class and the appropriateness of scales to measure such effort. As a consequence, the authors deviate slightly from previously used techniques, such as class size, course level, teaching mode, and discipline. Of course, great disagreement continues on the relative influence of these factors.

The most frequently used index for measuring activity is the number of "hours spent per week" in a given activity. Much of the

popularization of this index can be traced to work on faculty activity analysis undertaken by NCHEMS in the early 1970's (Romney and Manning, 1974; Stecklein, 1974). Contact hours as a measure of activity (Goodwin, 1970) have been substituted for hours per week, but this approach has also elicited sharp criticism on philosophical grounds (AAUP, 1970). Regardless of whether hours or contact hours are used, a philosophical concern exists over evaluating a professional activity on the basis of time spent rather than quality (Shay, 1974; Enochs, 1960).

The National Science Foundation (1967) offered a seemingly ignored solution: measure the effort required for an activity, rather than the time spent. That report defined effort to include:

1. Degree of engagement of abilities (native ability, experience, learned and acquired skills)
2. Degree of intensity of application (expenditure of energy-physical, emotional, and mental power), and
3. Amount of time expended (NSF, 1967, p. 95).

This study reports on a two-step procedure to investigate effort as a measure of faculty activity required to teach a class. As such, the study seeks to establish a basis for the NSF proposal and to provide an alternative to the simple-minded techniques now employed.

## Methodology

As a first step data were obtained from department heads using a national sample of 25 comprehensive universities. From the responses of these department heads, we developed a model to relate the effort required to teach a class to the level, size, instructional mode, and discipline of the class. In a second or validation step, we applied the model to faculty responses to a typical faculty activity form.

The questionnaire to department heads was mailed in March, 1979, to 1,314 department heads in a geographically selected sample of twenty-five

comprehensive universities. We received 491 usable responses. (A list of universities in the study and the number of department heads responding is in Appendix A.) The department heads responded to an open-ended question which asked: "What factors do you consider to be most important in determining equity of teaching assignments among faculty in your department?" and to a series of questions which required them to rate the faculty effort needed to perform various instructional tasks. Respondents related effort to class size and level by assuming that a three-credit-hour-lower-division-lecture class with 25 students received 100 points. Using 100 as the base score, the department heads added or deleted points as credit hours and students varied. The respondents rated varying credit hour and laboratory classes to various enrollments (5, 10, 25, 50, 100, and 200) at four levels (lower and upper division undergraduates, first-year and advanced graduates). Using the categories proposed by Biglan (1973), we identified the respondents as being from academic disciplines which were

a. Hard or Soft (clarity of definition of paradigm or methods),

b. Pure or Applied (relative concern with practical application), and

c. Life or Nonlife (relative emphasis on the study of living systems).

These categories, proposed by Biglan (1973), have been investigated extensively by Smart (for example, see 1975) and related by him to characteristics of departmental activity (Smart, 1975).

Findings

The typical respondent was the head of a department which contained about 29 faculty members and 300 majors with approximately 23 percent of these majors at the graduate level. Instructional faculty members typically taught 10 contact hours per week and spent about one-half of

their time in instructional activities (51 percent); about one-fourth of their time in research, scholarships, and professional development (25 percent); and the remainder in interacting with students (10 percent), institutional service (8 percent), and other activities (6 percent).

The results of a content analysis of the responses to the question on "equity of teaching assignment" are shown in Table 1.

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(Table 1 about here)

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The most important factors mentioned relate to internal assignments which decrease the instructional time for a faculty member. The key point, as related to effort, is that such activity may not be reflected in the full-time equivalent characteristic of the faculty member as maintained in institutional data bases. Other factors, however, reflect the more traditional indices such as class level or number of students in a class. Expertise, which is one of the factors, is a major component of the definition of effort as used by the National Science Foundation. The relevance of "faculty interest in teaching" also seems logical if one assumes effort rather than time is the major determinant of equity. The remainder of this research involves developing an equation to explain instructional effort required to teach a class and then validating that equation on self-reported data from a faculty activity analysis.

The relationship of effort to the variables of class size, mode of instruction (lecture versus lab), level, and curricula was investigated by developing linear models to determine main effects and interactions and the use of natural logarithmic and polynomial transformations on effort and enrollment. Best fits were obtained with log-log transformations,

Table 1

Factors in Determining

Equity in Teaching Effort

| Order of Importance | | Percent Mentioning |
|---|---|---|
| 1 | Service and Administration | 29.1 |
| 2 | Research Activity | 26.9 |
| 3 | Student Enrollment | 24.8 |
| 4 | Class Level | 20.4 |
| 5 | Faculty Expertise | 18.7 |
| 6 | Faculty Interest in Teaching | 16.3 |
| 7 | Department Needs | 12.8 |
| 8 | Teaching Ability | 12.4 |
| 9 | Contact Hours Taught | 10.6 |
| 10 | Supervision of Graduate Students | 9.8 |
| 11 | Student Credit Hours Generated | 9.8 |
| 12 | Preparation of New Courses | 9.0 |

although, as shown in Figure 1, there was some curvilinearity for classes with higher enrollments.

