# THE COMPREHENSIBILITY OF A NEW ZEALAND UNIVERSITY CALENDAR (WITH VARIATIONS IN LENGTH)

## RICHARD KAMMANN and ROBYN IRWIN

*University of Otago*

A study was made of the open-book comprehensibility of a New Zealand university calendar by 7th-form high school students presented with 24 representative test problems. In addition, the length of the calendar was varied through six levels in a geometric progression from 1.5 to 530 pages.

The results showed that comprehension of the full calendar by high school students was 56 percent correct. The two areas of the calendar causing the greatest difficulty were the sections on bursaries and allowances (26.7 percent correct) and on Faculty Prescriptions for purposes of planning a course of study (41.5 percent).

Variations in length revealed small but systematic gains in accuracy and speed as calendar length was reduced but it is suggested in discussion that reduction in length may not be as powerful as the use of logical or flowchart formats for the more difficult sections.

The purpose of the present study is to report some applied results of interest to New Zealand psychologists (and to University officials) in respect to the comprehensibility of a typical New Zealand university calendar, and in particular the comprehensibility of different sections of the calendar.

However, since the original purpose of the study was to establish descriptively the relationship between the length of a set of instructions and their comprehensibility, the more applied results cannot be reported properly without also considering the method and results of the length variable investigation. While the length effect might have been studied with any of a large variety of real or concocted instructions, a university calendar was chosen specifically to obtain some locally useful, applied, spin-off data.

Another design decision was the choice of seventh form high school students as the subjects for the experiment. While it is obvious that a university calendar is not written primarily for this class of readers, it is also true that these readers have little prior knowledge of the rules and operations of a university, although many or most of them will start acquiring this knowledge over their next few years. In that sense, seventh form high school students represent the class of "new people" moving into a particular university environment, and thus provide the best or strictest test of the communication effectiveness of the words printed in the calendar, whereas experienced students and staff members will have acquired considerable extra knowledge by word-of-mouth and trial-and-error.

Since comprehension was tested by the open-book method, by-passing the need for reliance on memory, it might be expected that comprehension for the full-length calendar should be very high, perhaps over 90 percent. However, it has been previously suggested (Kammann, 1975) that the true expected level of open-book comprehension of prose instructions is in the range of 60-75 percent. Since this "two-thirds rule" of reading comprehension was based upon open book studies with representative (or better) samples of intended readers, and since the present study is concerned only with new readers, the expected level in this case should be even lower than the empirical prediction of the two-thirds rule.

## METHOD

### Subjects

The subjects were 115 seventh-form students in Dunedin contacted through six different high schools. Some were strictly volunteers while others were more or less "captured" by headmasters or teachers either in or out of classes.

### Instructional Materials

The instructional text chosen for study was the *University of Otago Calendar,* 1973 edition, which was the *Calendar* currently available when preparation of the different text lengths began in November, 1973.

The full length *Calendar,* unmodified, was used to define the 530-page length condition. Subsequently five shorter lengths were developed from the full *Calendar.* This was accomplished by random deletions of short subsections of the *Calendar* at each successive level of shortening. Two constraints were placed on the random deletion: first, that all material necessary to answer the test questions was preserved through each shortening, and second, that each shortened version had a sensible coherence and organization. Thus, if some of the prescriptions for taking a medical degree were included at a given length level, then the staff listings therein included some staff of some of the medical departments and the list of current publications also contained some of the publications from the same staff members, etc.

Each shortening reduced the length of the *Calendar* to approximately 40 percent of the length of the preceding level, except for the shortest length of 1.5 pages. This shortest length level was achieved by using

the 12-page length (i.e. the shortest version which provided reasonably coherent coverage of the test-relevant material) with the additional provision that at the end of each *test problem* the subject was given the page number or numbers in the 12-page booklet which contained the answer. The *Calendar* lengths which resulted from those procedures were 1.5, 12, 28, 76, 211, and 530 pages.

The type faces and wording used in all shorter versions were identical to those in the 530 page version, and the five shorter versions were bound in plastic ring binders.

