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How Do High-Achieving Students Approach Web-Based, Copy and Paste Note Taking?

Selective Pasting and Related Learning Outcomes

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Imagine that you are a high school teacher. Having reserved time in your school's media lab, you instruct your students to use the Internet to find and gather information—to take notes—on certain topics for a course project. How might your students choose to take these notes? Recent research suggests students are likely to use the copy and paste (CP) function of a computer when they take notes from the Internet (Igo, Bruning, McCrudden, & Kauffman, 2003; Igo, Bruning, Riccomini, & Pope, 2006). However, few empirical studies have directly addressed CP note taking. Essentially, CP note taking has two phases: the *selection* of information and then the *creation of a record*. As such, related research addressing text underlining and paper-and-pencil note taking seems relevant and helps conceptualize CP note taking.

CP note taking is related to text underlining: In each process, information deemed important is selected and offset from

Previous research has indicated that most students copy and paste notes from Internet sources in a mindless way; they typically paste large sections of text into their notes and then later can recall little of what they have stored. However, supplying students with a note-taking framework that restricts the amount of text that may be pasted can prompt them to engage in more selective pasting, and this seems to result in greater learning. But the extant research has not specifically addressed copy and paste note-taking behaviors of high-achieving students. The high-achieving high school and college students in the present study used a note-taking tool on the computer that consisted of an electronic matrix to cue students to note certain types of information. In one condition, the number of words that could be included in each cell was restricted, whereas in the other group, the students' cells were unrestricted. After the note-taking sessions, all students completed assessments to document the amount of information they learned. High-achieving students in both conditions learned the same amount through the note-taking process. These results were inconsistent with the previous research. Follow-up analyses of students' notes indicated that although the high-achieving students in the unrestricted note-taking group were not limited in the number of words they copied, many of them selectively chose which information they pasted into the grid. The relationship between text-pasting selectivity and learning remained: High-achieving students were more selective in their note taking, and they also were more successful on the posttests.

summary

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the main text. But, CP differs from underlining because copied and pasted information is moved into, and stored in, another word processing document, whereas underlines are stored in the original text. CP note taking also is related to paper-and-pencil note taking because students may use either process to create a record of information from a text source. Although some paper-and-pencil notes create this record in the margins of books or articles and other paper-and-pencil notes are made on paper separate from the original text, material that is copied and pasted is always moved into a new document where it is available for further study. In sum, although the text-transformative nature of CP note taking distinguishes it from both underlining and paper-and-pencil note taking (i.e., the resulting product is always a new document), underlining, note taking, and CP clearly are related text activities.

For the purposes of this study, an important characteristic shared by underlining, note taking, and CP is a possible *encoding function* (Divesta & Gray, 1973; Igo, Bruning, & McCrudden, 2005; Lorch & Lorch, 1995). This refers to the amount of learning that results from the performance of those activities, alone, without further study of notes or underlined text. Apparently, different kinds of note taking, underlining, and CP techniques affect encoding differently (Slotte & Lonka, 1999). For instance, underlining and note-taking research shows that students encode (or learn) more ideas from text when they follow instructions intended to deepen their mental processes, such as main idea identification, paraphrasing, or summary instruction (Blanchard, 1985; Hidi & Anderson, 1986; Mayer, 2002; McAndrew, 1983; Rinehart & Thomas, 1993).

Similarly, when instructions restrict how much and what students can underline per paragraph—be it main ideas, memorable sentences, or the most important sentences—they presumably are more evaluative in what they mark, and they remember more of what they read (Johnson, 1988). Without such instructions, students tend to rely on default underlining and note-taking strategies that require little depth of processing and yield minimal encoding, such as underlining vast amounts of text or taking verbatim notes (Friend, 2001; Loranger, 1994; Pressley & Woloshyn, 1995; Rinehart, Stahl, & Erickson, 1986; Slotte & Lonka, 1999). In short, the key to encoding information while underlining and note taking seems to be for students to engage in deep levels of processing (Craik & Lockhart, 1972).