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(Figure 1 about here)

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The best model to review independent variables and their interactions was selected based on statistical and judgmental criteria of parsimony. The judgment criterion was used, for example, in a decision not to use power terms for log enrollment even though these terms were significant. In addition, a decision was made to use a single model for instruction for both lectures and laboratories. Such a decision appeared justified even though some statistical criteria supported separate models inasmuch as the model for lecture had a higher efficiency than the model for laboratories. Nevertheless, after extensive investigation, the following model was selected:

$$\begin{aligned}\text{Log}_e \text{ Effort} = {} & 2.804 + .862\ (\text{Lecture}) + .1214\ (\text{Upper UG}) \\ & + .3215\ (\text{First G}) + .4452\ (\text{Adv G}) \\ & - .1916\ (\text{Nonlife Discipline}) + .2939\ (\text{Hard Discipline}) \\ & + .4034\ (\text{Log}_e \text{ Size}) + .0560\ (\text{Lect x Pure Discipline}) \\ & + .1333\ (\text{Lect x Nonlife Discipline}) - .2631\ (\text{Lect x Hard Discipline}) \\ & - .1396\ (\text{Lect x Log}_e \text{ Size}) + .0329\ (\text{Nonlife Discipline x Log}_e \text{ Size})\end{aligned}$$

$(F = 914.5;\ df = 12/12604;\ R = .682)$.

In this equation all variables except $\text{Log}_e$ Size are scored 1 for an observation in a category, and $\text{Log}_e$ is defined as enrollment + 3.5.*

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*The constant 3.5 was empirically determined to maximize the collection. While all variables were significant ($p<.001$), knowledge of whether a curriculum was Life or Nonlife (main effect and interaction) and the interaction of lecture x pure discipline might be dropped if one wanted to simplify the model.

