The Contributions of Writing to Learning and Development: Results from a Large-Scale Multi-institutional Study

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Conducted through a collaboration between the Council of Writing Program Administrators (CWPA) and the National Survey of Student Engagement (NSSE), this study identified and tested new variables for examining writing's relationship to learning and development. Eighty CWPA members helped to establish a consensus model of 27 effective writing practices. Eighty US baccalaureate institutions appended questions to the NSSE instrument based on these 27 practices, yielding responses from 29,634 first-year students and 41,802 seniors. Confirmatory factor analysis identified three constructs: Interactive Writing Processes, Meaning-Making Writing Tasks, and Clear Writing Expectations. Regression analyses indicated that the constructs were positively associated with two sets of established constructs in the regular NSSE instrument—Deep Approaches to Learning (Higher-Order Learning, Integrative Learning, and Reflective Learning) and Perceived Gains in Learning and Development as defined by the institution's contributions to growth in Practical Competence, Personal and Social Development, and General Education Learning—with effect sizes that were consistently greater than those for the number of pages written. These were net results after controlling for institutional and student characteristics, as well as other factors that might contribute to enhanced learning. The study adds three empirically established constructs to research on writing and learning. It extends the positive impact of writing beyond learning course material to include Personal and Social Development. Although correlational, it can provide guidance to instructors, institutions, accreditors, and other stakeholders because of the nature of the questions associated with the effective writing constructs.

For those seeking to identify and encourage teaching strategies that increase student learning in undergraduate education, writing has achieved a prominent status. Although problem-based learning, inquiry-guided instruction, active learning, and other approaches are commonly supported in postsecondary teaching, writing has garnered unmatched institutional investment in the forms of required entry-level writing courses as well as stand-alone units and positions devoted to promoting writing across the curriculum (WAC), writing in the disciplines (WID), writing-

intensive courses (WIC), and similar curricular initiatives. In many other countries, programs devoted to using writing as a tool for learning are also common (Thaiss & Porter, 2010). This burgeoning interest in spreading writing broadly across the curriculum is supported by the importance of writing ability in both academia and the workforce (Hart Research Associates, 2015; National Commission on Writing, 2004). Such initiatives have also been spurred and sustained for the past 40 years by theoretical and pedagogical claims about the powerful relationship between writing and learning (Anson, Schwiebert, & Williamson, 1993; Britton, Burgess, Martin, McLeod, & Rosen, 1975; Emig, 1977)—claims that have steadily grown in complexity and type (Klein, 1999) and now incorporate, for instance, developments in neuroscience (Willis, 2011) and studies of genre (Bazerman, 2009). In recent decades, new and existing writing-extensive programs have gained additional support in learning-enhancement projects required for institutional reaccreditation in some US regions.

While the power of writing to enhance learning seems intuitively obvious, empirical research supporting this conviction has produced mixed results. In the past 25 years, three large studies have been especially influential in promoting general acceptance of the claim that writing enhances learning, although this was not these studies' central aim (Arum & Roksa, 2011; Astin, 1992; Light, 2001). Using different research methods, all three concluded that more writing is associated with more learning—a conclusion that has bolstered the WAC movement's emphasis on increasing attention to writing in all courses and curricula. In contrast, small-scale, quasi-experimental studies that examine the impact of specific writing interventions sometimes show positive results but sometimes do not, causing some scholars to challenge the claim that empirical evidence demonstrates that writing can increase learning (Ackerman, 1993; Ochsner & Fowler, 2004; Schumacher & Nash, 1991).

