Research Note

Going Beyond "That was fun": Measuring Writing Motivation

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Structured Abstract

- **Aim**: The use of validated measures of writing motivation is imperative to improving our understanding and development of interventions to improve student writing utilizing motivation as a mechanism. One of the most important malleable factors involved in improving student writing is motivation, particularly for secondary school students. This research note systematically examines the measures of writing motivation for students in grades 4–12 used by researchers over the last ten years and summarizes their psychometric and measurement properties to the extent provided in the underlying literature. This collection of measures and their properties and features is designed to make researchers more aware of the various options and to point out the need for additional measures.
- **Problem Formation**: Writing is crucial to college and career readiness, but adolescents are inadequately prepared to be proficient writers. Grades 4–12, once students have generally learned the basics of writing, are when students begin to develop more fluent and sophisticated writing abilities. They turn from learning to write to writing to learn, and writing is increasingly done across content areas and in multiple genres. Unfortunately, writing is a difficult skill to master, and students in middle and high school suffer from declining motivation. The ability to measure changes in writing motivation at this developmental stage will allow researchers to more effectively design and assess writing interventions. What are the current, validated measures of writing motivation available for researchers working with adolescents? Motivation research has grown significantly in the last ten years, and a variety

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of motivation constructs (e.g., self-efficacy, expectancy-value) and related measures are used across the field. In addition to the variety of motivation constructs used in research today, researchers require domain- or context-specific measures of motivation (e.g., science motivation) to enable an accurate understanding of the role of motivation in achievement. Despite increased developments in both motivation and writing research over the past few decades, the intersection of these two fields remains relatively unexplored (Boscolo & Hidi, 2007; Troia, Harbaugh, Shankland, Wolbers, & Lawrence, 2013).

- **Information Collection:** A thorough literature search was done to find measures of writing motivation used for this age group within the last 10 years. Psychometric properties, to the extent available in the underlying articles, of each measure are described.
- **Conclusions:** Ultimately, seven discrete measures of adolescent writing motivation were found, but only limited psychometric details were available for many of the measures. No "gold standard" measure was found; indeed, the measures utilized varied motivational constructs and rarely reported more than the Cronbach's alpha of the underlying instrument. Researchers need to carefully parse through the related motivation literature to understand the most likely constructs to be implicated in their intervention. They need to consider factors specifically related to their study, such as how stable the construct being targeted is developmentally, whether the term and type of intervention will be sufficient to make an impact on the students' motivation as suggested by the underlying motivational literature, and what the target of the intervention is. Appropriate motivational constructs to be measured will vary depending on the intervention and its anticipated theory of change.
- **Directions for Further Research:** Several underlying motivation constructs have been used in the measures described in this review, particularly self-efficacy. However, a number of important motivation constructs, such as interest and self-determination theory, were not captured by the measures found. This review of currently available measures will give researchers options when wanting to include validated measures of writing motivation in their studies and suggests that additional, validated measures are needed to adequately cover the relevant motivational constructs.

Keywords: measurement, motivation, secondary school students, writing, writing analytics

1.0 Aim

Students in the U.S. are not adept at writing, despite the importance of writing proficiency for college and career readiness (Applebee, 2011; Graham, 2012; Graham & Perin, 2007; Leu, Forzani, Rhoads, Maykel, Kennedy, & Timbrell, 2014; National Center for Education Statistics, 2012). Upper elementary and secondary students face increased writing demands, in multiple genres, across content areas, and with texts of greater complexity (CCSSI, 2018). At the same time, students face declining motivation as they progress into and through secondary school (Eccles & Roeser, 2011; Hidi & Boscolo, 2006; Wang & Pomerantz, 2009).

One of the most important malleable factors involved in improving student writing is motivation, particularly for secondary school students. Despite increased developments in both motivation and writing research over the past few decades, the intersection of these two fields remains relatively unexplored (Boscolo & Hidi, 2007; Troia, Harbaugh, Shankland, Wolbers, & Lawrence, 2013). An understanding of students' motivation as it relates to writing and achievement can shed light on the motivation-writing connection and the mechanisms by which interventions can positively affect writing achievement.

Given the fact that writing is understudied, particularly the writing of those who have moved beyond beginning writing but not reached proficient adult writing, we sought to understand and collect current measures of writing for this group. This collection of measures, and their properties and features, is designed to make researchers more aware of the various options and to point out the need for additional measures. Ultimately, we seek to answer the question: "What are the current, validated measures of writing motivation available for researchers working with adolescents?"

