Writing Self-Efficacy and Performance Among Students in an Online Doctoral Program

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ABSTRACT

Writing an argument is an essential skill for doctoral students in achieving academic and occupational success. Writing an argument effectively requires the ability to use correct writing mechanics, but doctoral students may tend to think their writing mechanics are better than they are, and their ability to write an argument effectively may be compromised as a result. At one university, this gap between student perceptions of their ability to write and their writing performance appeared to exist. A study was conducted to determine whether there was a mismatch between perceived writing self-efficacy and writing performance. Study results showed that higher perceived writing self-efficacy seems to be associated with certain mechanical writing errors, including wordiness and inaccurate grammar. Knowing this mismatch between writing self-efficacy and writing performance may exist is important (1) for students in terms of their awareness and (2) for tertiary educators to better target tertiary writing interventions.

KEYWORDS

Doctoral Students, Graduate Students, Perceived Writing Self-Efficacy, Writing, Writing Performance

INTRODUCTION

Writing an argument is an essential skill for doctoral students in achieving academic and occupational success. First, writing is the basis on which their degree is awarded. The ability to write well is one of the most important tools for success for graduate research candidates (Badenhorst & Guerin, 2015; Simpson et al., 2016). Second, writing in a grammatically correct, clear, correctly punctuated, and well-structured manner is an essential skill for any professional (Ferguson, 2009; Law & Baer, 2012; Varelas et al., 2015), whether they work in academia or industry. Therefore, graduates of doctoral programs higher education institutions should be expected to demonstrate clear and effective mastery of the mechanics of writing (Duchardt et al., 2016) to package and deliver their words effectively. Students are finding more and more access to artificial intelligence tools that are intended to improve

DOI: 10.4018/IJITLHE.304080 *Corresponding Author

writing, but if a student feels they are a good writer (whether or not they are), will they utilize available resources to improve?

LITERATURE REVIEW

Writing grammatically correct, clear, correctly punctuated, and well-structured text is a valuable skill. However, employers reportedly have a difficult time finding qualified candidates who can write clearly, which is an essential skill for graduates in the 21st Century (Holland, 2013; Schartel et al., 2019). Interestingly, "academic writing…is gaining recognition as an area that all students need support in, regardless of linguistic or educational background" (Wilmot, 2018, p. 258). In 2006, the Chronicle of Higher Education published a study indicating that college professors felt students were unprepared for college-level writing. If students entering college have limited writing skills, students' likelihood of success in academic writing activities is low (Sanoff, 2006). Poor writing skills have implications for students in terms of their professional careers. Schartel, Dunn, and Lane (2019) found, in their research, that supervisors felt recent graduates were ill prepared in terms of writing skills, grammar, and proofreading skills. In this same study, supervisors rated proofreading and correct grammar at a higher importance than interns (Schartel et al., 2019).

Some researchers have related the lack of writing skills to the proliferation of social technologies and casual communication formats such as texting and instant messaging. In particular, grammatical mistakes in formal writing have been significantly related to the use of social technologies (Purcell et al., 2013; Shafi et al., 2010; Turner, 2009). As students tend to use these same casual communication formats in writing assignments, providing students with feedback on their writing is necessary for improvement. The form of this feedback can vary, including writing improvement strategies and online grammar checkers. With this said, understanding the extent of poor writing among doctoral students, perceived writing self-efficacy, writing improvement strategies, and online grammar checkers can offer an option to students as a means of assessing the accuracy of their written work.

Extent of the Problem in Doctoral Students

Proficiency in basic writing composition is an expectation of doctoral students. It is also generally assumed that these students will already be relatively skilled writers when they enter a doctoral program. Yet, many doctoral students lack writing abilities, even though a written culminating project (i.e., dissertation, thesis, or capstone) is the primary medium of assessment in a doctoral program. In the online environment, a lack of writing skills is a particularly troubling issue since writing is the primary communication medium. Even online course discussions are done in writing. In other words, "students writing abilities become magnified in digital submissions" (Duchardt et al., 2016, p. 467).

