The Reading Matrix: An International Online Journal
Volume 20, Number 1, April 2020

Reading Academic Citations: How Professors and Graduate Students Read for Different Purposes

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ABSTRACT

Citations provide truncated yet socially complex information about sources in academic texts which students are obliged to read, comprehend, and then ultimately produce as part of an academic discourse community. While researchers have observed a developmental process whereby students produce citations during source-based writing, little work has investigated the reading stage when students visually encounter citations. In this study, we explored academic reading behaviors by examining eye movements of 27 graduate students and 18 professors as they read 6 authentic research texts for various purposes (summary, analysis, synthesis). Results of factorial ANOVAs showed no differences between students and professors but did reveal that both groups spent far less time looking at citations than surrounding text and that reading purposes affected citation reading behavior. These results indicate that students and professors read academic citations in similar ways. Further, the findings suggest that synthesizing sources, not just summarizing or analyzing them, results in greater attention to citations; thus, students developing their academic writing and citation skills may benefit from synthesizing multiple sources.

INTRODUCTION

A citation is a bibliographic description providing truncated information about a cited work, such as authors' surnames and publication date, to identify relevant information (Shotton, 2010). Such citations are "virtually obligatory in academic writing" (Hyland, 2002, p. 129), and scholars use citations to credit other authors, support an argument, and position the writer's contribution in existing academic discussion (Erikson & Erlandson, 2014; Harwood, 2009; Kaplan, 1965; Schoonbaert & Roelants, 1996).

Students writing in academic English must learn to use citations correctly to build an authoritative ethos and situate their own argument while avoiding plagiarism (Hyland, 2002; Shaw & Pecorari, 2013). How they develop this skill remains an important question within higher education, though theorists have identified sequential stages of citation progression starting with copying and mimicking source texts, then engaging in patchwriting—partially altering or replacing text with the student's voice—, and eventually developing authorial control (see Howard, Serviss, & Rodrigue, 2010). In addition, applied linguists have examined source use among non-native English writers and pedagogical options for teaching students to integrate sources effectively (see Cumming, Lai, & Cho, 2016; Grabe & Zhang, 2013; Liu, Lin, Kou, & Wang, 2016; Pecorari, 2016). Their observations indicate that novice writers' background knowledge and strategies affect their citation ability and that instruction can lead to students' improved intertextual writing.

Additionally, read-to-text practices, where students integrate two or more sources to address an essay prompt, help novices notice and understand field-specific citation usage since "source use starts with having an appropriate purpose and strategy in one's reading" (Shaw & Pecorari, 2013, p. A2; see Grabe & Zhang, 2016; Ma & Qin, 2017; McCulloch, 2013; McGrath, et al., 2016). Successful students appear to learn citing behavior from the sources they read (Samraj, 2013). Yet most research focuses on the writing processes of developmental citation use rather than examining how students actually read citations in academic texts or whether students attend to citations differently than do experienced academic writers.

Presumably, noticing and reading citations in source texts allows readers to access information that would facilitate later production of sophisticated and properly cited disciplinary writing, or at least provide rhetorical information about the use and purpose of citations during reading. Since eye movement behavior is thought to reflect readers' attentional focus (Conklin & Pellicer-Sanchez, 2016; Rayner, 1998, 2009), and, by extension, words they actively attend to, it is well suited for measuring attention to citations in academic reading. For these reasons, we developed a research study to explore the reading behaviors of novice and experienced academic writers when engaged in reading academic texts. We expected to see differences in how these groups visually attended to citations in literature review passages of published journal articles as a sign of developmentally different citation reading practices.

LITERATURE REVIEW

Citations are "almost a defining feature of the academic research article" (Hyland, 2002, p 115). Moreover, they serve numerous social purposes including bestowing credit and recognition on previous authors' works, revealing judgments about the venue where the research is published, demonstrating a writer's ability (and willingness) to cite from a particular field and awareness of audience expectations, and demonstrating epistemic community membership

(Cronin, 1984; Ericson & Erlandson, 2014). This complex social reality can be frustrating for novice academic writers who are obliged to write like experts before they become experts themselves (Kamler, 2008). Researchers have lamented for decades that citation rules are tacit, vague, opaque, and sometimes wholly idiosyncratic (Cronin, 1984; May, 1967; Ravetz, 1971), which is perhaps why students often struggle to understand citations correctly when reading (Hyland, 2002).