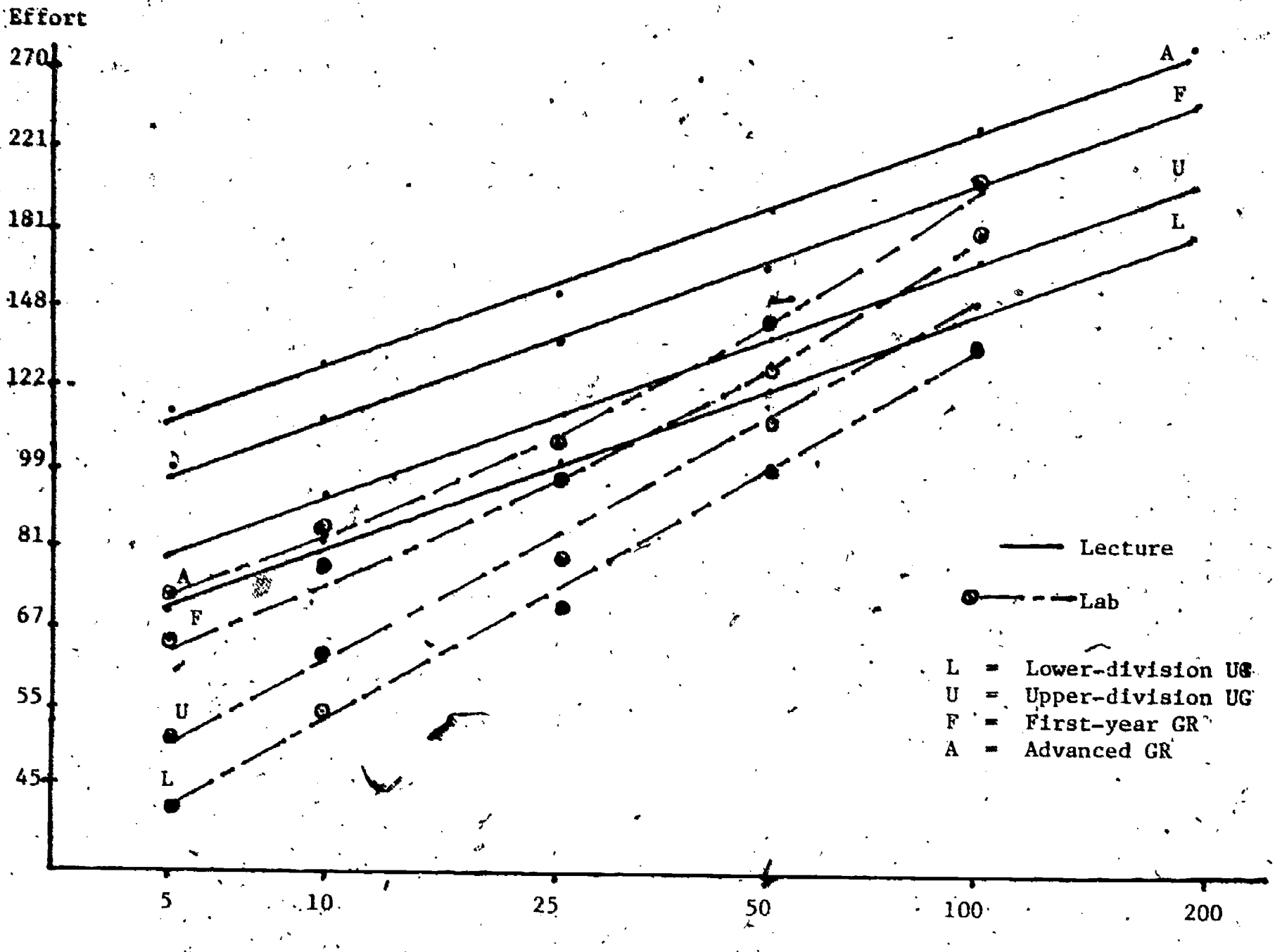


Figure 1

Means of $\text{Log}_e$ Effort by Class Type, Level, and Size

Reviewing the terms included in the model, two alternative explanations can be offered. Those who have argued that the task of teaching is based on mode of instruction, curricula, enrollment, and class level have some ground for their beliefs; it might also be argued that faculties in higher education have been brainwashed into listing such factors as influencing instruction.

As previously noted, respondents were also asked to think of a three-contact-hour lecture course and a three-contact-hour laboratory with an enrollment of 25 students as having a value of 100 points. The department heads in the survey displayed a striking linearity in what they thought to be the effort required to teach more contact hours. As the contact hours increased from 1 to 5, respondents increased effort. In a similar fashion they increased effort with class size, at least initially. Figure 2 displays the fact that some effort is required to teach a class even with zero contact hours--a phenomenon which teachers recognize as necessary for working with registrars, program committees, and preparation of material.

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(Table 2 and Figure 2 about here)

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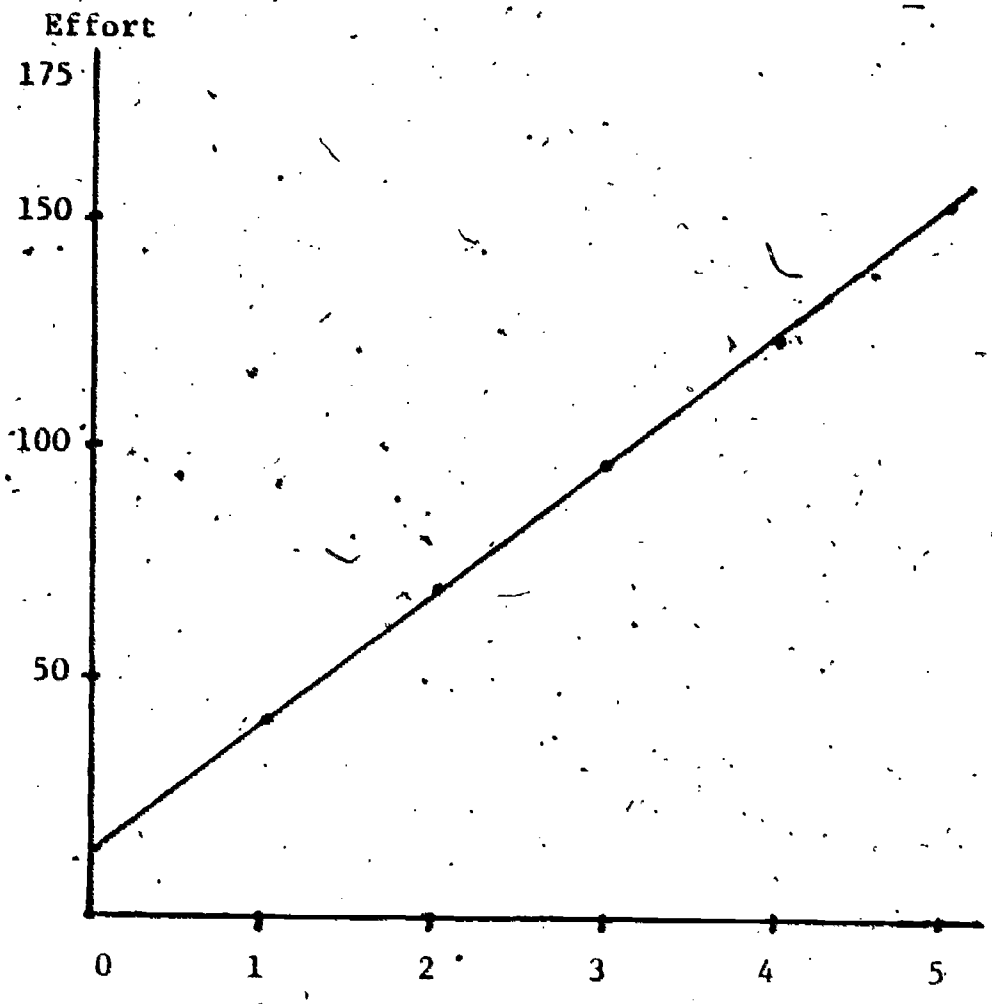
While additional information from the department heads was obtained on the effort required for advising, independent study, thesis committees, and multiple sections, similar information was not available for use in the validation phase of the research and therefore is not reported at this time. The validation phase, while exploratory in nature, provides insights on the relationship of effort to time.