Research has shown that undergraduate college students can lack strong writing skills (Carnes et al., 2015) and that grammar skills may even decline among some undergraduate college students during the time they are in college (Willis et al., 2012). Where undergraduate and graduate students are expected to achieve a mastery level between 90-100% in their writing of complete and complicated sentences, Duchardt et al. (2016) found that 60% of undergraduate and graduate students did not write complete sentences, 73% could not master complicated sentences, and 60% could not master punctuating complicated sentences correctly. In fact, it is possible that poor writing skills among doctoral students originate at an early age. Writing is not a part of the national reform movement in the United States and is not emphasized in secondary schools (Graham, 2009). In 2011, the Nation's Report Card indicated that only 24% of students in grades 8 and 12 were proficient in writing (National Center for Education Statistics, 2011). This 2011 assessment was the most recent of this kind for which results are provided online. Furthermore, English composition classes at institutions of higher education tend to focus on content and creativity rather than essential writing skills such as structure and grammar (Fields & Hatala, 2014). Deductively speaking, poor writing mechanics preclude one's

ability to write strong arguments since writing mechanics are the foundational requirements needed to deliver complex ideas effectively.

Perceived Writing Self-Efficacy

Perceived self-efficacy was first brought to light in 1977 by Bandura et al. (1999) and refers to an individual's belief (or confidence) in their ability to perform to achieve attainment of a particular task. Kruger and Dunning further researched this concept of perceived self-efficacy in 1999. Their findings suggested that individuals are not always able to judge their competence accurately and often rate their skills higher than what they are in reality. Additionally, Gignac and Zajenskowski (2020) proposed that the reason for the inability to accurately judge one's competence "is because of the relative absence of the ability" itself (p. 2). Because the environment does not always provide accurate feedback regarding a skillset, the perception of being highly skilled when not, often goes uncorrected (Carter & Dunning, 2008). To effectively improve a skillset, direct feedback is necessary. Indeed, direct feedback points out where one is failing or can improve when it has not been self-evident to the individual (Carter & Dunning, 2008). Given the importance of direct feedback and perceived writing self-efficacy in improving one's skills, strategies for providing direct feedback should be explored so that students can more efficiently align their perceived writing self-efficacy with their actual writing skills.

More specifically, writing self-efficacy is one's belief in their writing competence (Huerta, et al., 2017) and could be divided into various dimensions based on different aspects of the act of writing. Several studies of undergraduate students have shown that writing self-efficacy predicts writing performance (Sanders-Reio et al., 2014; Shell et al., 1989). Writing ideation self-efficacy would be one's confidence in their ability to generate ideas, and writing self-regulation self-efficacy would be one's confidence in their ability to direct themselves successfully through writing's many dimensions (Bruning et al., 2013). Writing mechanics, or conventions, self-efficacy would be one's confidence in using correct writing mechanisms or conventions (e.g., spelling, punctuation, and sentence structure). However, as Dunning (2011) pointed out, "that act of judgment [of skills] relies on the same set of skills as the act of forming a grammatically correct sentence in the first place" (p. 261). While writing mechanics such as correct spelling, punctuation, capitalization, and sentence structure may be a low-level dimension of writing, they are a key to successful writing (Bruning et al., 2013).

Providing students with strategies for building their confidence in writing academically could increase their writing self-efficacy (Huerta et al., 2017). For example, giving students multiple opportunities to receive immediate feedback allows them to be able to evaluate their level of competence more accurately as they continually self-assess their work. The ability to self-assess is a skill that has been shown to improve the more one does it (Sitzmann et al., 2010). Additionally, as shown by Quigley (2013), "meaningful feedback matters" (p. 597); if students receive feedback from a perceived credible source, it is likely that this will influence the accuracy of their perceptions about their level of competence. This aligns with one of Bandura et al.'s (1999) theoretical sources of self-efficacy beliefs: persuasion from credible sources. Grammar feedback is needed to achieve academic success (O'Neill & Russell, 2019), and it has been shown that the more immediate the feedback the better (Carter & Dunning, 2008). Overall, the interrelationship among perceived writing self-efficacy, writing performance, and writing feedback merits further exploration and may provide insights into how to focus tertiary interventions better.