Learning to use citations in socially acceptable ways may be part of a developmental process that begins with exposure to citations by reading scientific papers and concurrent sourcing. Sourcing is a process wherein a reader notices the source of a document and/or uses source information to predict, interpret, or judge a source's content (Gottleib & Wineburg, 2012; Rouet, 2006; Wineburg, 1991). Although sourcing traditionally refers to observations about a texts' author and related information, Strømsó, Braten, Britt, and Ferguson (2013) applied the concept to citations embedded within expository texts and found that readers paid implicit and explicit attention to in-text citations. Studies have demonstrated students' weak sourcing skills when interpreting texts (Britt & Anglinskas, 2002; Britt & Rouet, 2012; Wiley et al., 2009) and when contrasting novice and more experienced writers. Swales (2014) for instance, found that undergraduates tended to incorporate multiple citations from the same few sources while graduate students utilized a wider variety of sources with fewer citations of each source. A two-year longitudinal case study showed three master's degree students progressing at different rates but continuing to demonstrate a limited repertoire of citations (Davis, 2013). Mansourizadeh and Ahmad (2011) further found that graduate writers used citations for fewer and simpler purposes in first-draft articles than expert writers. Together, these observations suggest a developmental process in citation proficiency.

Appropriate citation use in writing is based partially on useful exposure to and instruction of citations. Reading and read-to-text practices help students develop awareness of citation usage, as successful reading strategies seem to lend themselves to successful writing (Ma & Qin, 2017; McCulloch, 2013; McGrath, et al., 2016; Samraj, 2013). Utilizing a read-to-text task, Ma and Qin (2017) investigated factors relating to citation competence and found reading proficiency (as measured by TOEFL scores) to be essential to successful academic writing and citation use. Another study identified reading strategies students employed and their application; student participants exhibited more disciplinary knowledge and intertextual synthesis as the tasks progressed in complexity (McGrath, et al., 2016).

A number of researchers have further examined how students synthesize sources in more naturalistic tasks. A comparison of master theses and published articles revealed notable similarities in terms of citation usage, suggesting that successful students learn from the sources they use (Samraj, 2013). McCulloch (2013) conducted a think-aloud case study where graduate students audio-recorded their thoughts while reading articles for their dissertations. She identified successful reading strategies like making inferences, taking a critical stance, attending to authors, and elaborating on texts, that enabled greater intertextual links for expanded citation purposes. Echoing these results, Ruilan (2015) adds purposeful mining and attention to general discourse features as read-to-write strategies. Overall, these findings suggest that students progress in their citation knowledge at least partly by reading and interacting with source texts.

Reading Behavior and Citations

While many studies have examined how academic writers develop source-based writing ability (e.g., Abasi & Graves, 2008; Cumming et al., 2018; Harwood & Petrić, 2012), others have examined reading behavior as a correlate of citation development through think-aloud studies. Research suggests that expert readers actively attend to source information when reading (Bazerman, 1985; Leinhardt & Young, 1996). Wyatt et al (1993) conducted think-aloud sessions with 15 social science professors as they read an academic research article in APA style format. The researchers found that 9 of the professors used both in-text and reference list citations to help them situate and interpret the content of research articles. Meanwhile middle school, high school, and undergraduate students struggle to access sources and citations (Lundeberg, 1987; Maggioni & Fox, 2009; McGrew et al., 2018; Perfetti, Britt, & Georgi, 1995; Wineburg, 1991).

When university students do attend to source information, results are uneven. Roig (1999) found that text readability affected university students' ability to paraphrase sentences from a single source. When presented with two sources, Nash, Schumacher, and Carlson (1993) found that university students adopted the organizational features of the first source, regardless of its textual value, to create subsequent compare-contrast essays. Le Bigot and Rouet (2007) had university students read seven related texts with in-text author and date information and found that they performed well only on local detail comprehension; however, students who read the same texts with author and date information in the hyperlink title of the readings performed well on main-idea comprehension and included explicit author references in subsequent essays. Research by Strømsø (Strømsø, et. al., 2013; Strømsø & Bråton, 2014) collected verbal protocols and subsequent synthesis essays from undergraduates reading between six and eight source texts on health effects of cell phone usage. Findings showed that during online reading, students paid explicit attention to both the original source of the text and to citations within each text and upwards of 88% of students cited at least one text in their essays. These results suggest development in source and citation awareness as students become familiar with university studies.