2.0 Problem Formation

2.1 Adolescent Writing

Writing is a crucial component of college and career readiness (Applebee, 2011; Graham, 2012; Graham & Perin, 2007; Leu, Forzani, Rhoads, Maykel, Kennedy, & Timbrell, 2014) and is central to academic language development, critical thinking, and development of reasoning in diverse content areas (Interseg. Comm. of the Academic Senates of the Calif. Community Colleges, the Calif. State Univ., and the Univ. of Calif., 2002). It is also an essential threshold skill for employment and promotion (Brandt, 2014; The Nat'l Comm. on Writing in America's Schools and Colleges, 2003, 2004). The challenge of improving students' writing to meet these needs stems from the fact that writing is a complex cognitive process, drawing on neurological, motor, cognitive, language, and visual processes.

Writing is a complex and highly challenging activity (Deane, 2011). It is not only a problem-solving process, but also a constructive process of transforming, formulating, and constituting new knowledge (Bazerman, 2011). Most learners struggle with the prerequisite coordination of multiple processes and linguistic conventions (Deane et al., 2008; DeBono, Hosseini, Cairo, Ghelani, Tannock, & Toplak, 2012; De La Paz & Graham, 2002).

According to Flower and Hayes (1981), writing is composed of planning, translating, and reviewing and revising. During the planning phase, writers form an internal representation of the knowledge that will be used in writing by using sub-processes like generating and organizing ideas. During the translation phase, writers generate written text, which involves syntactic and lexical skills as well as motor skills and working memory. Finally, during the reviewing and revising phase, writers improve existing text. The Flower and Hayes model was developed to describe the writing of proficient, skilled adults. In later research with beginning and developing writers, Berninger et al. (1996) argued that (a) text generation (which itself has the components for producing words, sentences, and paragraphs) is distinguished from idea generation, and (b) planning is of two types: advanced planning prior to any translation and in-process planning of the next thing to write. They noted further that neurodevelopmental skills (such as orthographic coding) place constraints on writing development to varying degrees throughout the lifespan (Berninger et al., 1996). Skill development influences transcription, higher level linguistic and cognitive skills such as planning, translation of ideas into appropriate structures, and revision (Berninger & Swanson, 1994; Kim, 2015; Kim & Schatschneider, 2017). Ultimately, composition is a recursive process (Berninger et al., 1996; McCutchen, 1996): Writers cycle through the planning, translating, and reviewing multiple times, and these stages all interact with one another throughout the composing process (Flower & Hayes, 1981).

The ability of educators to improve students' writing skills is complicated in the adolescent population by the fact that students in middle school are at a heightened risk for declines in both student achievement and motivation (Eccles & Midgley, 1990; Wang & Pomerantz, 2009; Wigfield & Eccles, 2000), at the same time that the requirements for writing proficiency increase dramatically.

2.2 Motivation to Write

Writers make a multitude of decisions that drive and shape what is written. In effect, they exert agency over the writing process, as they must decide to undertake the task, determine how much effort to commit, formulate their intentions, determine their ownership over the writing task, decide what cognitive resources to apply, pick what tools to use, and consider how to distribute the tasks involved in writing (Zimmerman & Reisemberg, 1997; see also the domain model in White, Elliot, Peckham, 2015, writing motivation sits in the interpersonal zone). Graham (2018, p. 284) writes, "[t]hese decisions are fueled at the individual level by one's perceived value, utility, and interest in the writing task under consideration; emotional reaction to the writing tasks, motivations for engaging in it; knowledge about the topic, expectations for success, and beliefs about causes of success; dispositions for approaching new tasks, and identities as a writer." In turn, these motivational factors influence a writer's efforts and lead to the writer engaging in the writing processes using available cognitive resources (Graham, 2018). These motivational beliefs can foster or hinder writing; they influence whether a student engages in writing, how much effort the student expends, and what resources and tools are applied to the writing assignment (Eccles, 2005; Graham & Weiner, 2012; Wigfield, Tonks, & Kaudia, 2009).

Generally, motivation is increased when students attribute success to factors within their control, have high self-efficacy, are mastery goal oriented, and are intrinsically motivated; students' values and interests may also influence motivation (Kyllonen, Lipnevich, Burrus, & Roberts, 2014).