Might this same learning effect result from different kinds of CP note taking? Perhaps. Based on the research cited and CP's relationship to both underlining and note-taking, Igo et al. (2005) predicted that students would encode more ideas during CP note taking if an intervention prompted them to evaluate text ideas more deeply while they created CP notes. College students were assigned to one of two note-taking conditions: unrestricted and restricted CP. In the unrestricted condition, students were permitted to paste unlimited amounts of text into a cued word-processing chart as they read and noted Web-based text. In the restricted condition, students were obliged to paste only seven words or fewer into each cell. Results from learning outcomes showed that restricted pasters encoded more facts, concepts, and relationships from Web-based text than unrestricted pasters. To date, however, only one study has tested the depth of processing hypothesis related to CP restriction. This study seeks to add to the CP literature by testing the restriction hypothesis with samples from two different student populations: high-achieving high school and college students.

Why This Study Is Important

CP note taking is a common student behavior (Igo et al., 2003; Igo et al., 2006). When students are instructed to take notes from the Web, the majority seems to prefer copying and pasting their notes to typing their notes. For example, a study by Igo et al. (2003) showed that 86 of 108 high school juniors chose to paste their notes when both pasting and typing were available. Middle school students with learning disabilities (LD) seem to share this preference. In a mixed-methods study, 12 of 15 students with LD described CP to be vastly more appealing that both typing notes and writing notes from Web-based sources (Igo et al., 2006). Clearly, students prefer to use CP to take notes from Internet sources if the option is allowed. Students seem to favor pasting notes for different reasons, however. Whereas high school students' preference possibly signifies diminished motivation (Igo et al., 2003), middle school students with LD describe pasting notes as a less stressful activity than typing or writing notes (Igo et al., 2006). However, high-achieving students do not share this preference. Igo et al. (2003) found that when given the choice, 16 out of 18 high school juniors in Advanced Placement courses preferred to type their notes from the Internet rather than paste their notes. But, if obliged to paste their notes, might high-achieving students approach the task differently than general education students?

Second, this study is important because the limited CP research has demonstrated an educational problem with CP note taking. Students seem to have trouble encoding text ideas during the CP note-taking process (Igo et al., 2005; Igo et al., 2003; Igo et al., 2006). They generally can recall little of the information they paste into their notes (Igo et al. 2005; Igo et al., 2003), and they seem to have difficulty transferring the text information later (Katayama, Shambaugh, & Doctor, 2005).

One plausible explanation for the learning problem associated with CP notes exists. When most students take CP notes from Web-based text, they process the text at shallow levels (Craik & Lockhart, 1972; Igo et al., 2005). High school and college students tend to paste large amounts of text into their notes—such a large amount that they are unable to recall much of what they have noted (Igo et al., 2003). Not all students display this problem, however. The extant research shows also that a minority of students approach CP note taking in a more selective and evaluative way.

For example, in a study by Igo et al. (2005), the amount of information that students learned while taking unrestricted CP notes from Web-based text was inversely related to the amount of text they selected for their notes. Selecting fewer words per cell of a cued, note-taking chart resulted in more learning and selecting more words resulted in less learning. In short, when it comes to taking CP notes from Web-based sources, some students are selective and learn more, but most students are not selective and learn less (Igo et al., 2005; Igo et al., 2003). Might this minority of selective pasters be more prevalent among high-achieving students? If so, understanding their specific note-taking approach could help teachers instruct other students.

The Present Study

The present study sought to test the restriction hypothesis for high-achieving college students (Experiment 1) and high-achieving high school students (Experiment 2) taking notes from Web-based text. The restriction hypothesis postulates that more learning will occur when students take notes in an identical, restricted copy and paste condition than when they take notes in an unrestricted condition. In Experiment 1, participants were deemed to appropriately represent high-achieving college students if they had Scholastic Aptitude Test scores of 1250 or higher (obtained from official records), had already completed 2 years of college, and had cumulative grade point averages of 3.5 or higher. In Experiment 2, participants were deemed to appropriately represent high-achieving high school students if they were of junior class standing in high school, were enrolled in at least one Advanced Placement course, and had cumulative grade point averages of 3.5 or higher.