Table 2

Means and Standard Deviations of Faculty Effort Required to Teach A Course of 1 to 5 Contact Hours

| Contact Hours | Lecture | | Laboratory | |
|---|---|---|---|---|
| | Average Effort | Standard Deviation | Average Effort | Standard Deviation |
| 1 | 44.14 | 15.57 | 46.35 | 16.34 |
| 2 | 72.91 | 10.24 | 73.81 | 13.76 |
| 3 | 100 | --- | 100 | --- |
| 4 | 127.96 | 12.44 | 127.84 | 14.85 |
| 5 | 158.70 | 29.00 | 158.28 | 34.58 |



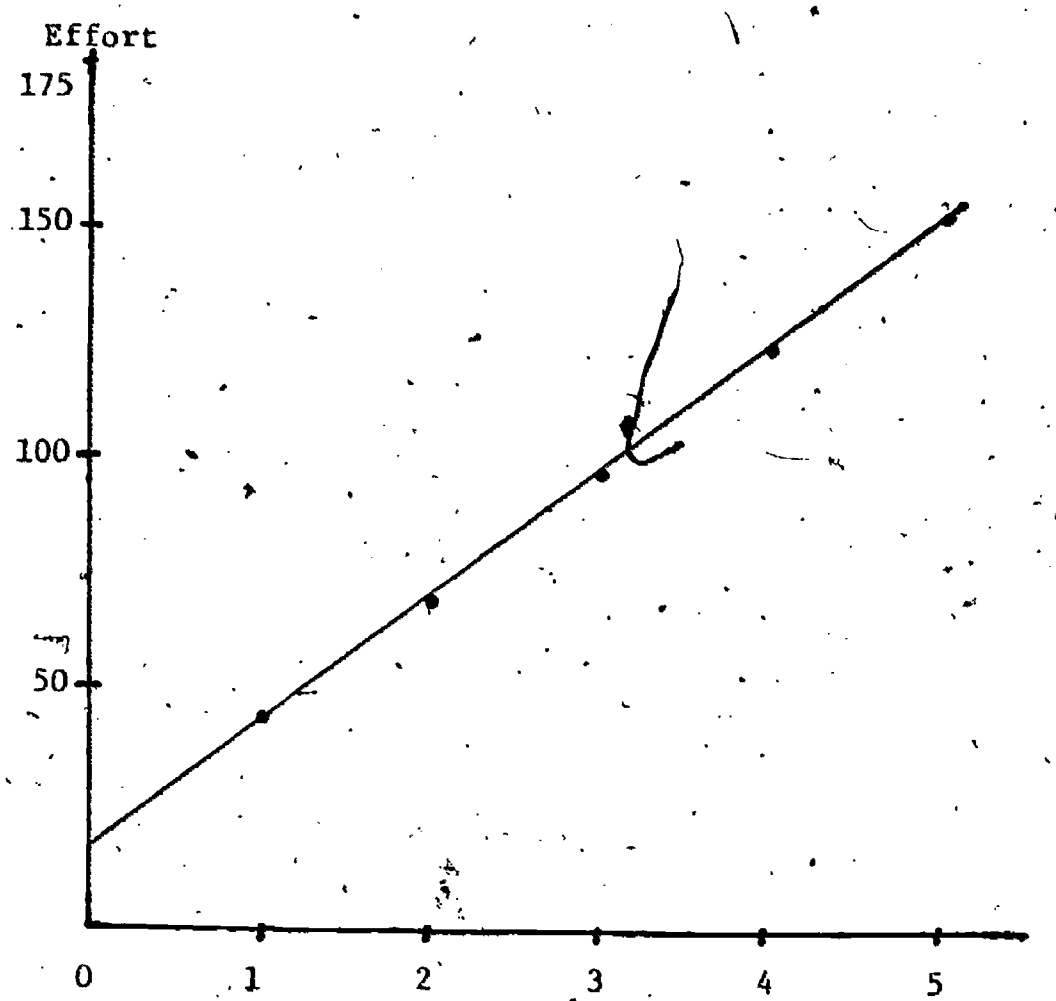




Figure 2

Effort Required to Teach Courses of Various Contact Hours

Validation Phase

The validation phase of this study provides an opportunity to test results from the department head study against data collected in another survey. In 1975, faculty members at a comprehensive southeastern state university responded to a state-wide faculty activity questionnaire which asked them to report the hours they spent on each class and on other activities during a census week which fell in the middle of a fall term. The survey instrument employed was a modified form of the Faculty Activity Analysis developed by NCHEMS (Romney and Manning, 1974).

In order to apply the model of effort as a function of class characteristics to information from the faculty activity analysis, the model was re-run using a combined level for graduate enrollment. This yielded a weight for graduate level of .382 compared to the full model of .329 for first-year and .445 for advanced graduate level classes. Other regression weights changed less than .001, and the $R^2$ for the reduced model was .461 versus .465 for the full model.

Considering each class taught as a separate observation, analyses were undertaken for linear, linear-log, and log-log variations in the relationship between time and effort. The log-log model proved to be the best ($\log_e$ time = -1.579 + .777 $\log_e$ effort, R = .531), although the other models had a reasonably close efficiency (R = .45). The inclusion of the variables, e.g., Biglan's categories of lecture versus laboratory, caused a statistically significant increase in the log-log model (R = .546); however, this finding is not considered to constitute a major difference when considering the fact that the .531 came from a validation process which did not take advantage of sampling error.