Writing Improvement Interventions

Doctoral writing pedagogy has included a variety of interventions at the tertiary level. Interventions have included university writing centers (A. T. Still University, 2019; Northwestern State University, 2014; Purdue University, 2012), writing coaches (Rice-Bailey & Baker, 2017), peer facilitated writing groups (Ferguson, 2009; Kumar & Aitchison, 2018; Wilmot, 2018), doctoral writing advisors (Chatterjee Padmanabhan & Rossetto, 2017), writing support circles (Larcombe, et al., 2007;

Plakhotnik & Rocco, 2012), grammar and mechanics review courses (Ruppert, et al., 2012), peer tutoring (Waring, 2005), and peer writing coaches (Beard et al., 2020). These have been successful in assisting graduate students in developing their writing skills and providing communities of practice (Kumar & Aitchison, 2018). In particular, Ruppert et al. (2012) showed that a hybrid online/classroom writing course designed for graduate students to help them detect lower-order writing errors was effective in improving their awareness of lower-order errors. Even though these interventions have been successful, due to the time constraints these types of one-on-one interactions with students represent, it may be difficult to provide comprehensive feedback regarding the technical aspects of a student's writing (Cavaleri & Dianati, 2016; Narita, 2012).

ONLINE GRAMMAR CHECKERS

Another approach is to provide learners with opportunities to check their writing by providing immediate feedback via a computer program as they engage in writing (Stizman et al., 2010); online grammar checkers may be such a potential self-assessment tool.

Online grammar checkers (e.g., Grammarly, PaperRater, Grammark, After the Deadline, and LanguageTool), as they are commonly referred to in the literature, may provide a more scalable way to help students improve their grammatical accuracy (Cavaleri & Dianati, 2016). Word-processing software programs (e.g., Microsoft Word) with built-in grammar checkers have served in this capacity since the mid-1980s, but they can have questionable accuracy (Cavaleri & Dianati, 2016). Some online grammar checkers flag not only grammar but also style and vocabulary usage, which require artificial intelligence due to the intricacies of language (Cavaleri & Dianati, 2016) that word processors may not be able to identify. Grammarly generally appears to outperform Microsoft Word (Enderle, 2020). Additionally, John and Woll (2020) showed that Grammarly outperformed Microsoft Word in number of composition errors flagged, appropriateness of proposed replacement forms, and accuracy in flagging an inappropriate form.

Research on online grammar checkers is limited. In one study of 18 undergraduate and graduate students in Australia, most students reported that Grammarly was useful and easy to use (Cavaleri & Dianati, 2016). Specifically, most students felt the suggestions provided by Grammarly were helpful in improving their paper, 50% felt that the feedback from Grammarly helped them achieve a better grade, and 94% rated Grammarly a 4 or 5 on a scale of 1 (not useful at all) to 5 (extremely useful). Most students also noted that it improved their writing and understanding of grammar rules and gave them more confidence in their writing. However, the authors of the study did not report whether or not the students' writing skills improved. According to a survey conducted by Grammarly, 70% of students reported that Grammarly increased their level of writing confidence, and 84% reported that Grammarly improved their grades in general (PR Newswire, 2014). However, again, these are student perceptions and not actual writing performance measures.

METHODS

This quantitative cross-sectional study used a correlational research design to answer the following research question: "How is perceived writing self-efficacy associated with writing performance among students currently enrolled in their first term of an online EdD program?"

Quantitative data measuring each student's perceived writing self-efficacy were collected using a survey from students who consented to be in the study between the third and sixth week of their first term in an online EdD program. Students completed the electronic survey directly upon giving informed consent to participate in the study and were then provided with the premium version of Grammarly for their use while in the EdD program. The premium version of Grammarly differs from the free version of Grammarly in that, in addition to what the free version provides (i.e., writing suggestions in spelling, grammar, punctuation, and conciseness), it also provides writing suggestions in style, tone,

and clarity (Grammarly, 2015, 2022). Quantitative data measuring writing performance were collected for each student participant from a report generated by Grammarly for their first assigned written paper in the first required course they took in the program. This assigned a four to five page written paper was about the strengths, weaknesses, and appropriate use of certain adult learning theories in higher education. The assignment was completed and submitted by students before consenting to participate in the study and completing the perceived writing self-efficacy survey. Statistical testing was performed on these data to determine if and how perceived writing self-efficacy and writing performance were related to each other. Approval by the institutional review board at the institution where the study was conducted was received before implementing the study.