Writing is a self-directed process (MacArthur & Graham, 2016). Writers need to employ a variety of strategies to write successfully, regulating the writing process, their behavior, and the writing environment (MacArthur & Graham, 2016). In order to navigate that process, writers need to deploy cognitive monitoring, requiring actions and interactions among metacognitive knowledge, metacognitive experiences, goals (or tasks), and actions (or strategies; Flavell, 1979; cf. Deekens, Green, & Lobczowski, 2017). Cognitive monitoring is quite limited in young children, and still developing in adolescents (Flavell, 1979). Thus, improving students' cognitive monitoring abilities is one lever to improving their writing proficiency. Indeed, self-regulated strategy development is one of only three evidence-based practices recommended in the IES Practice Guide on secondary writing. The differences in students' self-regulation ability are, to some extent, developmental, and we see significantly increasing skill at processes such as planning, from grades 4 to 8 (MacArthur & Graham, 2016).

The demands of writing, including the use of cognitive monitoring and employment of appropriate strategies, require motivation to fuel the effort (MacArthur & Graham, 2016). Motivation impacts both immediate behaviors, such as the time and effort students put into a writing task, as well as more distal behaviors that have an accumulative effect on overall writing abilities (Harris, Graham, & Mason, 2006) and identities as writers (Hyland, 2002). Both "what is taught" and "how things are taught," including the design of academic tasks, can influence students' motivation for writing and overall learning (Ball, 2002; Eccles, 2011; Fredricks, Blumenfeld, & Paris, 2004).

Motivation research has grown significantly in the last 10 years and a variety of motivation constructs and related measures are used across the field. In addition to the variety of motivation *constructs* used in research today, researchers require *domain- or context-specific* measures of motivation (e.g., science motivation, or in this case, writing motivation) to enable an accurate understanding of the role of motivation in achievement. Not all of the prominent theories of motivation have been studied in connection with writing, however (MacArthur & Graham, 2016, citing a lack of research on writing and expectancy-value theory, Wigfield & Eccles, 2000; cf. Harackiewicz, Canning, Tibbetts, Priniski, & Hyde, 2016 for a randomized control trial of a utility value intervention in a college science course). We will briefly outline the three major constructs that have been studied in connection with writing to date.

The motivation construct most studied in connection with writing is self-efficacy (MacArthur & Graham, 2016). Self-efficacy relates to the student's judgement of her capability to organize and execute the actions needed to perform, in this case the ability to navigate the writing process successfully (MacArthur & Graham, 2016, citing Bandura, 1986; see also Kyllonen, Lipnevich, Burrus, & Roberts, 2014). In general, "self-efficacy is presumed to affect academic performance by increasing persistence, goal setting, management of work time, and flexibility in testing

problem-solving strategies" (Kyllonen, Lipnevich, Burrus, & Roberts, 2014, p. 10, citing Schunk, 1984 and Zimmerman & Bandura, 1994). In the context of writing, researchers have found that students' confidence in their ability to complete specific writing tasks predicts writing achievement scores (see Pajares & Valiante, 2006), with separate factors having been found for composing tasks (more predictive for high school students) and skills (more predictive for elementary school students; Pajares, 2007).

Achievement goal theory has been researched specifically in connection with writing (Elliot & Church, 1997; Pintrich, 2000). The ability to set goals for quantity, quality, or rate of performance is part of successful self-regulation (Kyllonen, Lipnevich, Burrus, & Roberts, 2014) necessary for writing, with goals helping students choose and execute appropriate writing strategies. Generally, researchers look at three goal orientations in achievement goal theory—mastery, performance-approach, and performance-avoidance goals (MacArthur & Graham, 2016). While performance goals may serve as powerful motivators, mastery goals are believed to be more effective for enhancing self-efficacy and self-regulation (Kyllonen, Lipnevich, Burrus, & Roberts, 2014). Writing researchers have tended to look at goal orientation in writing in conjunction with self-efficacy (MacArthur & Graham, 2016), in part because goals improve "self-regulation by affecting students' self-evaluations of progress, self-efficacy, and motivation" (Kyllonen, Lipnevich, Burrus, & Roberts, 2014, p. 11, citing Schunk, 1995). They have found positive correlations between mastery goals and self-efficacy and negative correlations between performance-avoidance goals and self-efficacy (MacArthur & Graham, 2016, citing Kauffman et al., 2010; MacArthur, Philippakos, & Graham, 2016; Pajares, Britner, & Valiante, 2000; and Pajares & Cheong, 2003).

Finally, writing researchers have looked at the construct of interest, both as a cognitive and affective concept. Hidi & Renninger (2006) have shown that situational (something in the environment or learning context, for example, in writing, the topic) and individual (a more enduring personal orientation) interest are related to academic performance, attention, and learning. Once again, this construct may be looked at in connection with self-efficacy, in that they tend to reinforce one another; we like to do what we think we are good at (MacArthur & Graham, 2016).