The restriction hypothesis was applied to each experiment, based on previous research. Because a seven-word restricted CP condition in previous research yielded better learning from Web-based text, this hypothesis predicted that students assigned to the seven-word CP condition in Experiments 1 and 2 would perform better on tests assessing (a) cued recall of facts, (b) recognition of concepts, and (c) inferences regarding relationships among text ideas than students in the unrestricted CP conditions.

Experiment 1

Method

Participants. Forty-three students from a large Southeastern university volunteered to participate in order to receive extra credit in their introductory educational psychology class or a psychology class. Students who participated (a) were judged to have minimal background knowledge of the experimental content (based on pretest scores below 50%), (b) were of junior or senior standing at the university (juniors > seniors), (c) had grade point averages ranging from 3.5 to 4.0, and (d) had an average Scholastic Aptitude Test (SAT) score of at least 1250 (the mean score was 1294). Twenty-two students were assigned randomly to the unrestricted CP group and 21 were assigned to the seven-word restricted CP group. Of the participants, 30 were female and 13 were male.

Materials. For purposes of across-study comparison, materials for Experiment 1 were identical to the Igo et al. (2005) study. Students took notes from a text passage that was 1,796 words long (Flesch-Kincaid grade level = 11.3). The text described three learning theories (behavioral, social, and constructivist) and was presented on a single, continuous Web page (HTML document) and accessed through Microsoft Internet Explorer. Describing each learning theory along parallel lines, the text identified each theory's (a) definition, (b) view of the importance of the environment, (c) view of the importance of mental activity, (d) key assumptions, (e) impact on curriculum, (f) impact on instruction, (g) impact on assessment, and (h) criticism.

The note-taking tool was an electronic matrix (or chart) that fit the text's structure. It contained three columns corresponding to the three text topics and 11 rows corresponding to the 11 text categories. The three columns were labeled from left to right as *behavioral theory*, *social theory*, and *constructivist theory*. The 11 rows were labeled *definition*, *environment*, *mental activity*, *key assumptions #1–#4*, *impact on curriculum*, *impact on instruc-*

tion, *impact on assessment*, and *criticism*. Thus, at the outset, the tool presented students with 33 blank cells, 11 for each learning theory, with cues directing students to find information intersecting topics and categories. The tool itself could be minimized, maximized, or reduced in the same manner as other computer programs. The students could choose to have the tool appear on the screen as they engaged in copy and paste decisions with the text, or they could expand the text to cover the screen and hide the chart.

Students' ability to enter information into the tool by typing was disabled, obliging students to copy and paste information into the tool (under restricted or unrestricted conditions). Students could paste words that appeared together in the text or combine words from disparate areas of the text, as long as the total number of words pasted per cell did not exceed their level of restriction (if one was indeed assigned). They also were permitted to change or delete part or all of their selections as they saw fit.

Dependent measures also were identical to the Igo et al. (2005) study. Three tests assessed recall of facts, concept recognition, and relational inferences. In the facts test, students filled in a cued paper chart (analogous to the online note-taking chart) with all, or any part of, the information they could remember reading or pasting into their notes. The columns and rows were labeled in the same way the note-taking chart was labeled; the cells were blank. The test was scored by awarding one point per idea recalled and placed in the correct, cued cell corresponding to an idea from the text, whether the idea was originally noted or not. There were 33 possible points. Two raters scored the quiz, blind to experimental conditions, with an acceptable level of interrater reliability (Cohen's $\kappa = .91$).

A 13-item, multiple-choice, concepts test ($\alpha = .72$) required students to recognize novel examples of information presented in the text (e.g., "*How would a teacher who subscribes to social learning theory use praise during instruction?*"). One point was awarded for each correct response.