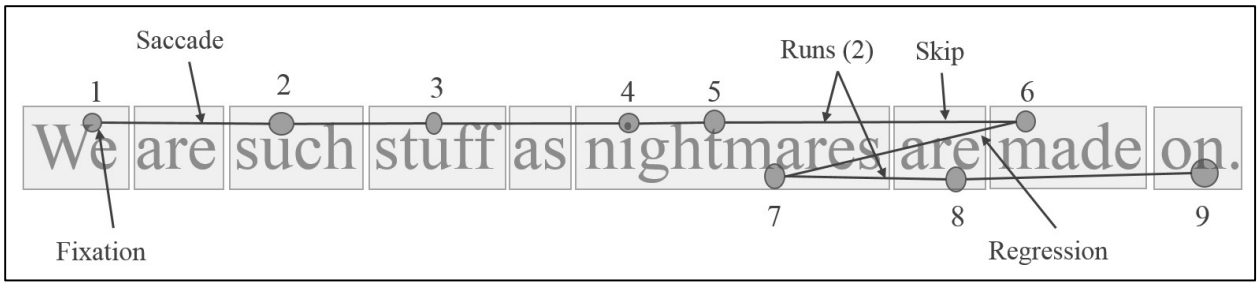
It may be expected that experienced academic readers who possess greater topic knowledge and/or familiarity with referenced authors would demonstrate greater source awareness compared to less experienced academic readers. While it is possible for learners to self-report reading and processing behaviors through oral protocols and reflective interviews, this information can be subject to variations and inconsistencies due to reactivity in verbal reporting (see Bowles, 2010; Godfroid & Spina, 2015). Thus, coupling this approach with a more direct measure of processing behavior through eye-movement research can triangulate previous observations. Eye-movement research has the advantage of limiting construct interference, particularly in contrast to think-aloud protocols. Also, eye-tracking requires no secondary tasks such as self-timing or strategic response and thus measures naturalistic reading behavior and taps into real-time comprehension processes (Roberts & Siyanova-Chanturia, 2015).

Visual Attention to Citations

Eye-movement analysis is built theoretically upon the 'eye-mind hypothesis' (Just & Carpenter, 1980) which assumes that visual attention (i.e., eye fixation) reflects mental processing, and the duration of fixation(s) reflects the effort required to process that which is attended to (Staub & Rayner, 2007). Readers fixate, or pause, on letters and words for very short

durations then skip to nearby letters and words in sweeping moves called saccades (Rayner, 1998). They often return to previously-read material, in movements called regressions, in order to reconsider or synthesize unfamiliar or confusing material or to fixate on something that was initially skipped or overlooked. Readers may also skip words entirely, especially if those words are small, highly predictable, or highly functional, though they may also accidentally overshoot a target, causing a skip (Rayner, 1998). Any movement into a word, whether from the right or the left is called a run. Figure 1 illustrates common eye-movements in natural reading.

Figure 1. Eye-movement behaviors during normal reading



Eye-movement measures in reading research are typically categorized roughly as early and late measures (Conklin, Pellicer-Sánchez, Carrol, 2018). While early measures are thought to reflect automatic word recognition and lexical access processes, later measures are thought to relate primarily to conscious, controlled, and strategic processes (Conklin, Pellicer-Sánchez, Carrol, 2018; Inhoff, 1984; Paterson, Liversedge & Underwood, 1999; Staub & Rayner, 2007). Conklin and Pellicer-Sánchez (2016) associate skipping rate, first fixation duration, and first run dwell time with early measures while total dwell time and rereading (e.g., run count) are related to late measures. Clifton, Staub, and Rayner (2007) argue that regression rate (likelihood of returning to a word) can tap in to either early or late processing since regressions can signal immediate difficulty integrating a word or the time required to overcome integration difficulty (see also Conklin & Pellicer-Sánchez, 2016). A regression count measure is more likely aligned with late reading because it indicates the number of times a word is fixated upon, not just a probability, such that a higher number indicates greater text processing difficulty for a particular word. Fixation count is not a measure of processing time and therefore not an early or late reading measure but rather an indication of the number of times a word was fixated (Roberts & Siyanova-Chanturia, 2013). Rayner (1998) argues that both early and late measures should be analyzed in reading studies because they may reflect different processes.

Since eye movement behavior is thought to reflect readers' immediate attentional focus (Conklin & Pellicer-Sanchez, 2016; Rayner, 1998, 2009), and, by extension, input that is actively attended to, it is well suited for measuring attention to citations in academic reading. In the past decade, only a small number of researchers have used eye-tracking methods to examine searching and sourcing behavior, none of it directly related to the reading of in-text citations. Kammerer and Gerjets (2012) found that a tabular presentation of internet-based search results led to a longer fixation time on objective (versus biased) sources than did a list presentation of the same results. Kammerer and Gerjets (2014) and Kammerer, Kalbfell, and Gerjets (2016) further used eye movement data (i.e., total fixation time) to confirm observations in previous think-aloud studies that students paid attention to an article's source, defined as the "about us" page of a website, when reading texts that contained conflicting information. However, no

studies that we know of explicitly examine whether and how long readers fixate upon in-text citations of academic text.