3.0 Information Collection

We began with a literature search of the academic databases Web of Science (WoS) and Academic Search Complete (ASC). The literature search initially used the keywords *writing and motivation* to find relevant literature within the past 10 years. Additional searches replaced the term *motivation* with *engagement* and *interest*. The initial searches found a total of 426 articles. We reviewed the abstracts of these articles to determine whether or not they fit the search criteria and, where necessary to accurately determine relevance, read the methods section of the article. Similar reviews were conducted with the additional searches, but the nature of the terms led to 1,548 articles (ASC, *engagement*), 51 articles (ASC, *interest*), 2,991 articles (WoS, *engagement*), and 11,148 articles (WoS, *interest*), so those searches were then restricted to educational research

in peer-reviewed journals. Ultimately, only nine articles met the inclusion criteria. Once this initial body of literature was found, *backward and forward* searching strategies were used (Webster & Watson, 2002). These strategies include *backward references searching*, e.g., searching through the referenced articles; *forward and backward authors searching*, e.g., using the initial body of literature to identify authors and then searching their other publications for related literature; *previously used keywords searching*, or examining keywords used by the articles yielded in the initial search; searching through *forward references*, or articles that cite the initial articles found (Levy & Ellis, 2006). The search was iterated until we were satisfied that we had found, and fleshed out, the primary measures of writing motivation used for this age group over the past decade (Webster & Watson, 2002).

The yielded articles were screened based on the following inclusion and exclusion criteria:

1. Quantitative measures of constructs related to theories of motivation (e.g., self-efficacy, attribution theory, expectancy-value theory, interest, engagement)
2. Measures specifically tied to writing, not English language arts or literacy
3. Studies involving 4–12th grade students
4. Native English language speakers (i.e., not second language learners)
5. Students not identified as being in special education
6. Studies within the last 10 years

Although we are very committed to serving the needs of all students and the principles of Universal Design for Learning (Rose & Meyer, 2002), we feel that the challenges and needs of English language learners and students with disabilities are more complicated and specific, thus better suited to a subsequent, more focused review. If we were to include this population, it would necessitate the inclusion of additional institutional and socio-cultural considerations that are beyond the current scope of this article. The focus on students in grades 4–12 relates to the relevant population for writing studies on preadolescent and adolescent writers who have transitioned from beginning writers, but are not yet proficient adult writers. In addition, these years track a period when school-related motivation begins to decline and thus, forms an important part of interventions designed to improve students' writing achievement (e.g., Eccles et al., 1983; Wigfield, Eccles, MacIver, Reuman, & Midgley, 1991; see discussion in Klassen, 2002).

4.0 Conclusions

Following is a brief summary of the measures found. Psychometric details, to the extent available in the underlying articles, are set forth in the Table of Measures in the Appendix. In the table, we begin by noting the motivation construct measured (e.g., self-efficacy) and the citation to the relevant study. For each study, we then note the grades investigated, the number of participants in the study (*N*), and the number of items in the measure itself (e.g., the Pajares, Johnson, & Usher [2007] study used a measure with 10 questions). The number of items gives

researchers an initial impression of how extensive the measure is, how long it might take to administer, and the extent to which it burdens the subjects. Underneath these items, we then indicate any subgroup of grades reported (e.g., elementary school results or middle school results) and any subscales reported (e.g., self-efficacy for idea generation, writing conventions, or self-regulation; shown in italics). For each of these subgroups, we note available information, including the number of participants in that subgroup and the number of items in the subscale. With respect to each measure or reported grade/subscale we provide:

- The alpha coefficient (this tells us how reliable, stable, or internally consistent the test is),
- The mean (and standard deviation) of the responses in the study and the range of responses,
- Any goodness of fit tests reported, specifically X^2, SRMR, CFI, RMSEA, or NFI.

Goodness of fit tests are done to determine how well a statistical model fits the data; all measures at least indicate the X^2. Each test has strengths and weaknesses, and researchers will note that some measures fare better under one test than the others. The Standardized Root Mean Square Residual (SRMR) is an absolute measure of fit and is defined as the standardized difference between the observed correlation and the predicted correlation. There is no penalty for complexity. CFI stands for the Comparative Fit Index, which is an *incremental* measure directly based on the non-centrality measure and carries a penalty for complexity. RMSEA, or Root Mean Square Error of Approximation, is an absolute measure of fit based on the non-centrality parameter which also carries a penalty for complexity. Finally, the Normal Fit Index (NFI) is also an incremental fit index with a penalty. Standardized parameter estimate ranges are shown in the final column if the study published the loadings of the items from a confirmatory factory analysis.