Relational inferences were measured with a single essay test item requiring students to compare and contrast ideas presented in the text. Students were asked to "Describe how each theory's views of the importance of the environment and the importance of mental activity are related." These descriptions were scored using a rubric that included eight idea units. A total of eight points was possible—one for each idea. Maximum points were awarded if a student's complete answer described the opposite relationship of each theory's emphases on the environment and mental activity, as well as each theory's position on the importance of the environment and mental activity (e.g., behavioral theory places a greater emphasis on the environment and tends to discount mental activity, whereas constructivist theory is just the opposite). Two scorers rated the essays based on the rubric, blind to experimental conditions, with an acceptable level of interrater reliability (Cohen's $\kappa = .87$).

Procedure. The experiment occurred over 2 days. On Day 1 (in three separate sessions), students met in a university computer lab and were assigned randomly to one of the experimental groups. Next, they were given an overview of the note-taking task and completed informed consent forms. In the overview, the students were informed that the experiment was going to be conducted on 2 separate days. The primary researcher told the students that on Day 1 they were going to read and take notes on material that would later be covered in their course and that on Day 2 (4 days later) they would be given tests of facts, concepts, and relationships. They then read a brief two-paragraph statement describing the note-taking chart and a written explanation of the version of the chart they were supposed to use (restricted or unrestricted). Next, participants logged on to their computers and created user names and passwords (which permitted their notes to be saved and printed). The students were instructed by the primary researcher to take notes using the cues provided in the chart—for example, *definition* and *criticism*—(which they also read in the two-paragraph statement), to read and take notes at a pace that was comfortable to them, and to take as much time as they needed to complete their notes. Students then read, completed their notes, and saved their notes on the computer. Students were not permitted to print their notes or to save them on a storage drive to which they had access, as the study of notes was not permitted. All students completed the note-taking task in approximately 38 to 47 minutes. Students were not forced to conform to identical time on task because the researchers wanted to most closely approximate typical student behaviors, as prompted by the different versions of the note-taking tool.

On Day 2, participants took the three tests. The facts test was administered first so that recall was not prompted by the other tests, which contained additional retrieval cues. The relational test then was administered, followed by the concepts test, which contained the most cues. Each test was collected before the next test was given.

Results

A multivariate analysis of variance (MANOVA) was conducted to evaluate the effects of the copy and paste conditions on student performances on the (a) facts test, (b) relational test, and (c) concepts test. Table 1 displays a summary of the means and standard deviations for each of the three tests. These three measures were moderately correlated (see Table 2). The MANOVA indicated that there were no significant differences in performance between the groups, Wilk's $\Lambda = .97$, $F\,(3, 39) = .47$.

Experiment 2

Method

Participants. Forty-six students from two Southeastern high schools volunteered to participate as partial fulfillment of an assignment for an Advanced Placement English course. Students who participated (a) were of junior class standing, (b) had grade point averages of at least 3.5 (self-reported), (c) were presently

Table 1

Group Performances and Words Pasted per Cell for Experiments 1 and 2

	College R	College U	High School R	High School U
Facts test				
M	5.00	4.67	6.03	5.24
SD	3.87	3.85	2.02	1.88
Relational test				
M	3.57	3.45	2.03	1.82
SD	2.35	2.24	.72	.60
Concepts test				
M	7.95	7.94	8.74	8.72
SD	2.34	2.92	.76	.87
Average number of words pasted per cell	6.72	22.87	6.81	24.25

Note. R = restricted CP; U = unrestricted CP.

receiving college English credits in a high school Advanced Placement course, and (d) were judged to have minimal background knowledge, based on a pretest of the content. Twenty-two students were assigned randomly to the unrestricted CP group and 24 were assigned to the seven-word restricted CP group. Of the participants, 25 were female and 21 were male.