SAMPLE

A convenience sampling method was used to email all new students (N = 103) beginning the online EdD program at a private university in the United States in the fall and spring semesters of the 2019-2020 academic year and the fall semester of the 2020-2021 academic year. These students were emailed via their university's email address starting at the beginning of the third week of each term, with reminders sent out once during each of the fourth and fifth weeks of each term. Of the 103 students emailed, 27 students (26%) consented to participate and completed the perceived writing self-efficacy survey. Of these 27 students who participated in the study, English was the first language for all of them, 19 (70%) were White, six (22%) were Black or African American, one (4%) was White, Black or African American, one (4%) was American Indian or Alaska Native, 24 (89%) were females, and three (11%) were males. Their writing performances were also assessed using the first written paper assignment they had submitted in the first required course they had taken in the EdD program, and prior to taking the perceived writing self-efficacy survey. This written paper assignment was part of their regular coursework.

DATA COLLECTION

Students who consented to participate in the study were provided with the perceived writing self-efficacy survey, with the survey being generated using Qualtrics software, a cloud-based platform for creating and distributing web-based surveys. Study participants completed the 7-item survey in an average of 2.76 minutes (after two outliers of 9,960 hours and 92.8 hours were removed). Additionally, data measuring writing performance were collected from the Grammarly report of the written paper assignment for each participant.

INSTRUMENTATION

Since self-efficacy is a domain-specific construct, scales measuring self-efficacy "must be tailored to the particular domain of functioning that is the object of interest" (Bandura, 2006, p. 308). The perceived writing self-efficacy survey for the current study was developed by adapting the Self-Efficacy for Writing Scale (SEWS) (Bruning et al., 2013) obtained from PsychTESTS, a database of the American Psychological Association, where it was stated that use of the scale does not require permission for educational purposes. The SEWS was partially used and partially adapted so that all survey items for the current study aligned explicitly with corresponding writing performance measures provided by Grammarly for any given written paper. This allowed the authors to compare perceived writing self-efficacy in certain areas with their writing performance in those areas. The resulting survey included three of the existing SEWS items (i.e., "I can spell my words correctly," "I can punctuate my sentences correctly," and "I can write grammatically correct sentences"). Four items were created in parallel with the way items are worded in the SEWS survey items (i.e., "I can think

of appropriate words to use when writing," "I can use proper sentence structure," "I am able to take information from multiple sources and put it into my own words," and "I can write sentences clearly"). Each of the seven survey items were measured on a 5-point Likert scale with the following scoring options: 1 = Always, 2 = Most of the time, 3 = About Half the Time, 4 = Sometimes, 5 = Never.

Writing performance for corresponding perceived writing self-efficacy items was measured using item-total error counts (i.e., Grammarly criterion) for the written paper assignment. Table 1 presents the perceived writing self-efficacy survey items that aligned with specific criteria scored by Grammarly for written work. For each perceived writing self-efficacy survey item, the authors defined the item-total error count as the sum of all of the Grammarly criteria error counts that aligned. Since the authors were unable to align the perceived writing self-efficacy survey item of "I am able to take information from multiple sources and put it into my own words" with a Grammarly criterion, there was no total corresponding item-total error count for this survey item.

DATA ANALYSIS

Frequency and percent of responses to each perceived writing self-efficacy survey item and mean, standard deviation, and minimum and maximum of the number of words are reported. Additionally, total errors per paper and error rate (number of errors divided by total number of words) for each criterion, item-total, and grand-total are provided. For item-total error rates, summary statistics are also reported by the respective item self-efficacy rating to assess whether the bulk of students accurately determined their level of competence. For each item, Kruskal-Wallis and post-hoc Wilcoxon Mann-Whitney tests were used to assess the association between item-total error rates and self-efficacy rating. For two items ("I can think of appropriate words to use when writing" and "I can spell words correctly"), the authors collapsed the bottom two response categories of "sometimes" and "about half the time," because data were sparse. Analyses were conducted using SAS version 9.4 software. A $P<0.05$ was considered statistically significant.

RESULTS

Frequency and percent of responses to each perceived writing self-efficacy survey item are reported in Table 2. For each perceived writing self-efficacy item, the majority (70% [19/27] to 89% [24/27]) responded with "most of the time." For 44% (12/27) of participants, their response did not change across the six perceived writing self-efficacy items. The mean ± Standard Deviation (mean (SD)) number of words per paper was 1190 (380, range = 250-1732), and the mean (SD) number of total errors per paper was 195 (73, range = 32-333).