4.1 Self-Efficacy Measures

Self-efficacy is one of the most established measures used to evaluate motivation with respect to writing. Self-efficacy relates to a student's assessment of his ability to perform a task. Researchers have found that general self-efficacy is positively associated with effort on a task, persistence, good strategy use, and achievement (Troia, Shankland, & Wolbers, 2012). Self-efficacy is a domain-specific construct; thus, the more closely related the self-efficacy measure and the achievement measure, the better the construct validity of the motivation measure (Bruning et al., 2013).

The Pajares (2007) and Pajares, Johnson, & Usher (2007) study measures students' writing self-efficacy beliefs in grades 4–11, and the measure is based on Bandura's four hypothesized sources of self-efficacy. Writing self-efficacy was operationalized as students' judgments of their confidence that they possessed the various composition, grammar, usage, and mechanical skills appropriate to their academic level. The 10 questions asked students how sure they were that they could perform specific writing skills on a scale from 0 (no chance) to 100 (completely certain). The skills ranged from basic to more advanced, such as write simple sentences with good grammar to write a well-organized and well-sequenced paper that has a good introduction,

body, and conclusion. Construct validity appears strong for the items mentioned, but only a few items were noted in the article (Appendix A). The measure's factor structure and construct validation based on other scales of writing motivation are reasonable (Pajares, 2007; Appendix A), with alphas of .88 (elementary), .92 (middle school), and .91 (high school).

The self-efficacy scale developed by Bruning, et al. includes 16 items that assess self-efficacy for three dimensions of writing (ideation, conventions, and self-regulation; Bruning et al., 2013). Ideation focuses on writers' judgments of the availability, quality, and ordering of ideas; conventions on the mechanics and standards of general academic writing; and self-regulation on the ability to progress through the stages and processes of writing. The three-factor model of writing self-efficacy with middle school students was found to be acceptable (Bruning et al., 2013; Appendix A), with an SRMR of .05 and a CFI of .95, but had an RMSEA of .07. The middle school instrument had alphas of .90 (idea generation), .85 (writing conventions), and .88 (self-regulation). The instrument has also been administered to high school students, and confirmatory factor analysis confirmed the generalizability of the three-factor model. The high school study had alphas of .92 (idea generation), .86 (writing conventions), and .87 (self-regulation; Appendix A). Some of the items in this instrument were previously used in a study of college students (Dempsey, Bruning, & Kauffman, 2010).

Taking items from Bruning et al. (2013) and Graham, Berninger, and Fan (2007), a third self-efficacy instrument was created by Graham, Kiuhara, Harris, and Fishman (2017). This instrument was used to measure the writing motivation of 4th grade students looking at attitude toward writing and writing self-efficacy. Students' attitudes toward writing were assessed using a self-report instrument that consisted of five items, and each item was rated on a 5-point Likert scale (from *strongly disagree* to *strongly agree*). Students' self-efficacy for writing was assessed using a 13-item self-report instrument measuring students' perceived confidence in their ability to perform various tasks related to writing (11 items from Bruning et al., 2013, one modifying the time a student could write from 60 minutes to 35 minutes, plus two new items—*I can quickly think of the perfect word* and *I know when and where to use writing strategies*). Items were scored on a 100-point scale from *no chance* to *completely certain*. CFA confirmed that attitudes and self-efficacy were two separate constructs, and the measures had acceptable Cronbach's alphas (Graham, Kiuhara, Harris & Fishman, 2017; Appendix A, .87 for self-efficacy and .83 for attitude).

4.2 Goal Orientation

Goal theory looks at whether students have mastery or performance goals. Mastery goals are associated with a focus on learning the underlying content or skill and improving individual performance; performance goals are more focused on demonstrating relative levels of achievement to others (Troia, Shankland, & Wolbers, 2012). Performance goals may be separated into approach and avoidance goals, with a focus on displaying competence or avoiding a display of incompetence (Troia, Shankland, & Wolbers, 2012). Goal setting is part of self-

regulation, as noted above a key malleable factor of interest to researchers focused on improving writing.