Our extrapolation study (Kane, 2013) examines the possibility that the mix of positive and negative outcomes in quasi-experimental studies occurs because some use more effective pedagogical interventions than others. The crux of our study is an attempt to identify and empirically establish more specific and more effective practices associated with enhanced learning than the simple admonition (supported by the three large-scale studies) to assign "more writing." In a collaboration between the National Survey of Student Engagement (NSSE) and the Council of Writing Program Administrators (CWPA), we explored this possibility by enlisting the help of CWPA members in creating a list of 27 "effective practices" in teaching writing, which we appended to the regular NSSE survey at 80 US baccalaureate institutions. We then examined the relationships between the responses of more than 70,000 first-year and senior students to the 27 writing questions and their responses to questions on the regular survey that provide data on two sets of established NSSE constructs: participation in Deep Approaches to Learning, and Perceived Gains in Learning and Development.

In this study, we join the movement catalyzed by Boyer (1990) and championed by many professional organizations that focus on higher education, including two that have a particular interest in writing. The Association of American Colleges and

Universities includes writing in its list of high-impact educational practices (Kuh, 2008), and it has created a rubric for writing (Association of American Colleges and Universities, 2008) with the aim of establishing a national framework for writing goals in baccalaureate education. Similarly, the Lumina Foundation's Degree Qualifications Profile (DQP) characterizes desired competencies for writing at various levels in associate's, bachelor's, and master's programs, and it commends efforts to improve "the experiences and practices that move students toward those outcomes" (Adelman, Ewell, Gaston, & Schneider, 2011, p. 4). Our project also answers the call from within writing studies for research that identifies specific evidence-based teaching practices that use writing to enhance student learning, and it responds to the need "to demonstrate the value of writing across the curriculum at local and national levels" (Addison & McGee, 2010, p. 148). Our study offers a new set of concepts, strategies, and evidence for examining the contribution of writing to learning. It may also be useful to a variety of stakeholders in addition to writing specialists because many institutions use NSSE results internally to guide learning improvement initiatives and externally for accountability, accreditations, and marketing, and because NSSE now includes a module on "Experiences with Writing," constructed from the results of our study.

Literature Review

The relationship between writing and learning has been studied for at least 90 years and from many perspectives, such as the ability of required themes to aid students in acquiring information (Ulrich, 1926), the potential for high school students' writing ability to predict college success (i.e., ability to learn; Geiser & Studley, 2002), and writing's contribution to learning when used with other pedagogical strategies, such as problem-based learning (Allen, Donham, & Bernhardt, 2011). Studies have also included students at all educational levels, from elementary (Hyser, 1992) to graduate school (Goldman, Cohen, & Sheahan, 2008).

Our study focuses specifically on the relationship between writing assignments and undergraduates' learning and development. Three large studies have been especially influential in promoting the general acceptance of the claim that writing can enhance student learning, even though they did not focus on specific instructional practices. In a survey of nearly 25,000 students who completed four years of study at 217 baccalaureate institutions, Astin (1992) found that a focus on the development of students' writing skills correlated positively with a larger number of general-education outcomes than any other course attribute. Drawing on findings from in-depth interviews with more than 1,600 students, mostly from Harvard but also from 24 other colleges and universities, Light (2001) concluded that the amount of writing in a course has a stronger relationship with students' level of engagement than does any other course characteristic, "whether engagement is measured by time spent on the course, or the intellectual challenge it presents, or students' level of interest in it" (p. 55). Studying the performance of over 2,300 students at 24 colleges and universities on the College Learning Assessment (CLA), which provides an empirical measure of their abilities, Arum and Roksa (2011)

concluded that after the first three semesters of college education, students made "barely noticeable" improvement in two central areas, critical thinking and complex reasoning (p. 35). The exception was writing: students made significant gains in both areas if they had taken courses taught by demanding faculty who required 20 or more pages of writing during a semester and 40 or more pages of reading per week. In their latest study, Arum and Roksa (2014) found that the presence of substantial writing and reading requirements, among other factors, has significant impacts on students' lives after graduation, for instance by reducing the likelihood that they will have difficulty finding employment, be employed in positions for unskilled workers, or lose the jobs they find.