The mean error rate, errors per 1000 words, for each Grammarly criterion, item-total, and grand total is reported in Table 3. The mean (SD) total error rate was 161 (29, range = 125, 255). The highest mean (SD) error rates were found in the Grammarly criteria of wordy sentences (12.4 [3.8]), word choice (10.1 [3.6]), and passive voice misuse (9.7 [4.3]).

The mean error rate for each item-total by the respective item self-efficacy rating is reported in Table 4. The error rates differed by the self-efficacy rating for "I can write grammatically correct sentences" ($P = 0.02$). The error rate among those who responded "most of the time" was higher than those who responded "always" ($P = 0.03$) and "about half the time" ($P = 0.0495$). No differences in error rates between self-efficacy responses were found among the other self-efficacy items (all $P>0.12$).

Table 1. Perceived writing self-efficacy survey items aligned with specific criteria scored by Grammarly for written work

Grammarly Criteria	Item 1: Grammar	Item 2: Punctuation	Item 3: Word choice	Item 4: Spelling	Item 5: Sentence structure	Item 6: Clarity
Correctness						
Punctuation in compound/complex sentences		X				
Wrong or missing propositions	X					
Misspelled words				X		
Pronoun use	X					
Determiner use (a/an/the/this, etc.)	X					
Confused words	X					
Faulty tense sequence	X					
Faulty subject-verb agreement	X					
Comma misuse within clauses		X				
Improper formatting					X	
Conjunction use	X					
Incomplete sentences	X					
Closing punctuation, misuse of semicolons, quotation marks, etc.		X				
Incorrect noun number	X					
Misplaced words or phrases					X	
Mixed dialects of English	X					
Incorrect verb forms	X					
Modal verbs	X					
Clarity						
Wordy sentences			X			
Intricate text						X
Passive voice misuse	X					
Hard-to-read text						X
Engagement						
Word choice			X			X
Monotonous sentences						X
Delivery						
Colloquialisms			X			
Tone issues			X			

Table 2. Number and frequency of responses to each perceived writing self-efficacy survey item (N = 27)

No.	Survey Item	Response, N (%)				
		Never	Sometimes	About Half the Time	Most of the Time	Always
1	I can write grammatically correct sentences.	0 (0)	0 (0)	4 (15)	21 (78)	2 (7)
2	I can punctuate my sentences correctly.	0 (0)	0 (0)	4 (15)	24 (89)	2 (7)
3	I can think of appropriate words to use when writing.	0 (0)	1 (4)	4 (15)	21 (78)	1 (4)
4	I can spell words correctly.	0 (0)	1 (4)	4 (15)	19 (70)	3 (11)
5	I can use proper sentence structure.	0 (0)	0 (0)	4 (15)	19 (70)	4 (15)
6	I can write sentences clearly.	0 (0)	0 (0)	4 (15)	19 (70)	4 (15)
7	I am able to take information from multiple sources and put it into my own words.	0 (0)	2 (7)	5 (19)	18 (67)	2 (7)

DISCUSSION

Overall, high-perceived writing self-efficacy is not reflected in a high level of writing performance among students currently enrolled in their first term of an online EdD program. In the current study, higher perceived writing self-efficacy was associated with writing sentences that were more verbose and grammatically incorrect sentences. The better students tended to believe their writing was, the less clear and the less grammatically correct their writing was. However, the more students believed they could write grammatically correct sentences, the less they incorrectly pluralized nouns. Except in the instance of noun pluralization, results generally reflect Kruger and Dunning's (1999) findings that individuals may rate their skills higher than what they really are.

Given the scalability of online grammar checkers in identifying errors in the mechanics of written material (Cavaleri & Dianati, 2016), the results of this study indicate that such software programs can be useful in helping students recognize they may not be using grammar and other mechanics of writing as well as they believe, and in encouraging them to seek writing assistance at the tertiary level.

The results of the current study may be limited if study participants' answers to the perceived writing self-efficacy survey items were not accurate. For 44% of participants, it is concerning that their response did not change across the six perceived writing self-efficacy items, potentially indicating a limitation in that either some participants may not have given much consideration to each survey item and/or they erroneously believe they have equal ability in all writing aspects. However, this could also be the result of a lack of mastery of writing skills (Duchardt, et al., 2016). Future research should use a richer perceived writing self-efficacy scale that is validated through exploratory factor analysis and assessed for internal consistency. Additionally, these trends in the findings should be explored further with a larger data set to confirm this study's findings. It may also be prudent to examine students over time to determine the association between use of an online grammar checker and improvement in writing performance, as well as improvement in perceived writing self-efficacy, to provide any further evidence of Usher and Pajares' findings (2008).