In order to take a closer look at the relationship between time and effort, classes were grouped by effort, and the mean time for each group

of classes was computed. These means along with values of the regression line for individual classes are shown in Figure 3. A strong relation exists until it becomes discontinuous at an effort of about 220, equivalent to a typical undergraduate lecture class of about 300 to 400 students. Based on current practices, it is probable that this discontinuity represents the use of graduate assistants, computer graded tests, and similar procedures which are employed to aid instructors in coping with large courses.

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(Figure 3 about here)

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The second validation of the department head's model resulted from comparing total time spent by faculty members as a function of total effort required for their classes. The equation which gave the best fit of total time to total effort was again in log-log:

$$\text{Log}_e \text{ (Total time)} = \text{Log}_e \text{ (Effort)} \times .758 - 1.246$$

$$(R = .738,\ p \leq .01)$$

The means of total time spent for various projected amounts of effort are shown in Figure 4 along with the points expected from the regression line. Again, as with the data using classes as the unit of observation, there is a noticeable discontinuity for the higher levels of effort.

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(Figure 4 about here)

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The third validation involved a comparison of the relative amount of time an individual spent on a class with the relative effort required to teach the class. In this test we wanted to avoid biasing the results

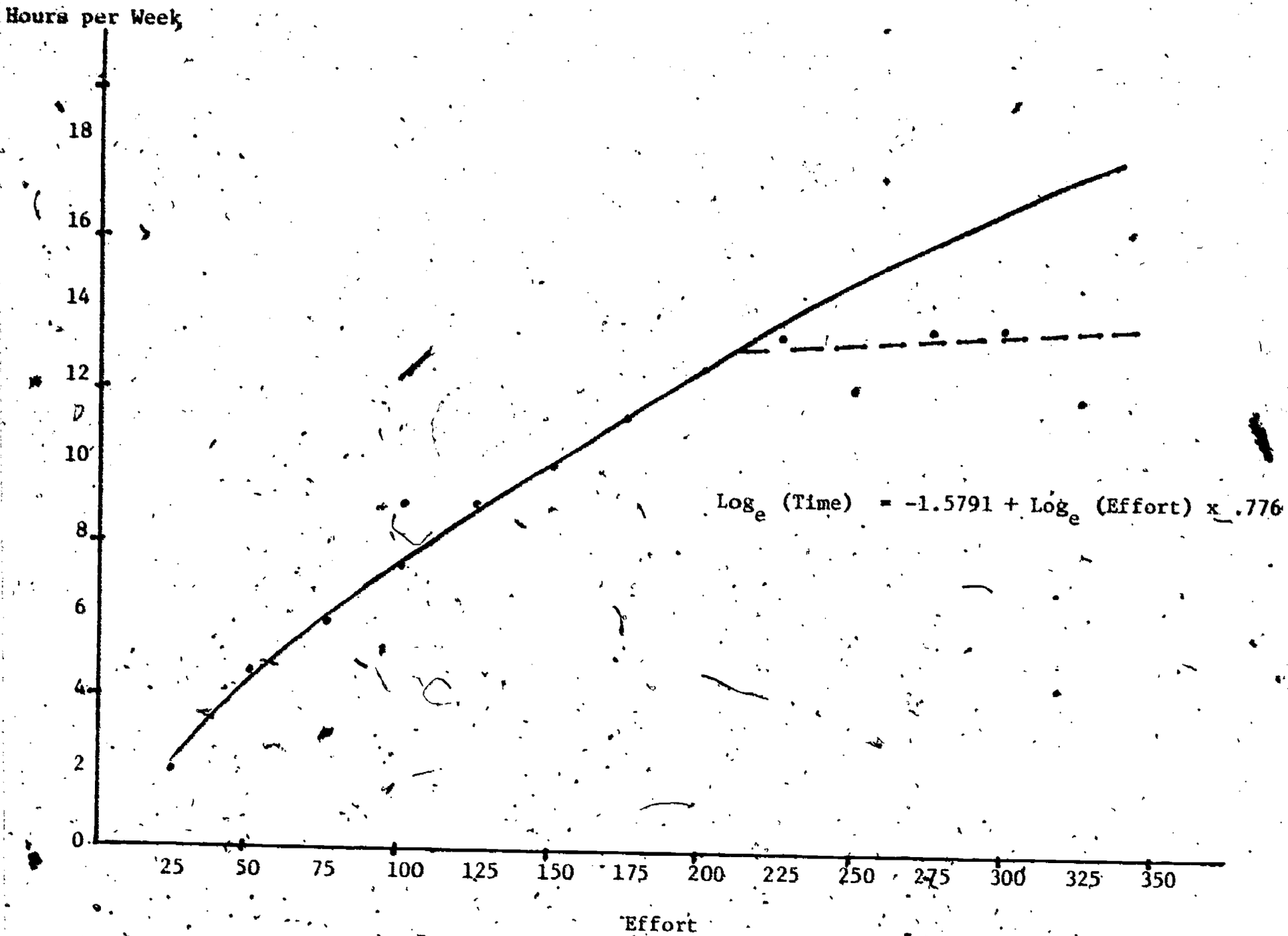


Figure 3

Mean Time as a Function of Effort for Classes Taught

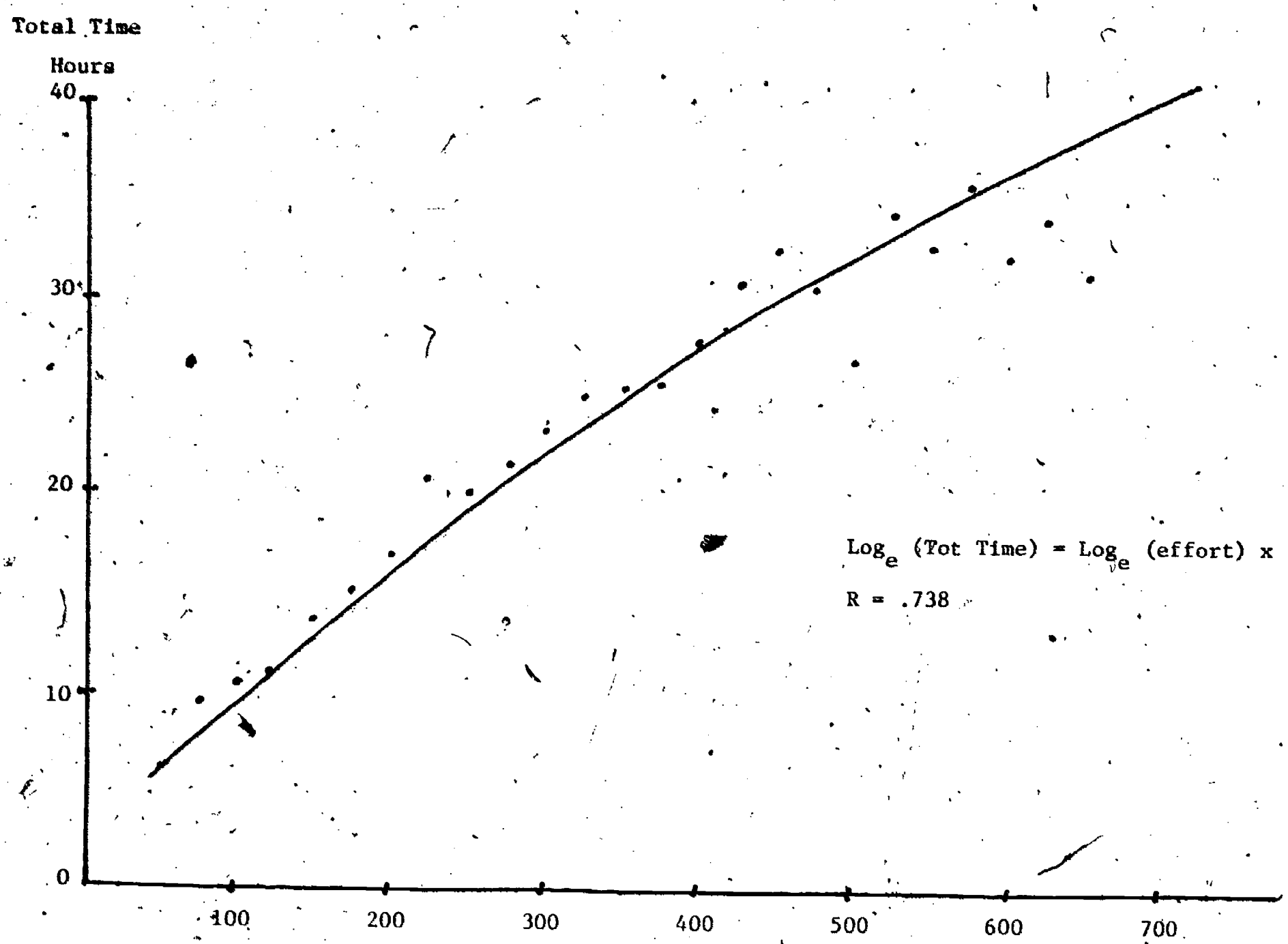


Figure 4

Mean of Total Time for Levels of Effort

by allowing time to be evenly divided since teachers with two classes might report about one-half of their time on each class and those with three would tend to report about one-third on each, etc. The validation, therefore, was tested on the difference from the amount expected if an individual were to spend the same amount of time on each class:

$$\text{Time deviation}_{ij} = \frac{\text{TIME}_{ij}}{\text{Total time}_i} - \frac{1}{\text{Number of Classes}_i}$$

$$\text{Effort deviation}_{ij} = \frac{\text{EFFORT}_{ij}}{\text{Total Effort}_i} - \frac{1}{\text{Number of Classes}_i}$$

for the jth class of the ith person.