## The Test Items

Before any shortening of the *Calendar* occurred, two academically superior third-year psychology students went through the *Calendar* and generated a pool of test questions which covered the range of information available in the *Calendar* which might be of some use or interest to University students. The two students were instructed to avoid constructing particularly complex or tricky problems. After editorial selection and re-wording for clarity, this procedure yielded 24 test items. These were subsequently divided into three matched sets of eight questions each, so that any subject would normally be able to get through the experiment in much less than one hour. The three sets were "matched" in the sense that each included three simple short-answer items, two short answer course-planning problems, two long-answer course-planning problems, and one problem on bursary allowances. One of the sets of eight questions was as follows:

1. When does the second term of the University begin?
2. What are the central library hours during the August vacation?
3. How many people can Carrington Hall of Residence accommodate?
4. How many years of study is required for a Bachelor of Home Science?
5. What are the compulsory subjects for the third year in a Diploma of Physical Education?
6. What professional subjects are you required to do, after completing a Bachelor of Laws Degree or a Degree of Bachelor of Laws with Honours, before being admitted as a Barrister and Solicitor of the Supreme Court?
7. During your school years you obtained "High School Certificate". In your first year at University, your results were as follows:

|  |  | your results |
|---|---|---|
| Biology | | fail |
| Chemistry | | fail |
| Physics | | pass |

In your second year your results were:

|  |  |  |
|---|---|---|
| Chemistry Intermediate | | B pass |
| Biology Intermediate | | B pass |
| Physics Advanced I | | C pass |

According to the Bursary Regulations, what money are you entitled to apply for in your coming year of study, i.e. your third year?

8. You are going to be a third year student doing a Bachelor of Commerce in Management Studies. Below is the outline for the course you have already completed in your first two years.

| | | your results |
|---|---|---|
| Year I: | Management I | pass |
| | Accounting I | pass |
| | Economics I | pass |
| | Intermediate marketing | pass |
| Year II: | Management II | pass |
| | English | pass |
| | History | fail |

Design the course of study for the completion of your degree in the minimum time possible. You may assume in your answer that you pass all your units each year and that there are no timetable clashes amongst the units you select.

The effect of having the three sets of test problems was that it was necessary to have three different and corresponding versions of the *Calendar* at length levels 1.5, 12, and 28 pages, whereas only one version of the *Calendar* was needed at levels 76, 211, and 530 pages.

## Procedure

Subjects were tested in groups ranging in size from three or four up to about 75 in one instance. Subjects were assigned randomly without replacement to one of the six length levels and one of the three sets of the test problems.

The students first read the directions for the experiment which instructed them to take the problems in the order given with the attitude that it was more important to get the correct answer than to be fast. They were also instructed to copy down the time-card number shown in the front of the room by the experimenter as they finished each problem. The number showing on the time cards was incremented by one every 30 seconds after the experiment began. All students started on the test at the same time with the first time-card showing zero (0).

It has been previously shown by Kammann (1973) that this paper and pencil testing procedure yields an excellent correspondence in results with a procedure in which subjects are tested individually and are forced to go through an actual task simulation (telephone dialing) rather than providing written answers.

## Scoring

In those cases in which more than one correct answer was possible, all varieties of the correct answer were scored as correct.

# RESULTS

## Comprehension as a Function of Length

The results in terms of the percent correct over all 24 questions at each length level are shown in Figures 1 and 2 for accuracy and total test time, respectively.