Table 3. Mean error rates by Grammarly criterion

Perceived Writing Self-Efficacy Item	Grammarly Criterion	Mean	Standard Deviation (SD)	Min, Max
Grammar	Wrong or missing propositions	1.4	1.34	0, 5.36
	Pronoun use	0.52	1.14	0, 5.67
	Determiner use (a/an/the/this, etc.)	3.5	3.0	0, 12.8
	Confused words	1.17	1.01	0, 3.18
	Faulty tense sequence	0.13	0.4	0, 1.63
	Faulty subject-verb agreement	0.98	1.21	0, 4.5
	Conjunction use	0.023	0.117	0, 0.608
	Incomplete sentences	0.33	0.52	0, 1.5
	Incorrect noun number	1.2	2.0	0, 9.8
	Mixed dialects of English	0.24	0.76	0, 3.46
	Incorrect verb forms	0.67	0.81	0, 3.06
	Modal verbs	0.05	0.17	0, 0.7
	Passive voice misuse	9.7	4.3	3.3, 20.1
	Item-Total	47.1	8.6	35.5, 75
Punctuation	Punctuation in compound/complex sentences	6.7	4.0	0, 18
	Comma misuse within clauses	3.1	2.9	0, 9.5
	Closing punctuation, misuse of semicolons, quotation marks, etc.	0.74	0.98	0, 3.26
	Item-Total	10.2	5.8	0, 21.7
Word Choice	Wordy sentences	12.4	3.8	3, 20.3
	Word choice	10.1	3.6	0.6, 17.6
	Colloquialisms	0.73	0.91	0, 3.83
	Tone issues	0.04	0.16	0, 0.59
	Item-Total	23.3	5.7	12.4, 35.2
Spelling	Misspelled words	3.5	4.1	0, 18.5
Sentence Structure	Improper formatting	0.97	1.48	0, 6.35
	Misplaced words or phrases	0.31	0.48	0, 1.68
	Item-Total	1.14	1.46	0, 6.35
Clarity	Intricate text	6.0	2.6	0.9, 11.2
	Hard-to-read text	2.3	2.0	0, 9.8
	Monotonous sentences	0.11	0.31	0, 1.11
	Item-Total	9.2	3.7	1.6, 16.5
	Grand Total	161	29	125, 255

Table 4. Grammarly item-total error rates by perceived writing self-efficacy item and student-perceived assessment (N = 27)

Self-Efficacy Item	About Half the Time or Less				Most of the Time				Always				
	N	Mean	SD	Min, Max	N	Mean	SD	Min, Max	N	Mean	SD	Min, Max	*P*
Grammar	4	41.5	5.4	35.6, 46.3	21	49.1	8.5	36.5, 75.0	2	37.2	1.7	36.0, 38.4	.02
Punctuation	1	12.2			24	10.8	8.5	3.2, 21.7	2	2.2	3.2	0.0, 4.5	.12
Word Choice	5[a]	21.4	5.2	12.8, 26.9	21	23.5	5.9	12.4, 35.2	1	28.0			.51
Spelling	5[a]	3.5	3.7	0.0, 7.9	19	3.6	4.6	0.0, 18.5	3	2.5	1.3	1.6, 4.0	>.99
Sentence structure	4	1.3	1	0.0, 2.3	19	1.1	1.6	0.0, 6.4	4	1.1	1.4	0.0, 2.9	.77
Clarity	4	9.0	4.9	5.4, 16.2	19	9.2	3.6	1.6, 16.5	4	9.3	4.3	4.0, 13.4	.94

Error rate defined as number of errors per 1000 words.

P-values resulting from Kruskal Wallis tests.

5[a] participants included four who perceived their ability to spell words correctly was "about half the time" and one who responded "sometimes."