Study Purpose and Research Questions

In this study, we wanted to investigate whether readers differ in their attention to citations depending on their backgrounds and the nature of the reading task in academic texts since citation reading behavior can affect the amount of information students obtain from academic writing. In order to empirically study citation reading behavior across reader background and task purpose, we were guided by these research questions:

1. Do students and professors read textual words and citation words in academic writing differently? How does task purpose affect this?
2. How do students and professors read just textual words in academic writing? How does task purpose affect this?
3. How do students and professors read just citation words in academic writing? How does task purpose affect this?

METHODS

Participants

Forty-five professors and graduate students from a large university in the Western United States who were either studying or teaching in the education, psychology, or language teaching departments completed the study. Eighteen participants were professors with a terminal degree and publications in their respective fields; aged from 34 to 68 years old (M=43); 14 male and 4 female; and all had worked in a university setting between 1 and 41 years (M=9). Twenty-seven participants were graduate students pursuing either an M.A. (19) or Ph.D. (8); aged 23 to 46 years old (M= 29); 16 female and 11 male.

Instruments

Reading passages. Six paragraphs of academic text, each about 250 words long (M=255, SD=12), were carefully selected from recent research reports about educational technology, technological affordances in the classroom, and entrepreneurship education in higher educations as published in established education journals. These topics were chosen because of their proximity to participants' research fields but sufficiently distant that no participants had read these materials before. Slight modifications were made so each paragraph contained three integrated and four non-integrated citations in APA formatting. No other adjustments to the authentic paragraphs were made. Table 1 illustrates the range of complexity for each text. Texts contained 255 words and nearly 8 sentences on average and ranged in type-token ratio (TTR) from .51 to .64; all contained at least 31 words from the academic word list. A Flesch-Kincaid grade level score showed that all texts were college-level.

Table 1. Lexical complexity scores for authentic texts by paragraph.

	Para 1	Para 2	Para 3	Para 4	Para 5	Para 6	M	SD

Topic	EdTech	EdTech	Entrepr.	Entrepr.	Afford.	Afford.		
Tokens	236	253	275	256	246	264	255.00	12.44
Types	128	130	150	165	126	148	141.17	14.26
TTR	0.54	0.51	0.55	0.64	0.51	0.56	0.55	0.04
1,000	177	183	195	166	163	180	177.33	10.69
2000	18	29	25	37	35	39	30.50	7.34
3,000-9,000	34	37	51	43	33	36	39.00	6.24
10,000+	3	0	1	0	1	1	1.00	1.00
Off	3	3	3	9	14	8	6.67	4.11
AWL	31	46	33	36	39	49	39.00	6.56
Sentences	8	9	7	6	7	10	7.83	1.34
Words/Sentence	29.5	28.22	38.86	42	35.71	26.6	33.48	5.74
Flesch Reading Ease	22.4	28.4	10.1	16	28.7	40.1	24.28	9.66
Flesch-Kincaide Grade Level	17.5	16.4	18.7	18.1	13.5	13.7	16.32	2.04

Note: 1,000-10,000+ refer to the 1,000-word bands from the BNC-COCA word frequency list

Apparatus. Eye-tracking data were collected by an SR Research EyeLink 1000 Plus with a spatial resolution of 0.01° sampling at 1000 Hz. A computer screen with a 1600 x 900 display resolution presented the reading stimuli and was positioned 63 centimeters from the participant so that approximately 3.5 characters subtended 1° of visual angle.

Procedure

When participants entered the eye-tracking lab, an attendant primed them for the experiment by engaging in a 10-minute conversation to build the participant's knowledge about the topics to be presented and solicited their personal views and opinions thereof (see Appendix A). This conversation allowed participants to increase their schematic content knowledge. Participants were also instructed on the upcoming guided tasks and asked for questions they might have about the topics or the eye-tracking procedure.

Participants were then seated at the eye-tracker for a nine-point calibration to ensure accurate data collection before reading a practice pair of paragraphs on the eye-tracker. Participants read at their own pace until they felt ready to complete the practice guided task. Participants then left the eye-tracker and were asked to orally summarize the main points. This same procedure of calibration, reading, and a guided task was followed for the three pairs of study paragraphs. The guided tasks differed for each pair of paragraphs and their associated topics: participants were asked to orally summarize the main points of the educational technology paragraphs, analyze the entrepreneurship education paragraphs for the similarities and differences, and synthesize the technological affordances paragraphs. Written response to each task was eliminated and oral response adopted because of time constraints and because oral response is a common and ecologically valid and encouraged intermediary step between reading and writing (e.g., discussing readings with a professor, colleague, or peer). Task order was randomized.