In terms of *accuracy* mean percent comprehension rises in a continuous function from 56 percent in the 530-page condition up to 71 percent for the 1.5-page condition. Applying Duncan's range test the conditions below which share a common underline have *not* been demonstrated to be significantly different at the .05 level. Although the data points follow a smooth monotonic progression, the differences tend not to be significant among the shorter length versions.

|  1.5  |  12  |  28  |  76  |  211  |  530  |

A corresponding pattern emerges for the mean times as shown in Figure 2 which decline from 31.3 min in the 1.5 page condition, yielding an overall savings of 40 percent in time between the longest and shortest conditions. The Duncan's range test reveals that the significant differences (at the .05 level) are greater in the middle and shorter length levels while the three longest lengths are not significantly different from each other.

|  1.5  |  12  |  28  |  76  |  211  |  530  |

If both accuracy and time are taken to be conceptually overlapping indices of the convenience, effectiveness, or utility of the instructions, a combined index showing the number of problems (out of eight per subject) solved correctly per minute yields the values of .30, .25, .22, .19, .15, and .14 for the successive conditions from 1.5-page to 530-pages. While this utility index is rather arbitrary, it indicates a more pronounced performance benefit from shortening than does the accuracy or the time curve taken separately.

## The Comprehension of the Calendar

The 56 percent correct comprehension of the 530-page version of the *Calendar* is below the level predicted by the two-thirds comprehension rule (i.e. 60-75 percent). However, this result was to be expected since the two-thirds rule is based upon *representative* samples of the
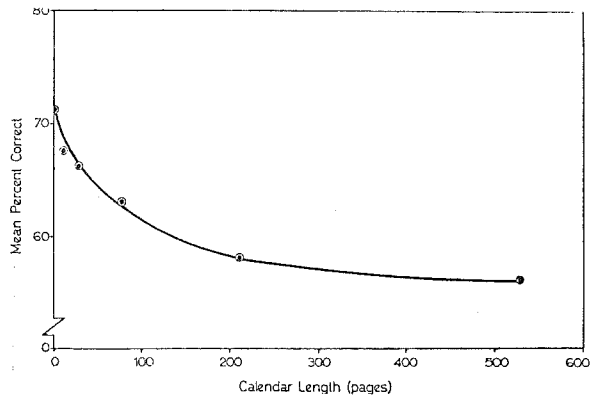
Figure 1. Mean percent correct across 5 Calendar length levels.

intended readership and not only on "new people". Nevertheless, the result suggests that under the optimum condition of an open-book comprehension procedure, the new reader is only slightly more likely to obtain the correct answer than to obtain an incorrect one.

In order to diagnose which sections of the *Calendar* are producing the greatest sources of error in comprehension, the results were analyzed separately for each of the 24 problems.

From this it appeared that the items fell into four clusters corresponding with different sections of the *Calendar*, with results as shown in Table 1. The results for each problem are based upon all six length

TABLE 1

Accuracy and speed of comprehension for four clusters of test problems

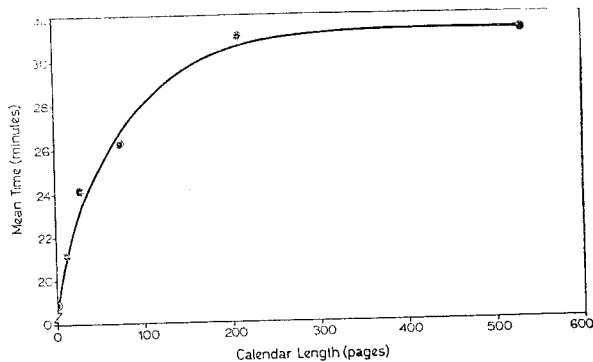| Calendar Section | No. of problems | Percent correct | | Time per problem (min) | |
|---|---|---|---|---|---|
| | | Range | Mean | Range | Mean |
| I Bursary Section | 3 | 11-37 | 26.7 | 3.5-5-3 | 4.3 |
| II Course planning (Long-answers) | 6 | 07-79 | 41.5 | 2.3-8.7 | 5.6 |
| III Course planning (Short-answers) | 6 | 63-87 | 74.8 | 1.6-4.0 | 2.6 |
| IV All other | 9 | 72-100 | 93.3 | 0.8-3.6 | 1.6 |

Figure 2. Mean time (min) to solve 8 problems across 5 Calendar length levels.

versions of the *Calendar* and therefore underestimate the absolute difficulty in terms of time and accuracy of the full 530- page *Calendar* alone.

