Essays for the Graduate Management Admissions Test must be written with a word processor (except in some foreign countries). The test sponsors, the Graduate Management Admissions Council, believed that this is fair because some word processing skill is a prerequisite for advanced management education. Furthermore, it might also be unfair to require students who routinely use word processors to shift to paper and pencil just for a testing situation. The current study addressed the comparability of scores from handwritten and word-processed essays using a sample of 3,470 examinees who had written essays in both formats. Both the computer and paper-and-pencil versions contained two 30-minute essay questions, one asking for an analysis of an issue and the other analyzing the reasoning of a presented argument. Results indicate that scores were higher on the handwritten essays than on the word-processed essays, and that this difference did not interact with gender, ethnic, or English-as-a-Second-Language group classifications. Differences between scores for handwritten and word-processed essays were smallest for the most experienced computer users, but even examinees who reported using a word processor more than two times a week had higher scores on their handwritten essays than on their word-processed essays. Other findings indicated that reader reliability was higher for the word-processed essays, and that in either format there were substantial practice effects, with the scores on the second essay about 0.4 standard deviation units higher than scores on the first essay. (Author/SLD)
Comparability of Scores on Word-Processed and Handwritten Essays on the Graduate Management Admissions Test

Brent Bridgeman and Peter Cooper

Educational Testing Service, Princeton, NJ
Abstract

Essays for the Graduate Management Admissions Test must be written with a word processor (except by examinees in some foreign countries that do not have access to computer testing centers). Although forcing all students to use a word-processor may seem to be unfair, the test sponsors, the Graduate Management Admissions Council, believed that some word-processing skill was a reasonable prerequisite for advanced management education. Furthermore, it might be equally unfair to require students who routinely use word processors to shift to paper and pencil just for a testing situation. The current study addressed the question of the comparability of scores from handwritten and word-processed essays using a sample of 3470 examinees who had written essays in both formats. Both the computer and paper-and-pencil versions contained two 30-minute essay questions, one of the two essay questions in each version required the student to write an analysis of an issue and the other question gave an argument and asked the student to write an essay analyzing the reasoning of this argument.

Results indicated that scores were higher on the handwritten essays than on the word-processed essays, and that this difference did not interact with gender, ethnic, or English as a Second Language group classifications. Differences between scores for handwritten and word-processed essays were smallest for the most experienced computer users, but even examinees who reported using a word processor more than two times a week had higher scores on their handwritten essays than on their word-processed essays. Other findings indicated that reader reliability was higher for the word-processed essays, and that in either format there were substantial practice effects, with scores on the second essay about .4 SD units higher than scores on the first essay.
Comparability of Scores on Word-Processed
and Handwritten Essays on the Graduate Management
Admissions Test

The use of word processors is ubiquitous on college campuses. Many students have come
to rely on word processors for their college writing assignments. Thus, it would seem to be
reasonable to assess the writing skills of college students with essays that were produced on word
processors. Indeed, as of October, 1997, the essays for the Graduate Management Admissions
Test must be written with a word processor at a computerized testing center (except for
examinees in some foreign countries that do not have access to computer testing centers).
Although it is assumed that candidates for graduate management programs should have some
word-processing skills, some fairness concerns with this requirement remain. Although forcing all
students to use a word-processor may seem unfair, it might be equally unfair to require students
who routinely use word processors to shift to paper and pencil just for a testing situation.

A comprehensive review of the effects of word processors on the quality of students’
writing has shown mixed results (Cochran-Smith, 1991). Many of the studies reviewed focus on
the role of the word processor in helping students make revisions over several drafts and may not
generalize to a testing situation in which only 30 minutes are allowed from first reading of the
question to final essay. Furthermore, findings from students in elementary and secondary schools
who have relatively little word-processing experience may not generalize to experienced word-
processor users in college. A study of college students found that scores assigned to word-
processed essays were fairly comparable to scores assigned to handwritten essays produced by the
same students (Powers, Fowles, Farnum, & Ramsey, 1992), with a slight advantage in producing
essays on the computer offset by a tendency to grade handwritten essays more leniently. The
sample of students in the Powers et al. study was very small (32), so separate analyses by
subgroups were not feasible. The current study was designed to assess the comparability of word-
processed and handwritten GMAT essays for different gender, ethnic, and language fluency
groups, and for examinees with differing amounts of word-processing experience.

Methods and Data Source

A random sample of students who registered to take the regular paper-and-pencil
administration of the GMAT in October 1996 were invited to also take the new computerized
version of the GMAT in October, including using the computer to word process the essays. A
random half of the sample was invited to take the computerized test first with the other half taking
the paper-and-pencil version first. The computerized test was free, and volunteers were told that
their scores on the computer test would replace the scores on the paper-and-pencil test if and only
if they were higher. Thus, students had nothing to lose, and possibly higher scores to gain, by
taking the computerized version. Students identified their level of word processing experience on
a posttest questionnaire. Categories on frequency of word-processor use ranged on a five point
scale from never to more than two times per week.
Both the computer and paper-and-pencil versions contained two 30-minute essay questions, one of the two essay questions in each version required the student to write an analysis of an issue and the other question gave an argument and asked the student to write an essay analyzing this argument. For the computer-delivered tests, there were 12 issue topics and 12 argument topics. The computer randomly selected one topic of each type for each person. Order was counterbalanced such that an issue essay was first for half of the sample and an argument essay was first for the other half. For the handwritten essays that were part of the regular GMAT October administration, there was only one argument topic; there were two issue topics (one for the Americas and one for the rest of the world). All students responded to the argument topic first.