Data Analysis

Eye-tracking data. Typically, eye-tracking researchers select theoretically-motivated areas of interest (AOIs) to limit the collection of eye-movement data to relevant parts of a text or image (Holmqvist et al., 2011) with each word being a common level of demarcation. We made each word an AOI and categorized each as a citation word (e.g. author names, dates, citation-specific letter or symbols like "&") or text word (all other words pertaining to the text of the material but not associated with references). Citation and text words were further coded depending on the task they belonged to (summary, analysis, synthesis). We collected seven unique measures from each AOI as described in Figure 2.

Figure 2. Participants' Frequency of Reading in English.

Measure	Description
Skip	Indication of whether a word was skipped (0) or fixated upon (1) during first run reading
First Fixation Duration	Duration in milliseconds of the first fixation when reading a word
First Run Dwell Time	Total duration in milliseconds of all fixations on a word during first run reading
Regressions in	Number of times a word was returned to after first run reading
Run Count	Number of unique times a word was fixated upon regardless of preceding saccade direction
Total Fixations	Total number of fixations on a word over all reading passes
Total Dwell Time	Total duration in milliseconds of all fixations on a word over all reading passes

Data were aggregated across all AOIs for each participant and a factorial ANOVA that compared role (professor/student), task (summary/analysis/synthesis), and token (text/citation) was performed for each dependent variable in order to respond to RQ1. Two subsequent two-way ANOVAS (task x token) were performed for the text AOIs and the citation AOIs to address RQs 2 and 3 respectively.

RESULTS

RQ1: Textual Words versus Citation Words

The first research question asked whether students and professors read citation words to the same degree as surrounding textual words and if their level of attention to citations changed depending on the task they were reading for. A factorial ANOVA (role x task x token) on the seven eye-tracking variables showed a significant main effect for token (whether a word was text or citation) for all variables as seen in Table 2. The means show that in all cases, participants gave less attention to citation words compared to textual words. For instance, readers on average skipped a little more than half of the textual words during their first run but skipped almost three-quarters of citation words indicating that participants viewed citation words proportionately less than textual words. Also, participants spent less time during first fixations of citation words (M=191 milliseconds [ms]) compared to textual words (M=222 ms) and less time on citation words (M=204 ms) compared to textual words (M=262 ms) during first runs, emphasizing reduced attention to citations during early reading. This trend persisted beyond early reading. Notably, total dwell time (the last measure in the table) shows that on average, participants spent

396 milliseconds, or about one-third of a second per textual word but only 136 milliseconds, or just over 1/10 of a second on citation words.

Table 2. Differences in textual word verses citation reading

		M (n=131)	*F*	*p*	η^2p
Skip	Words	0.58	94.36	<.001	0.274
	Citations	0.72			
First Fixation Duration	Words	222	82.34	<.001	0.24
	Citations	191			
First Run Dwell Time	Words	262	150.68	<.001	0.376
	Citations	204			
Regressions in	Words	0.499	359.26	<.001	0.590
	Citations	0.122			
Run Count	Words	1.55	221.20	<.001	0.469
	Citations	0.65			
Total Fixations	Words	1.83	235.18	<.001	0.485
	Citations	0.71			
Total Dwell Time	Words	396	272.35	<.001	0.521
	Citations	136			

Regressions in, which measure how many times readers return to a word, show that participants returned to about every other textual word but only about one in every eight citation words, indicating far fewer look-backs at citations. Similarly, participants re-read citation words less frequently (run count) and made fewer fixations on citation words as well.

While token as a main effect was significant for all measures, other main effects, including role and task, were not significant; interaction effects were also non-significant. In other words, students and professors did not have significantly different reading behaviors when it came to textual words verses citation words, nor did reading purpose (task) affect this pattern. Thus, in response to the first question, readers in our study tended to pay far less attention to citation words compared to textual words regardless of their status as student or professor or the task they were performing.

RQ2: Reading Textual Words Only

We then examined how both groups read just textual words to determine if role or task purpose had an effect on reading behavior. A factorial ANOVA (role x task) revealed no main effects and no interaction effects across all seven measures of reading behavior. In other words, students did not differ significantly in their reading of textual words compared to professors, nor was there a significant difference based on whether they were reading for summary, analysis, or synthesis of ideas.