Another limitation to this study is Grammarly's lack of precision in identifying certain errors, including hard-to-read text and passive voice misuse. Regarding hard-to-read text, in one of the papers assessed by Grammarly for the current study, Grammarly identified the following text as hard-to-read: "As students grow in age and experience, the cognitivist and constructivist approaches are more relevant due to greater personal and professional experiences." This text is not considered hard-to-read in the context of doctoral level writing, rendering Grammarly's flagging of this text as hard-to-read inaccurate. These inconsistencies prompted the authors to review the Grammarly report for each study participant's paper for these particular criteria. The primary author of the current study conducted an independent rating of each item flagged as "hard-to-read text" in the Grammarly report for each study participant to determine whether those items were accurately flagged based on expectations for doctoral level writing. Upon review, among the total 83 hard-to-read text errors flagged by Grammarly for all study participants only 24% of errors flagged as hard-to-read text seemed to belong in that category.

All these correctly flagged errors contained a grammatical issue or a wording error that impeded the reader's comprehension of the message. For example, the sentence, "In conclusion, behaviorism, cognitivism, and constructivism can concurrently be applied to creating effective instructional designs in higher education, when instructors can skillfully connect the theory and the methodology stemming from it, to the content of the materials, the teaching environment, and more importantly the learner" was correctly flagged as hard-to-read. While Grammarly may be imprecise in its flagging of hard-to-read text, research has shown that it is relatively precise in its flagging of composition errors (i.e., verb forms, subject-verb agreement, plural nouns, word forms, and relative clauses) (John & Woll, 2020). This was also verified for the current study based on a random selection of errors for each error category.

Regarding the misuse of passive voice, Grammarly flags any use of the passive voice as passive voice misuse; however, according to the *Publication Manual of the American Psychological Association: the official guide to APA style* (APA, 2020), not all use of the passive voice is unacceptable. Although "many writers overuse the passive voice…it is acceptable in expository writing when focusing on the object or recipient of the action rather than on the actor" (APA, 2020,

p. 118), such as when describing methodology. Grammarly's generation of errors for complex, yet accurate, text and also for acceptable uses of the passive voice is a limitation of the results of this study. The use of Grammarly for assisting students with direct feedback on their writing mechanics should take these limitations into account. Future research should continue to evaluate the accuracy of Grammarly's identification of errors for each criterion.

Writing feedback is clearly essential to writing improvement (Carter & Dunning, 2008; O'Neill & Russell, 2019; Sitzmann, et al., 2010), and tertiary interventions provide opportunities for writing improvement (A. T. Still University, 2019; Chatterjee Padmanabhan & Rossetto, 2017; Ferguson, 2009; Kumar & Aitchison, 2018; Larcombe, et al., 2007; Northwestern State University, 2014; Plakhotnik & Rocco, 2012; Purdue University, 2014; Rice-Bailey & Baker, 2016; Ruppert, et al., 2012; Waring, 2005; Wilmot, 2018), increase motivation to improve writing (Ferguson, 2009), and increased confidence in writing (Ferguson, 2009; Larcombe, et al., 2007). Even with the limitations of the online grammar checker used in this study, the use of online grammar checkers may still help both students and those in the tertiary intervention space to better target writing improvement interventions. Similar to Cavaleri and Dianati's (2016) findings, the findings from this study indicate that using a tool such as an online grammar checker may allow for a more efficient self-assessment of one's writing ability to use in conjunction with tertiary interventions. This would allow more time for tertiary educators to help students with higher-level writing by mitigating a lack of time for addressing lower-level writing issues such as grammar. Given the mechanic nature of spelling, punctuation, and grammar, online grammar checkers (that are driven by AI, or machine intelligence) seem to be an additional tool that students could use. Other components of writing, such as lack of argumentation, etc., may be best left to tertiary intervention.

CONCLUSION

Since doctoral students may think they write better than they do, a potential first step to improving writing among doctoral students may be to identify writing error patterns for both the student and tertiary educator using an online grammar checker (e.g., Grammarly), at least for writing mechanics for which a given online grammar checker is known to identify errors accurately. This self-directed approach on the part of the student may facilitate a more efficient learning process for the student in that they become aware of their writing patterns. Additionally, for the tertiary educator, this approach may allow for a more efficient assessment of where a student is in terms of the mechanical aspects of their writing. Using an online grammar checker may empower students to become curious about their own writing in a relatively neutral way and to seek guidance from tertiary educators to further improve their writing with a more targeted approach. This tandem writing improvement strategy may allow for a more scalable effort to improve writing among doctoral students, better preparing them for academic and occupational success.

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