All essays were read by two readers with a third reader used if the scores differed by more than one point. Each reader assigned a score of 1 to 6 on a holistic scale. The scores from the readers were averaged. Readers for the word-processed essays were a subset of the readers for the handwritten essays.

**Results**

Usable data were obtained from 3470 examinees who completed the test in both formats. Samples were smaller for some analyses; for example, only U.S. citizens are asked to provide ethnic group and some groups (e.g., American Indians) did not have sufficient numbers to be analyzed separately, resulting in a sample of 2453 examinees in four major ethnic groupings (African American, Asian American, Hispanic, and White). A separate analysis, that included non-U.S. citizens, compared the 2337 examinees whose best language was English with the 775 examinees who were most fluent in a language other than English.

Scores from both topics in the paper-and-pencil mode were added to make a handwritten essay total, and a word-processed essay total was similarly constructed. The word-processed essay total was subtracted from the handwritten essay total to form a difference score with positive values indicating higher scores on the handwritten essay. As shown in Table 1, values for all subgroups were positive, with relatively little variation among gender and ethnic subgroups. A 2 (genders) x 3 (ethnic groups) by 5 (levels of word-processing experience) ANOVA indicated a significant effect ($p = .04$) only for word-processing experience. A similar analysis contrasting the 775 examinees who were most fluent in a language other than English with the 2337 fluent English speakers produced similar nonsignificant results for fluency but a significant experience effect.

Rater reliability was estimated from the correlation between the two raters adjusted by the Spearman-Brown formula. Rater reliability was the same for issue essays and for analysis of an argument essays, but it was higher for the word-processed essays than for handwritten essays (.87 versus .80). This probably reflects the greater standardization in the word-processed essays in which raters cannot attend to differences in handwriting or overall neatness. Apparently because of this higher reliability, scores on the word-processed essays were more highly correlated with scores on the verbal scale than were scores from the handwritten essays (.60 versus .54).
There were significant practice effects both across formats and within the word-processed format. For examinees who took the computer test first, scores were .43 points higher on the handwritten tests (SD = .72), and for students who took the handwritten test first, scores were only .16 higher on the handwritten test (SD = .69). Assuming that practice effects were constant across modes, these numbers are consistent with a practice effect of .13 points and a mode effect of .29 points. As indicated in Table 2, for the word-processed essays, there was a substantial gain from the first topic to the second, regardless of which topic type was first. For the handwritten essays there was also a substantial gain; mean on the argument essay (which was always first in the handwritten administration) was 3.84 (SD = .96) and the mean on the issue essay was 4.19 (SD = .95), for a gain of .35 points on the 1 to 6 scale.

Educational Importance

Moving from handwritten to word-processed essay assessments would appear to have positive benefits in terms of enhanced reliability. Furthermore, this switch would not appear to disadvantage gender, ethnic, or language minority subgroups relative to handwritten assessments. However, caution is needed because of the high level of word-processing experience in this sample of examinees bound for graduate management training, and the indication that students with less experience may have relatively more difficulty with word-processed essays. The data on practice effects suggest that students would be well advised to practice writing essays on a word processor, with GMAT-type topics and timing conditions, before attempting to take the actual examination.
References


Table 1

Paper Essay Total Score Minus Computer Essay Total Score by Gender, Ethnicity, and Word Processing Experience Level

<table>
<thead>
<tr>
<th>Demographic Group</th>
<th>WP Experience</th>
<th>Statistic</th>
<th>M</th>
<th>F</th>
<th>M</th>
<th>F</th>
<th>M</th>
<th>F</th>
<th>M</th>
<th>F</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Asian</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>American</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>African</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>American</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hispanic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>White</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: --Word-processing experience levels: 1 = never; 2 = <once a month; 3 = between once a week and once a month; 4 = 1 or 2 times a week; 5 = more than 2 times a week.
Table 2
Gain from First to Second Word-Processed Essay

<table>
<thead>
<tr>
<th>Topic and Order</th>
<th>Mean</th>
<th>SD</th>
<th>Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argument First</td>
<td>3.46</td>
<td>1.06</td>
<td>.45</td>
</tr>
<tr>
<td>Issue Second</td>
<td>3.91</td>
<td>1.06</td>
<td></td>
</tr>
<tr>
<td>Issue First</td>
<td>3.59</td>
<td>1.06</td>
<td>.30</td>
</tr>
<tr>
<td>Argument Second</td>
<td>3.89</td>
<td>1.07</td>
<td></td>
</tr>
</tbody>
</table>
Title: Comparability of Scores on Word-Processed and Handwritten Essays on the Graduate Management Admissions Test

Author(s): Brent Bridgeman and Peter Cooper

Publication Date: April, 1998

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.

Signature: Brent Bridgeman
Organization/Address: ETS Princeton NJ 08540

Date: 4/28/98
### 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.)

<table>
<thead>
<tr>
<th>Publisher/Distributor:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Address:</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Price:</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

### 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:

<table>
<thead>
<tr>
<th>Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Address:</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

### V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

**THE UNIVERSITY OF MARYLAND**
**ERIC CLEARINGHOUSE ON ASSESSMENT AND EVALUATION**
**1129 SHRIVER LAB, CAMPUS DRIVE**
**COLLEGE PARK, MD 20742-5701**
**Attn: Acquisitions**

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

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