RQ3: Reading Just Citations

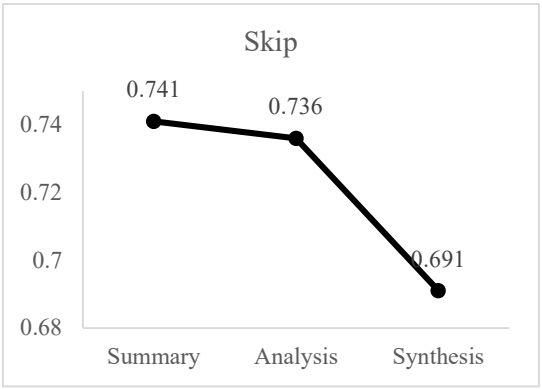
We finally looked at how students and professors read just citation words to determine if role or task purpose had an effect on reading behavior. A factorial ANOVA (role x task) of just citation words revealed a significant main effect for task in five of the seven measures (see Table 3), but no main effect for role and no interaction effect. Given these results, we identified areas of significance within task effect for each of the five significant eye-tracking measures using post-hoc Tukey HSD tests, described below.

Table 3. Task differences in citation reading

	M (n=131)	*F*	*p*	η^2p
Skip	0.723	4.73	.010	0.070
First Fixation Duration	191	0.40	.670	0.006
First Run Dwell Time	204	2.31	.103	0.036
Regressions in	0.122	3.46	.034	0.052
Run Count	0.651	3.15	.046	0.048
Total Fixations	0.710	3.43	.035	0.052
Total Dwell Time	136	4.36	.015	0.065

Skip. A post-hoc test showed a significant difference between summary reading (M = 0.74, SD = 0.09) and synthesis reading (M = 0.69, SD = 0.08) at $p < .001$ as well as a significant difference between analysis (M = 0.73, SD = 0.08) and synthesis reading at $p < .001$, see Figure 3. These results show little change in early word skipping between summary and analysis tasks, but a meaningful decline in synthesis reading. In summary and analysis tasks, readers skipped about 74% of citation words, but during synthesis reading, this dropped to just under 70%, indicating more early attention to citations when reading to synthesize material.

Figure 3. Average skip rate of citation words by reading task



Regressions-In. While the factorial ANOVA indicated a significant difference among tasks, a Tukey HSD test with its robust calculations for reducing false positives showed no

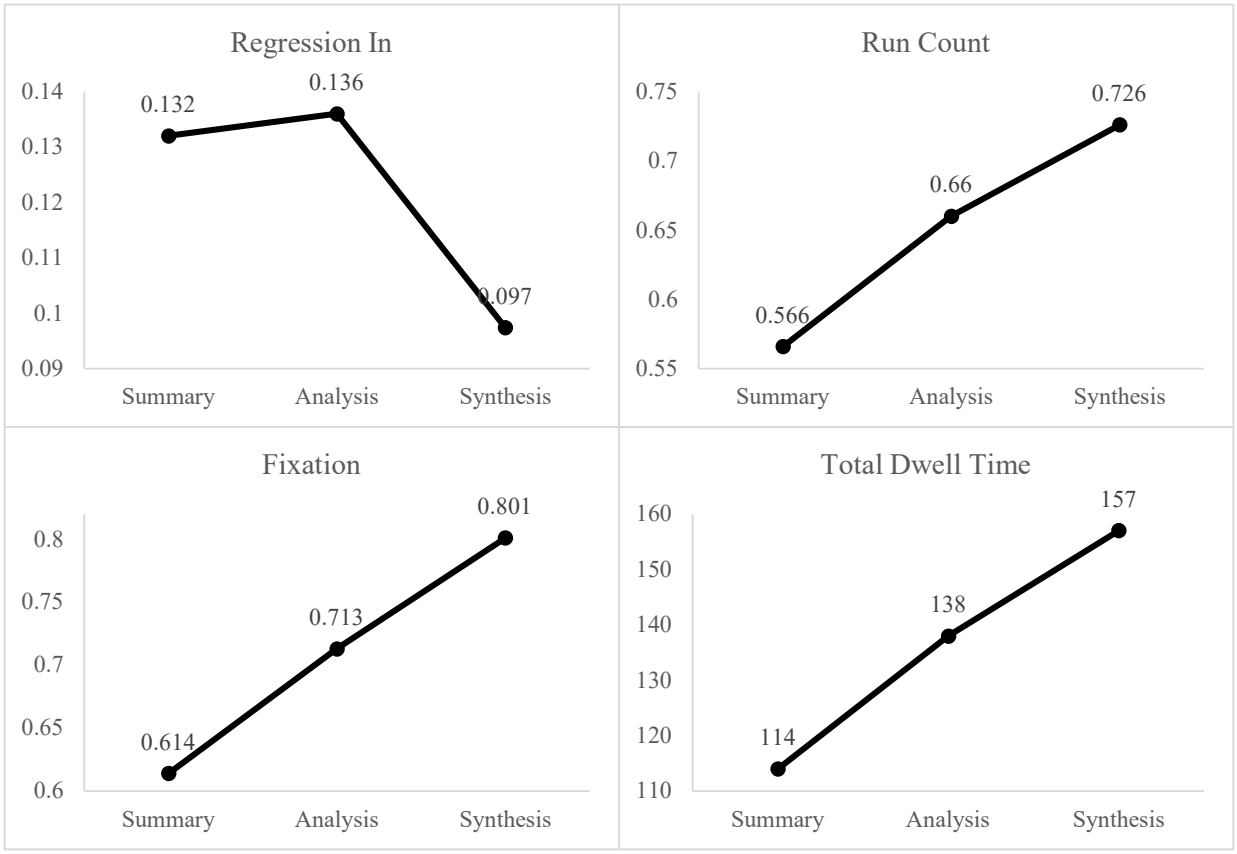
significant differences among task purpose, though analysis (M = 0.13, SD = 0.09) and synthesis tasks (M = 0.09, SD = 0.07) approached significance (p = .052), see Figure 4. The slope between analysis and synthesis shows lower immediate re-reading of citation words when reading for synthesis. This is likely explained by the fact that readers skipped fewer citations during synthesis reading in the first place, meaning that they were not obliged to return and capture as much missing information.