Time deviation, when regressed on effort deviation, gave the following equation:

Time deviation = .755 Effort deviation ($R = .60$; $p < .001$)

The plots of this equation along with the mean time deviations for those at various levels of effort deviation are shown in Figure 5. A possible discontinuity exists as indicated by the dashed line where the faculty member has a "difference limen" (Guilford, 1954, p. 22) for classes of typical difficulty (-.05 to + .025 for effort deviation), but the findings thereafter react in a linear fashion as the class requires amounts of effort beyond those limits.

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(Figure 5 about here)

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## Discussion and Conclusions

This research has produced four major findings:

1. All of the variables postulated to make a difference in amount of effort required to teach a class do make a difference. These variables include Biglan's curricula groups, size of class, mode of instruction, and level of class.

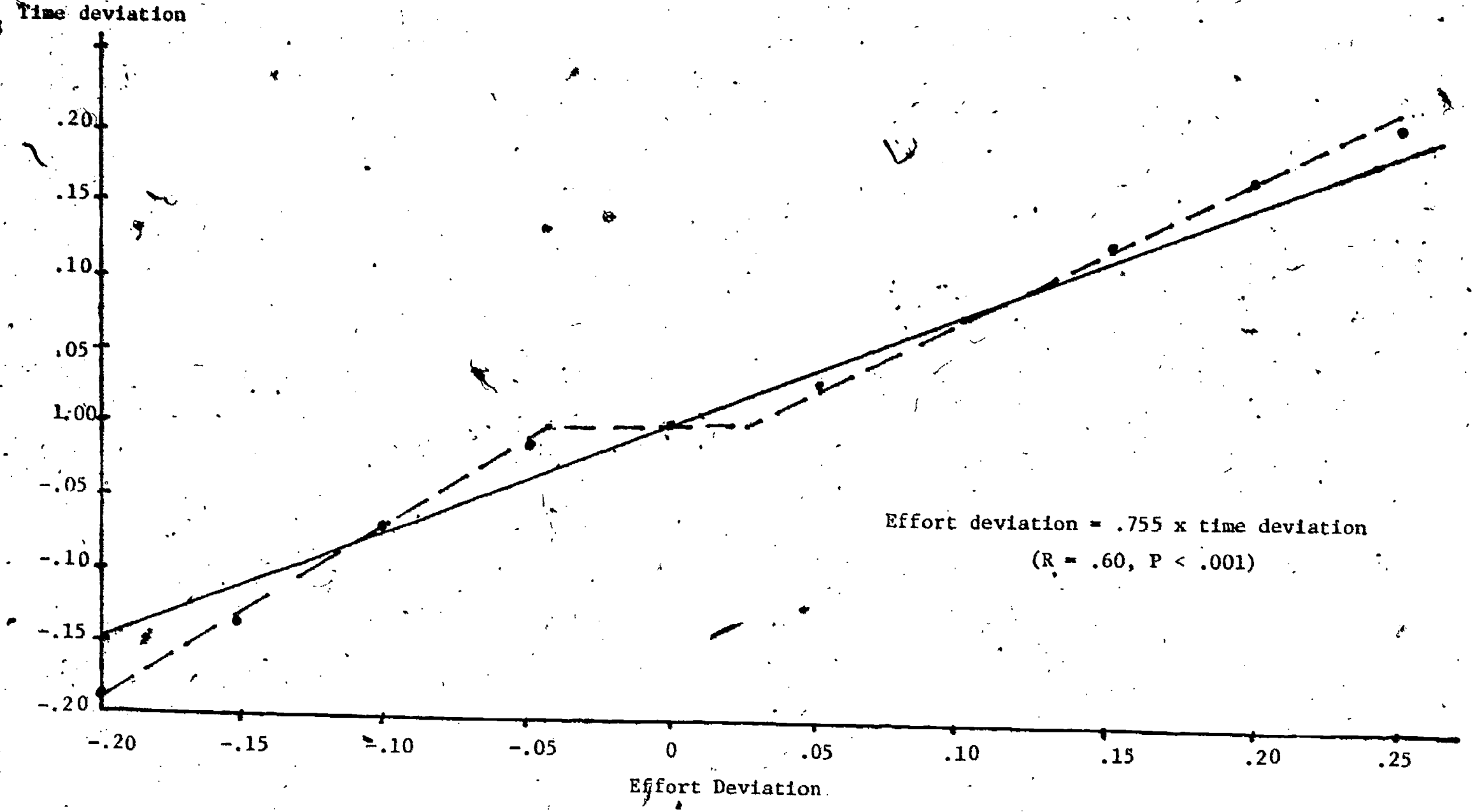


Figure 5

Mean of Time Deviation for Those at Various Levels of Effort Deviation

2. In the perceptions of the department heads, as enrollment increases, effort increases but at a decreasing rate. This is shown by the superiority of the log-log model.

3. As the anticipated effort to teach a class or a group of classes increases, the time spent increases but at a decreasing rate. This is shown in the superiority of the log-log model in the first and second validation analyses.

4. The relative time spent on a class by an individual with more than one class is proportional to the relative effort to teach the class. This is shown in the linearity of the relationship in Figure 5.