Materials. A 1,230-word text (Flesch-Kincaid grade level = 10.7) was created by the primary researcher and an English teacher. The content of the text (which was a part of the course curriculum that had not yet been covered by the teacher) described three kinds of writing (descriptive, narrative, and expository), and was presented on a single, continuous Web page (HTML document) and accessed through Microsoft Internet Explorer. Describing each kind of writing along parallel lines, the text identified the (a) purpose, (b) use of details, (c) characteristic 1,

Table 2

Correlations Among Tests for College and High School Students

Tests	1	2	3
	College (n = 43)		
1. Cued recall	—	.52***	.40***
2. Relational inferences		—	.42***
3. Multiple choice concepts			—
	High school (n = 46)		
1. Cued recall	—	.53***	.38***
2. Relational inferences		—	.35***
3. Multiple choice concepts			—

*** is significant at the .001 level.

(d) characteristic 2, (e) examples, (f) guideline 1, (g) guideline 2, and (h) guideline 3.

The note-taking tool used in Experiment 1 was used also in Experiment 2: An electronic matrix that fit the text's structure cued students to note certain information. It contained three columns corresponding to the three kinds of writing (descriptive, narrative, and expository) and eight rows corresponding to the eight text categories (a–h above). In sum, the tool presented students with 24 blank cells to fill, 8 for each kind of writing. In similar fashion to Experiment 1, three tests assessed recall of facts (Cohen's κ = .93), concept recognition (α = .75), and relational inferences (Cohen's κ = .88). Each test was graded and scored in ways analogous to Experiment 1.

Procedure. The procedure for Experiment 2 mirrored Experiment 1 as closely as possible. Experiment 2 occurred on 2 days. Students met in a school media center's computer lab, and were assigned randomly to one of the experimental groups. All of the students completed the note-taking task in approximately 35 to 43 minutes. Again, students were not forced to conform to identical time on task for the purpose of approximating actual student behavior. On Day 2 (2 days later), the classroom teacher administered the three tests to each student. The facts test was administered first, and then students acknowledged that they were finished by turning it facedown on their desks. The relational test then was given, followed by the concepts test.

Results

A multivariate analysis of variance (MANOVA) was conducted to evaluate the effects of the copy and paste conditions on student performances on the (a) facts test, (b) relational test, and (c) concepts test. Table 1 displays a summary of the means and standard deviations for each of the three tests. Table 2 displays the correlations among the three tests. The MANOVA indicated that there were no statistically significant differences between the groups, Wilk's $\Lambda = .95$, $F(3, 42) = .80$.

Discussion

In light of the obtained results, we must reject the restriction hypothesis, at least for high-achieving students. Based on a study by Igo et al. (2005), this hypothesis predicted that across two different samples, the restricted CP groups would outperform the unrestricted CP groups on three measures of learning. Instead, the present results indicate that the unrestricted groups and the restricted groups performed similarly on each test in each experiment.

In the Igo et al. (2005) study, restricting the amount of text students could paste into their notes boosted learning considerably. Postexperiment interviews conducted with some of the experimental participants indicated that the restricted group members tended to engage in deeper levels of processing while taking notes, whereas most unrestricted participants approached the task in a mindless way. However, within the unrestricted CP group, there was considerable variability among students' approaches to the CP note-taking task. Igo and colleagues divided students from the unrestricted group into four groups: those who generally pasted one, two, three, and four sentences per cell of their chart. A relatively small number of unrestricted students pasted an average of one sentence (or 18 words) per cell of their chart, and their test scores were higher than most other unrestricted students. Similarly, students who pasted two sentences per cell (or 31 words) learned more than others who pasted three or four sentences (44 or 59 words, respectively). In short, selecting fewer words for one's notes seemed to result in better learning (Igo et al., 2005); however, most students were not very selective. Further, in exhaustive interviews with the students, Igo and colleagues found that students who pasted fewer words also described engaging in much deeper text processing (e.g., evaluation of text ideas and metacognitive processes) than students who pasted more words. The present replication study sought to investigate how high-achieving high school and college students might approach the same tasks and how those approaches might affect learning.