Despite the widespread instructional adoption of writing to learn and its voluminous testimonial literature, the findings of these three large-scale studies have not been supported as uniformly or persuasively as one might expect by the many small-scale studies that have investigated specific teaching practices using a wide range of descriptive, quasi-experimental, longitudinal, and other methods (e.g., Anson & Beach, 1996; Chizmar & Ostrosky, 1998; Fry & Villagomez, 2012; Haswell, 1991; Herrington & Curtis, 2000; McCarthy, 1987; Newell & Winograd, 1995; Sternglass, 1997). Small-scale studies have the virtue of basing their findings on direct assessment of student learning, but they are limited because each is so tightly bounded by its particular context that it is impossible to derive generalizable teaching practices from it.

Well-designed, small-scale studies gain impact when a cluster of them employ consistent definitions of writing and learning across contexts and produce similar results. Consequently, the most compelling research into the power of writing to enhance learning may be Graham and Hebert's (2011) meta-analysis of 95 experimental and quasi-experimental studies conducted between 1930 (Barton, 1930; Newlun, 1930) and 2008 (Conrad, 2008) on the power of writing to help students in grades 1 through 12 improve their reading.

The number and range of small-scale studies have grown substantially, especially since the 1980s, inspired in part by early publications on WAC (e.g., Young & Fulwiler, 1982) and the enthusiasm of writing specialists for attaining greater prominence for their enterprise and enhanced resources for research and institutional programs. However, the number of meta-analyses that might be used to generalize from the results of these studies has not grown as rapidly, largely because of the wide range of types of writing activities and definitions of learning used. Consequently, some scholars have prepared reviews, rather than meta-analyses, several expressing skepticism about writing's ability to enhance learning. In 1991, Schumacher and Nash argued that the research on writing to learn was "confusing" (p. 67). After reviewing 35 early studies, Ackerman (1993) concluded that they do "not provide the long-sought empirical validation of writing as a mode of learning" (p. 334). In their review of 30 years of quasi-experimental studies, Ochsner and Fowler (2004) wrote that they "question evidence cited in support of WAC/WID goals and pedagogies" (p. 117), arguing that the efflorescence of the writing-to-learn movement is based primarily on testimonials from those predisposed to

accept its claims and by adherence to orthodoxy among writing specialists. On the other hand, in their meta-analysis of 48 studies, Bangert-Drowns, Hurley, and Wilkinson (2004) found cautious support for writing's ability to enhance learning: although they concluded that "the simple incorporation of writing in regular classroom instruction does not automatically yield large dividends in learning" (p. 51), the consistency of the positive effects in the studies they examined suggested "that one can reasonably expect some enhancement in learning from writing and that the enhancement is optimized by contextual factors" (p. 51).

As Ackerman (1993), Schumacher and Nash (1991), and Ochsner and Fowler (2004) have emphasized, the diversity of research on writing's contribution to learning presents a substantial challenge. First, the interventions varied widely, partly in response to the studies' contexts. Second, the definitions of what constitutes learning differed greatly. For one study, it was the effects on the reading comprehension of learning-disabled adolescents when they wrote responses to questions inserted into texts (Peverly & Wood, 2001), while for another it was the ability of college students to demonstrate critical thinking and complex reasoning abilities on a national test (Arum & Roksa, 2011). As these examples suggest, a third factor—characteristics of the student learners—acts as another variable that can limit the generalizability of the results of small studies.

The diversity of interventions, definitions of learning, and characteristics of student learners makes it difficult to find comparable studies to use in the meta-analyses that might enable researchers to generalize from the findings of small-scale studies in the ways that Graham and Hebert (2011) did. And even a meta-analysis like Graham and Hebert's has its limits. Their synthesis of 95 studies yielded three major instructional strategies for enhancing the reading abilities of K–12 students: have students write about the texts they read; teach students the writing skills and processes that go into creating a text; and increase how much students write. Two of these strategies encompassed a total of seven substrategies, such as asking students to write summaries or take notes, and asking or answering questions about a text (Graham & Hebert, 2011, p. 728). Some of these school-oriented strategies—such as providing instruction on paragraph and sentence structure (Graham & Hebert, 2011, p. 731)—would appear to be inappropriate or ineffective for enhancing college students' learning in diverse disciplines such as art, journalism, mathematics, or marketing. In addition, small-scale studies analyzed together may include populations that seem more universal than actually is the case (Egger, Ebrahim, & Smith, 2002; Glass, 1999; Soyeon, Ames, & Myers, 2012). The 48 "school-based" studies in Bangert-Drowns et al.'s (2004) meta-analysis ranged from elementary school to college. Of the 21 college studies, 7 were from algebra courses and 5 were from other mathematics or statistics classes, suggesting limitations in the generalizability of the results.