Run Count. A post-hoc test showed that readers re-read citation words more frequently in synthesis (M = 0.72, SD = 0.29) than summary tasks (M = 0.56, SD = 0.26) at p = .037, see Figure 4.

Total Fixations. A post-hoc test revealed that readers fixated more on citation words during synthesis (M = 0.8, SD = 0.32) than summary tasks (M = 0.61, SD = 0.3) at p = .027.

Total Dwell Time. Given that citation words provide liminal information, it is expected that dwell time relates to processing citation words in relation to the textual propositions they support. A post-hoc test indicated readers dwelled more on citation words during synthesis (M = 157, SD = 67.6) than summary tasks (M = 114, SD = 56.2) at p = .01.

Figure 4. Average late reading measures of citation words according to task purposes.



DISCUSSION

Differences between Text and Citation Reading

We found no significant difference in the way professors and students read words or citations. Nor did we find a difference in these patterns across reading tasks. We did, however, see significant differences in reading time between text words and citation words. Both groups spent significantly less time attending to citations across all seven eye-movement measures. This finding suggests that both groups found the citation words less critical than text words, likely believing they were superfluous. Our findings further seem to indicate that students had already attained sufficient exposure to citations and noticed their use in academic writing such that no special attention was needed by student readers to process citations. Moreover, the mere reading of citations may be an impoverished intellectual task in contrast to actually producing citations in an output task. If we had asked participants not only to read each paragraph but to write an extended report based on their reading, we might see different reading patterns. Similarly, if we had used highly familiar academic texts—texts which included citations from well-known authors that readers were undoubtedly familiar with—we might also see differences in how professors and students processed citations based on their background knowledge of those authors.

Differences between Professors and Students in Word Reading

Our analysis showed no differences in the way that professors and students read the text words in academic passages. Given that all participants were proficient English readers, it comes as little surprise that their reading behaviors would not be significantly different. However, it is somewhat surprising that reading measures showed no significant differences in reading across tasks since Liu et al. (2010) found contradictory results using eye-tracking methods, and other researchers have similarly found that task purpose has an important influence on how readers interact with text (Kunze, Utsumi, Shiga, Kise, & Bulling, 2013; Linderholm & Wilde, 2014). It is possible that the tasks measured as part of this research were difficult for participants to process. Moreover, the procedure by which we assessed readers' task performance may have affected participant responses as we merely asked for oral synthesis, analysis, and summary.