Hamilton, Nolen, and Abbott (2013) developed motivation measures based on goal orientation that allow for developmental changes over time. A two-cohort longitudinal sample confirmed cross-grade stability of the measures beginning in grade 1 or 3 and continuing over five years. Researchers modified the original items from Nicholls's (1989) scales and wrote new items to measure writing mastery orientation, creative self-expression orientation, social communication orientation, writing ego orientation, and writing avoidance/alienation orientation. Students were asked about their reasons for learning and the response scale was a modification of a traditional Likert scale from *YES!!* to *NO!!* Convergent and discriminant validity were confirmed from correlations with scale scores on the ERAS (McKenna et al., 1995, as adapted for writing attitude by Graham, Berninger, & Abbott, 2012 and used with early elementary students), along with other measures. EFA and CFA showed the dimensionality of the scales and the stability over time (Appendix A). Alphas varied widely, with creative self-expression having an alpha of .59 (4^{th} grade, cohort 1), .78 (4^{th} grade, cohort 2), and .75 (5^{th} grade); ego avoidance, .71 (5^{th} grade); social communication, .77 (4^{th} grade, cohort 1), .75 (4^{th} grade, cohort 2), and .75 (5^{th} grade); ego, .78 (5^{th} grade); and work avoidance, .82 (4^{th} grade, cohort 1), .81 (4^{th} grade, cohort 2), and .88 (5^{th} grade). For grades 6 and 7, respectively, the study showed alphas for mastery of .73 and .78; creative self-expression of .81 and .82; social communication of .66 and .83; ego of .79 and .81; and work avoidance of .85 and .86 (Appendix A).

4.3 Multi-Dimensional Models

Multi-dimensional models are hybrids, combining measures that relate to multiple motivation theories in a unified instrument.

The Writing Activity and Motivation Scales (WAMS; Troia, Harbaugh, Shankland, Wolbers, & Lawrence, 2013) is a multi-dimensional measure of writing motivation. The WAMS includes 30 items related to writing motivation: self-efficacy (7 items); success attribution (4 items); task interest/value (5 items); mastery goal (4 items); performance goal (4 items); and avoidance goal (6 items; Troia et al., 2013). This measure analyzes many of the major constructs believed to be important for developing strong writing skills in adolescents (Troia et al., 2013), and many of the items were adapted from scales used by major motivation researchers in other content areas (Pajares, Hartley, & Valiante, 2001; Eccles et al., 1989; and Shell et al., 1995). Researchers intended to strike a middle ground between high item specificity/congruence and overly broad items. Using a convenience sample of students in grades 4–7 and 9–10, researchers examined the correlations between items within each dimension of motivation and between the arithmetic mean of items within a dimension with all other dimensions prior to conducting factor analysis. To test the reliability and structure of the WAMS, researchers examined the internal consistency reliabilities of the items hypothesized to form a particular scale, analyzed response patterns to identify anomalous patterns, and used CFA to identify latent variables within the data. They found skewness (as in several other studies), response-point inflation, and a number of

inconsistent response patterns, so further analysis was done using robust estimation techniques. When analyzing the self-efficacy, task interest/value, and attribution items, the data showed strong internal consistency and reliability when the items grouped together, but a decline when separately analyzed. After analysis of the CFA for the measurement model, four items were removed from the scale. Similarly, three items were removed from the achievement goal orientations scale after reviewing the CFA. Researchers should note that the reliability of the mastery goal scale changed across grades, and this scale was only reliable for grades 7 and above. In addition, the reliability estimates for some of the measures were not strong, particularly the internal consistency for the mastery goal orientation portion (Appendix A). The study showed alphas of .51 (mastery), .68 (performance), .67 (avoidance) and .88 (motivational beliefs; Appendix A).

A final multi-dimensional writing motivation scale contains 44 items that examine writing beliefs across four dimensions: adaptive cognition (valuing, self-efficacy, mastery orientation); adaptive behavior (persistence, planning, and task management); maladaptive behavior (disengagement, self-handicapping); and maladaptive cognition (uncertain control, failure avoidance, anxiety; Collie, Martin & Curtwood, 2016.). The researchers examined internal and external validity using descriptive statistics, reliability coefficients (ranging from .75 for valuing to .86 for planning, Appendix A), confirmatory factor analysis, and structural equation modeling. For external validity, they conducted multiple-indicator-multiple-cause (MIMIC) modeling and invariance testing with multi-group CFAs to determine the extent to which the psychometric properties of the instrument differed as a function of age, grade, and language background. The properties were largely comparable across these subgroups. As some indication of construct validity, the adaptive motivation and engagement factors were positively associated with, and the maladaptive factors were negatively associated with, the writing and literacy outcomes. Also of interest, additional writing-related outcomes included adapted versions of previously published scales for personal best goals for writing, writing adaptability, academic buoyancy, enjoyment, and participation.