Apparently, high-achieving students approach CP note-taking in a much more strategic way. For example, after the experimental results were obtained, each student's set of notes was printed and analyzed. It was clear that each student completed the note-taking task, as each set of notes contained charts with no blank cells. The charts were completed appropriately, as well, with appropriate ideas pasted into cells with the corresponding cues (although one high school student did find a way to paste together the phrase "this is bs" into one cell of his or her chart). The most illuminating characteristic of the notes, however, was the amount of text unrestricted students chose to paste into their charts (see means in Table 1).

In the present study, high school and college students assigned to the unrestricted CP condition chose, of their own volition, to paste far fewer words than did students in the same condition in the previous research (Igo et al., 2005). For example, in the Igo study, 37 unrestricted pasters selected an average of 42 words per cell of their charts. Six of those students were more selective, pasted an average of 18 words per cell, and performed better on each test given. But, in the current study, 22 high-achieving college participants in the same condition selected an average of 23 words per cell, with about one third of them selecting an average of 18 words or fewer. Therefore, high-achieving high school students were nearly as selective as the most selective group in the prior study. Twenty-two unrestricted high school students selected an average of 24 words per cell, with one fourth of them selecting about 18 words. These are extreme differences in text-pasting selectivity between students in the present and previous research.

Assuming, for purposes of this study, that Igo et al.'s (2005) conclusion that the selection of fewer words during CP note taking is related to deeper cognitive processing of Web-based text ideas (as suggested by the interview phase of their study), the present finding does make sense. Whereas initially the present findings might seem entirely inconsistent with the previous research (where the restricted and unrestricted groups performed differently), the relationship between text-pasting selectivity, and learning first proposed by Igo et al. (2005) now seems more robust. Put simply, these high-achieving students seem to have been unaffected by the CP conditions because they approached CP note taking in a selective way. Thus, their personal strategies toward CP note taking seem to be more effective than students who participated in the previous research, preventing the differences in learning obtained in the previous research from surfacing.

Instructional Impact

The big picture of the present study is perhaps not that students remember more of what they note online when they paste selectively. Rather, the most important message from these results is that students think more deeply about online text when they paste selectively. Thinking more deeply results in the encoding of more ideas. In education, we want students to think deeply as they read any text, but the availability of CP makes it easy for students to forgo any deep processing as they gather notes. However, given that most general education students seem to prefer CP (Igo et al., 2003), teachers should learn how to help prompt students to engage in deeper mental processes when they use CP.

With the relationship between text-pasting selectivity and learning now more clear, a practical implication for instruction surfaces. Assume, again, that a high school teacher has reserved a media center computer lab or a media cart of laptops so that her students can gather information for a research paper from the Internet. In the paper, students must compare and contrast the responsibilities and limits of power of the three branches of the federal government. In an effort to ensure that students think more deeply about the information they will gather, the teacher could inform students to select main ideas instead of paragraphs, main ideas and the best supporting statement per paragraph, or the most important sentence per paragraph of appropriate text. Each simple instruction could increase students' CP selectivity, perhaps resulting in deeper thinking as they read and note the online text.

Limitations and Future Research

The present study, like the initial study by Igo et al. (2005), failed to investigate all of the learning benefits associated with note taking. Specifically, the external storage function of CP note taking remains unexplored. The external storage function refers to the amount of learning resulting from the study of notes. This is an important topic for exploration because the study of notes represents a large proportion of students' energy, especially at the high school and college levels. It is possible that restricted CP note taking initially could yield encoding benefits but later could lead to an inferior, incomplete set of notes. In that sense, students would trade increased initial learning (encoding) for diminished quality notes from which to study (external storage), and learning might suffer, on the whole. Thus, future research should begin to test the effects of studying notes created under different CP conditions.

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