The reading of citation words, however, tells a different story about reading behavior. While there were no significant differences between professors and students, there were differences across task purposes for several reading measures. Both groups paid more attention to citations in the synthesis task compared to the summary task. They skipped fewer citation words, fixated upon them more, re-read them more, and generally spent more time on citations when compared against the summary task. These measures together suggest that readers read citations more carefully in the synthesis task than summary. Moreover, readers appeared to check citations quickly during summary tasks but read through them multiple times and overall spent longer attending to citations when reading for synthesis. These findings tend to support sourcing research which shows that readers remember sources better when reading conflicting propositions (Bråten, Salmerón, & Strømsø, 2016) and that argumentative tasks lead to deeper processing than summary tasks (Naumann, Wechsung, & Krems, 2009; Stadtler et al., 2014). Thus, task purpose can affect how readers attend to citations, and it makes intuitive sense that when reading to synthesize views, readers would pay attention to the authors who posit those views. This finding likewise supports previous evidence that task purpose affects reading behavior (Kunze, Utsumi, Shiga, Kise, &

Bulling, 2013; Linderholm & Wilde, 2014; Liu et al., 2010), but it offers additional nuance by showing the role of sourcing when engaged in synthesis tasks.

CONCLUSIONS

This study was motivated by a belief that professors and students would attend to in-text citations differently; however, the results suggest that there is no important difference between these groups. Word type, on the other hand, was significant inasmuch as both groups gave far less attention to citation words than text words. Task purpose also resulted in significant differences indicating that both professors and students attended more to the citation words in synthesis tasks compared to summary tasks. Combined, these results indicate that parenthetical citations are rarely attended to by either professors or students, but synthesis tasks in which readers must combine points of view are likely to orient readers toward in-text citations.

Limitations and Future Research

The experimental design of this research led to a number of limitations that constrain its interpretability and make it difficult to apply to other settings. For instance, this experiment only sampled graduate students and professors, people who are already engaged in their specific academic fields. It would be informative to see how these participants compared with undergraduate students at the very beginning of their academic pursuits. Additionally, participants only came from a small sub-set of fields, and stimuli were prepared that only sampled from one field and used only one reference style (APA). No attempt was made to contrast integrated and non-integrated citations either, though a careful design could account for this and would likely show significant differences. Moreover, the experiment did not counter-balance tasks and text. That is, educational technology paragraphs were used only for summaries, entrepreneurship education for analysis, and technological affordances for synthesis. Even though the readings were of similar complexity, it is possible that the texts could have affected reading behavior, not just the task; therefore, further experimental control should be used to confirm the present results.

In addition to these limitations, participants were not familiar with the specific topic area that they read for this study, although it was tangentially related to their areas of study (research by Yu (2009) found that general topic familiarity did not affect text comprehension or summarizability among undergraduates). A more robust approach might gather participants from the same specific fields and present them with articles focused on their areas of expertise. One problem, however, is that professors might encounter articles that they had previously read while others might not. Another option could include greater priming in which, for instance, participants could read the entire article in advance from which a specific excerpt was taken for eye-tracking purposes. Permutations in design might provide additional insight into when and how individuals glean information from citations.

Implications

Graduate students in language acquisition and related fields may be happy to know that there is little meaningful difference in the way they read academic texts compared to professors, at least in an experimental setting when examining citation reading. How students and professors

interact with texts and citations in authentic school settings may be a different story. But for professors eager to encourage students to notice citations and to learn from them, it seems best to require students to synthesize from multiple sources rather than to simply summarize or even evaluate them.

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APPENDIX A
Priming text procedures and discussion

Instructions: Prime the readings by discussing them with the participant as explained below.

You will read six paragraphs in three sets of two. The paragraphs are taken from published academic articles, so the writing is dense and contains citations in APA format. Once you've read a paragraph and moved on, you won't be able to go back, so feel free to read each paragraph as many times as you need to comprehend the information. After every other paragraph, you will be asked to discuss the paired paragraphs with a researcher. To help prepare you for the readings, here are the topics of the three paragraph sets you'll see today. They will appear in random order.

1) Educational Technology in higher education (Summarize)
   Educational technology (aka EdTech) is a multi-billion dollar industry focused on making education better through technological innovation. It includes staples like Google Docs and Dropbox as well as games, virtual reality, and online classes. Obviously the EdTech revolution is here, but the question is whether and how to use it to improve teaching at the college level.
   - What is your opinion on the possibilities and limitations of EdTech?

2) Entrepreneurship education (Analyze)
   In the age of lucrative start-ups thanks to Silicon Valley and new market innovation, colleges and universities are no longer just preparing students for a vocation but to think as entrepreneurs. The question, then, is how universities and educators can incorporate an entrepreneurship design.
   - What is your opinion on possibilities and limitations of entrepreneurship education in college?

3) Technological affordances in education (Synthesize)
   Technological affordances can be thought of as the features of a piece of technology; the features of a cell phone, the features of a database, the features of a tweet. Every technological affordance also has constraints: a fix number of characters per tweet. Do the benefits of technology outweigh their constraints for learning in the classroom?
   - What is your opinion on the possibilities and limitations of technology for learning?

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