5.0 Directions for Further Research

This paper has surveyed the research literature on quantitative measures of writing motivation for preadolescent and adolescent populations. No "gold standard" measure was found; indeed, the measures utilized varied motivational constructs and rarely reported more than the Cronbach's alpha of the underlying instrument. The instruments fail to come anywhere close to reporting the essential items set out in the Standards for Reporting of Diagnostic Accuracy Studies (STARD; Bossuyt et al., 2015). Increased analysis of the measurement qualities of these instruments would be valuable to the research community.

Researchers need to carefully parse through the related motivation literature to understand the most likely constructs to be implicated in their intervention. They need to consider factors such as how stable the construct being manipulated is developmentally, whether the term and type of intervention will be sufficient to make an impact on the students' motivation as suggested

by the underlying motivational literature, and what the target of the intervention is. Appropriate motivational constructs to be measured will vary depending on the intervention and its anticipated theory of change.

Several underlying motivation constructs have been used in the measures described in this review, particularly self-efficacy. However, a number of important motivation constructs were not captured by the measures found. In particular, two key missing constructs are especially suited to investigating digital writing environments—interest and self-determination theory. Many current writing interventions utilize technology and hypothesize increased student engagement or motivation because of the use of technology—presumably through increased interest—as one of the mechanisms improving achievement. Many researchers of digital environments also look to self-determination theory (see, e.g., Ryan & Deci, 2002) to motivate their interventions. Validated measures of competence, autonomy, and relatedness are needed to confirm that the interventions indeed increase these constructs. Since researchers are increasingly looking at writing in digital environments in order to harness their new affordances, both for the writers and the researchers, these measures are urgently needed. With the sense that digital environments may be particularly motivating for adolescent writers, researchers need to be able to measure the motivation constructs more precisely than the bulk of the current studies, which simply survey teachers or students to see if they prefer writing on paper or digitally, or use similar imprecise "measures." Researchers of digital writing are able to look closer at the details of student writing in automated ways, using cutting edge datamining techniques to analyze large quantities of data on digital writing. Progress is being made in looking at lexical and syntactic features of students' writing, even keystroke and pause time data (see, e.g., Almond, Deane, Quinlan, Wagner, & Sydorenko, 2012; Crossley, Roscoe, & McNamara, 2014; Tate, Warschauer, & Abedi, 2016). Researchers will be increasingly interested in combining large amounts of digital writing data and validated writing motivation measures to understand writing processes and interventions for this important, but understudied, age group.

We also note that despite the importance of sociocultural influences on writers, researchers working in the cognitive domain of writing have not sufficiently considered sociocultural variables in relation to motivation. Such work would enrich models for measuring writing motivation. For example, Kirkland and Jackson (2009) explored the literacy practices of 11–14-year-old Black males to better understand the way "coolness" was enacted and the nuances of their discourse. Measuring writing motivation for these adolescents almost certainly requires different questions, different language, than those developed for a White college undergraduate student a generation ago (the context in which most measures have been created and validated). As Gee writes, "people adopt different 'ways with printed words' within different sociocultural practices for different purposes and functions" (2001, p. 30). Our measures must be informed by these differences and calibrated to illuminate them; the constructs must be at a sufficient level of abstraction that they are well defined across the relevant populations being assessed, targeted, and construct-relevant without confounding factors (Mislevy, 2018). Much like historical intelligence measures assumed certain cultural norms that may not be shared across

socioeconomic groups, it is important that our motivation measures detect *motivation* for writing, not other factors—whether they be socioeconomic status, comfort level with technology, or ways of expressing their literacy practices. Motivational measures that take into account the complexity of symbolic structures, including sociocultural influences, would provide even more powerful levers for investigating and improving the writing of diverse adolescents.

The use of validated measures of writing motivation is imperative to improving our understanding, and development, of interventions to improve student writing utilizing motivation as a mechanism. In order to effectively evaluate the benefits of writing interventions and understand one potential mechanism for improved writing achievement, motivation, we need to choose appropriate motivation constructs and then accurately measure the changes in student motivation, rather than rely solely on teacher and student reports that writing on computers is "more fun." This review of currently available measures will give researchers options when wanting to include validated measures of writing motivation in their studies and suggests that additional, validated measures are needed to adequately cover the relevant motivational constructs.