The selection of enrollment size is made to produce equal distances in logarithims, for it is assumed that if some amount of effort is required to teach one student then some additional effort is required for several students:

$$\Delta \text{ effort} = f\ (\Delta \text{ enrollment}/\text{enrollment})$$

If one further uses the general case of the Weber Law,

$$K = \Delta \text{ enrollment}/(\text{enrollment})^{n}$$

the result is that the response measure (effort) is a power function of the stimuli (enrollment) and the relationship between the two is linear in logarithims (Guilford, 1954, p. 41).

There is an implication in the scaling method (especially from the nonlinearity in logs of the ratings for laboratories) that the department heads responded not only to the external reference point (for example, a 25-person-lower-division lecture) but also to current practices in their departments. This concept, known as Adaptation Level (Guilford, 1954), leads to a model in which the judgment is influenced by (a) the standard class with an enrollment of 25, (b) the actual classes used in the

validation, and (c) the typical class (by mode of instruction and class level) as reported by department heads.

Further research should consider the feasibility of investigating factors which are peculiar to specific departments at given universities (for example, contextual stimuli) as suggested by Bolton (1965). This further investigation of contextual stimuli is particularly important if factors will reduce the time but not the effort spent on specific instructional assignments, or if these factors represent undesirable "traditions."

On the philosophical dimension, the use of effort avoids the negative connotations of "hours on the job" noted by Shay (1974) and seems to be similar to his concept of "'flexible units' that allow for differences in the various aspects of faculty work." While it does not directly measure quality of results, it is a good input measure against which to evaluate quality since it includes factors which may be a part of quality, for example, intensity, ability, and time.

The results on the relative time versus relative effort analysis support the belief by Stecklein (1968) that the proportion of activity is a viable alternative to total number of hours. In general, spending a larger proportion of time on an activity is directly and linearly related to the relative effort of that activity. Stecklein also appears to be correct in his belief that faculty have a good feel for the number of hours spent on an activity.

This present validation study does not relate effort in instruction to other major activities such as student services, professional development, research, or scholarship. The data also do not consider new preparations, number of preparations, independent study, student advising, or the use of graduate assistants.

The fourth finding, however, demonstrates the clear need to have a construct such as effort to measure the activity required to teach a class. Consider a faculty member assigned two classes who spends 21 hours per week on the two activities with 14 hours devoted to class A which requires twice as much effort as class B. But suddenly the professor's available time is reduced to 18 hours because of a committee assignment. The fourth finding implies the possibility of a readjustment of time to 12 hours to class A and 6 hours to class B. If one uses the measure of "hours per week" then an error term must be included since either class A takes 14 hours or 12 hours or some middle amount with both expenditures of time varying from the true amount by an error. The use of a model built on effort can expect either 12 or 14 hours based on the relative effort devoted to the classes and the total time available.

"Time spent" on activities is based on the complex interaction of the class, the faculty member, and the environment. In a professional process it is questionable whether it should be used in considering equity of assignment or appropriateness of staffing. "Effort required," on the other hand, is an intrinsic characteristic of a specific activity, which is performed through a mixture of time, ability, and intensity.

This research removes some but not all of the concerns stated in the NSF Report (1967) over the subjectivity and nonquantitative character of effort and helps to establish practical grounds for using the concept of effort as a basis for understanding and measuring the activities of academic faculty members. We have shown the potential for developing staffing models and ultimately funding formulas based on effort by demonstrating the consistency of judgment of a knowledgeable group of professionals.

## Appendix A

### Distribution of Respondents and Questionnaire Response

| Institution | Number of Questionnaires Mailed | Number of Questionnaires Returned | Percent Return |
|---|---|---|---|
| University of Arizona | 70 | 24 | 34.3 |
| University of Arkansas | 51 | 21 | 41.2 |
| Auburn University | 45 | 20 | 44.4 |
| Clemson University | 41 | 22 | 53.7 |
| University of Connecticut | 46 | 13 | 28.3 |
| Cornell University | 48 | 14 | 29.2 |
| Florida State University | 34 | 12 | 35.3 |
| University of Florida | 72 | 24 | 33.3 |
| University of Georgia | 57 | 28 | 49.1 |
| Iowa State University | 53 | 20 | 37.7 |
| University of Iowa | 54 | 20 | 37.0 |
| University of Kansas | 52 | 16 | 30.8 |
| University of Kentucky | 53 | 29 | 54.7 |
| Louisiana State University | 49 | 22 | 44.9 |
| Michigan State University | 69 | 29 | 42.0 |
| University of Minnesota | 65 | 17 | 26.2 |
| North Carolina State University | 47 | 25 | 53.2 |
| University of North Carolina | 44 | 13 | 29.5 |
| Pennsylvania State University | 71 | 10 | 14.1 |
| Purdue University | 49 | 16 | 32.7 |
| University of Tennessee | 50 | 22 | 44.0 |
| Texas A & M University | 56 | 17 | 30.4 |
| University of Texas | 50 | 19 | 38.0 |
| University of Vermont | 40 | 16 | 40.0 |
| West Virginia University | 48 | 20 | 41.7 |
| Total | 1314 | 489* | 37.2 |

*Two additional respondents did not identify their institutions.

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