From these results it is clear that the section on bursaries is the most incomprehensible part of the *Calendar* with a mean of 26.7 percent correct even with the shortened versions of the *Calendar* included, which necessarily included shortened versions of the bursary section.

The next most difficult section of the *Calendar* is the Faculty Prescriptions when used for planning a course of studies (e.g. items 6 and 8 in the Method section). Not only is comprehension below 50 percent, but the times taken on each problem are longer than those for the bursary problems.

That this course section is especially difficult is illustrated by the third cluster of items which used the same section of the *Calendar* but only for short-answer problems (i.e. items 4 and 5 in the Method section), still yielding only 74.8 percent correct.

These short-answer course items contrast with the nine other short-answer problems based on other sections of the *Calendar* (i.e. problems 1-3 in the Method section), where accuracy was relatively high (93.7 percent) and problem solving times were very low.

62

# DISCUSSION

The evidence from the 530-page condition of the experiment indicates that the material in the *University of Otago Calendar* can be correctly interpreted by new readers about 56 percent of the time across 24 widely varied test questions representing information that a student or staff member might reasonably wish to know. Furthermore, the new reader requires on average over one-half hour to answer eight questions, seven of which require concise and specific pieces of information. As most of the other available New Zealand University Calendars appear to be similarly structured and worded, the best assumption until proved otherwise is that they would yield similar results.

An analysis of the specific test problems indicates that the two sections which create the most difficulty in comprehension are the section on bursaries and allowances, and the section on course planning (i.e. the various faculty prescriptions). In these areas comprehension is in the range of 20-40 percent if only the 530-page version of the *Calendar* is considered. It is very likely that these are the two sections which are of greatest significance to the students.

It should be noted that the present results must inevitably underestimate the information loss from printed word to student decision, as the open-book comprehension procedure does not take into account losses due to forgetting or losses due to voluntary avoidance of the *Calendar* as a source of information.

The length variable has a significant negative effect on comprehensibility. The effect is very small for comprehension accuracy and can be described by the rule of thumb that every halving of the length of instructions will produce a gain of about 2.2 percent in comprehension accuracy.

The gain in terms of time saved is more substantial but still fairly small. The rule of thumb for time is that halving the instructions will produce a savings of about 6.3 percent of the study time required before halving. (These incremental gain values actually vary with the starting length. For example, time percentage savings reach a maximum of about 10 percent if the instructions to be halved are in the range of 30-60 pages, whereas the gain falls well below the mean of 6.3 percent for halving very long or very short instructions.)

Thus, reduction in length is not sufficient to achieve an important gain in comprehension accuracy and speed unless the reduction is very great. This might be the case if the *calendar* could be successfully divided into booklets averaging about 30-40 pages long which would yield a 10 percent gain in comprehension accuracy and a 23 percent savings in problem-solving times. Taken together these two indices suggest an increased utility and an increased likelihood that the separate Calendar booklets would be used as a source of information.

A much more promising approach derives from demonstrations by Kammann (1975) and Wright and Reid (1973) among others that an algorithmic or flowchart approach to instructional writing and formats can produce very substantial gains in comprehension accuracy in comparison with standard prose formats.

It would seem to be particularly desirable to consider such alternative formats in respect to the bursary and course planning sections of the *Calendar*.

In the end, the upper limit of success for any editorial approach to presenting information is the complexity and diversity of the rules and regulations which must be described. Perhaps the real significance of the low comprehensibility of the *Calendar* is its suggestion of a fairly complicated bureaucracy which requires 530 pages to describe (unsuccessfully).

## REFERENCES

Kammann, R. The comprehensibility of printed instructions and the flowchart alternative. *Human Factors,* 1975, 17, 183-191.

Kammann, R. A new flowchart and a test of paper and pencil methodology in instructional research. Holmdel, New Jersey, 07735, USA: Bell Telephone Laboratories, Technical Memorandum MM-73-3435-1, 1973.

Wright, Patricia and Reid, F. Written information: some alternatives to prose for expressing the outcomes of complex contingencies. *Journal of Applied Psychology,* 1973, 57 ,160-166.