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Appendix A

Table of Measures

Construct	Grades / *Subscale*	*N*	Items (#)	α	Mean (SD)	Range	X^2	SRMR	CFI	RMSEA	NFI	Parameter Range
Self-efficacy												
Pajares (2007); Pajares, Johnson, & Usher (2007)	Grades 4-11	1256	10			0-100						
	Elementary school			0.88	81.5 (14.4)							
	Middle school			0.92	75.0 (17.9)							
	High school			0.91	75.7 (16.3)							
Bruning, Dempsey, Kauffman, McKim & Zumbrunn (2012)			16			0-100						
	Middle school	697					439.15	0.05	0.95	0.07		
	Idea generation			0.90	70.46 (20.49)							
	Writing conventions			0.85	79.31 (16.44)							
	Self-regulation			0.88	61.31 (23.26)							
	High school	563					361.49	0.05	0.95	0.07		

Construct	Grades / *Subscale*	*N*	Items (#)	α	Mean (SD)	Range	X^2	SRMR	CFI	RMSEA	NFI	Parameter Range
	Idea generation			0.92	73.56 (18.99)							
	Writing conventions			0.86	84.39 (14.43)							
	Self-regulation			0.87	62.63 (23.02)							
Self-efficacy & Attitude												
	Liking writing			0.83			4.72	0.01	1.00	0.05		
Graham, Kiuhara, Harris, & Fishman (2017)	Grade 4	227					498.12	0.07	0.90	0.05		
	Self-efficacy		13	0.87	80.56 (16.04)	1-100						0.48-0.73
	Attitude		5	0.83	3.81 (0.99)	1-5						0.51-0.87
	Approach		10	0.77		1-5						0.43-0.70
Goal Orientation												
Hamilton, Nolen, & Abbott (2013)	Grades 2-7	234	18			Yes!!, Yes, ?, No, No!! (1-5)						
	Grades 4-5 (multiple cohorts)						120.76 / 120.63 / 124.87		0.95 / 0.94 / 0.95	0.05 / 0.05 / 0.05		
	Creative self-expression			0.59 / 0.78 /								0.30-0.77

Construct	Grades / *Subscale*	*N*	Items (#)	α	Mean (SD)	Range	X^2	SRMR	CFI	RMSEA	NFI	Parameter Range
				0.75								
	Ego avoidance			0.78 / 0.66 / 0.71								0.40-0.84
	Social communication			0.77 / 0.75 / 0.76								0.62-0.97
	Ego			0.78								0.56-0.88
	Work avoidance			0.82 / 0.81 / 0.88								0.44-0.83
	Grades 6-7 (multiple cohorts)						135.39 / 130.46		0.94 / 0.97	0.05 / 0.04		
	Mastery			0.73 / 0.78								0.56-0.85
	Creative self-expression			0.81 / 0.82								0.61-0.79
	Social communication			0.66 / 0.83								0.54-0.88
	Ego			0.79 / 0.81								0.63-0.88
	Work avoidance			0.85 / 0.86								0.62-0.80
Multi-dimensional Models												
Troia, Harbaugh, Shankland, Wolbers, & Lawrence (2012)	Grades 4-7, 9-10	618	30			0-100						

Construct	Grades / *Subscale*	*N*	Items (#)	α	Mean (SD)	Range	X^2	SRMR	CFI	RMSEA	NFI	Parameter Range
Achievement goal orientation							119.4		0.92	0.06	0.89	
	Mastery		4	0.51	66.24 (18.69)							
	Performance		4	0.68	67.80 (21.51)							
	Avoidance		6	0.67	61.35 (20.20)							
Motivational beliefs				0.88	67.3 (18.1)		190.5		0.94	0.07	0.92	
	Task interest / value		*5*		68.18 (22.25)							
	Internal attributions		*4*		72.67 (18.66)							
	Self-efficacy		7		56.72 (17.83)							
Collie, Martin, & Curwood (2016)	High school	781	44			1-7	2270.03		0.92	0.05		
	Self-efficacy			0.83	5.55 (1.07)							.70-.80
	Valuing			0.75	5.41 (1.02)							.54-.73
	Mastery			0.83	5.63 (.99)							.66-.81
	Persistence			0.82	5.19 (1.05)							.59-.81
	Planning			0.86	4.82 (1.23)							.64-.86

Construct	Grades / *Subscale*	*N*	Items (#)	α	Mean (SD)	Range	X^2	SRMR	CFI	RMSEA	NFI	Parameter Range
	Task Management			0.81	5.06 (1.13)							.65-.83
	Anxiety			0.81	3.97 (1.37)							.71-.74
	Failure avoidance			0.83	3.93 (1.44)							.50-.89
	Uncertain control			0.81	3.75 (1.37)							.66-.78
	Self-handicapping			0.80	2.89 (1.24)							.66-.80
	Disengagement			0.83	2.74 (1.24)							.62-.84