These limitations suggest the value of identifying new, more generalizable variables for studying writing's contribution to learning across the entire curriculum. They also indicate the value of developing a new approach to conceptualizing "learning" that has salience for faculty in a broad range of disciplines who

wish to incorporate research results into their teaching practices. The disadvantages of studying overly broad student populations (such as elementary school students through college seniors) or highly limited populations (such as students in one class) point to the benefits of focusing a study specifically on one population with many members from which a large, representative sample can be obtained.

Purposes of Our Study

In this article, we report the results of a large multi-institutional study that examined the relationships of writing to students' engagement in constructs related to Deep Approaches to Learning and to Perceived Gains in Learning and Development. This study, conducted through a partnership between NSSE and CWPA, examined survey responses from over 70,000 first-year and senior students who were enrolled at 80 bachelor's degree-granting colleges and universities in the United States. Our aim in this study was to explore how and to what degree writing is associated with learning and development by asking whether and under what conditions certain instructional practices contribute to several of the most important goals of higher education. Specifically, we aimed to determine whether *more writing* (number of pages) and whether *certain kinds* of writing assignments and instructional practices are associated with learning outcomes that are widely recognized as desirable in undergraduate education. We aimed to determine this regardless of: students' background characteristics such as major, gender, or race; institutional characteristics such as size, sector, or Carnegie classification; other educational practices that could explain the achieved goals; or the amount of writing students are asked to do. In short, we wanted to find, as best we could, what might work across the curriculum and also across the wide variety of students and institutions in the study.

Our use of the National Survey of Student Engagement is both a limitation and a major strength of our study. On the one hand, this instrument relies on self-reports, so its results must be viewed as provisional until a similarly large-scale study using direct measures of students' activities and writing can be conducted. On the other hand, NSSE is arguably the most important postsecondary survey in the United States. It is used not only as a research instrument, but also as a way to recruit students, to establish institutional priorities and policies, and to ensure institutional effectiveness for accrediting agencies. Because it relies on large amounts of data across hundreds of institutions, it also offers a much higher degree of generalizability than localized studies and is therefore of interest to the nation's colleges and universities and to many other stakeholders both inside and beyond the academy.

The collaboration between CWPA and NSSE yielded a new set of variables of potential interest to researchers, practitioners, and policy makers concerning features of writing assignments and instruction that might enhance students' learning. To develop these variables, we created a set of questions that describe what writing specialists identify as "effective practices" in writing assignments and instruction. We then grouped 22 of the 27 questions into three subsets ("scales") designed to measure constructs that reflect broader, latent writing practices. These scales include

measures of Interactive Writing Processes, Meaning-Making Writing Tasks, and Clear Writing Expectations. We then used confirmatory factor analysis (CFA) to refine the scales through an iterative process. With the resulting valid scales, we used ordinary least squares (OLS) regression analysis to test their relationships with six established NSSE scales—three for engagement in Deep Approaches to Learning and three for Perceived Gains in Learning and Development. In all, we employed 12 separate multivariate models because we treated first-year students and seniors separately.

After presenting our methods and results, we will discuss whether the results can provide broad guidance to researchers, practitioners, and institutions. Our research questions were as follows:

1. Do the three theoretical constructs measured by a set of writing-specialist-generated questions added to the NSSE fit the observed data?
2. After controlling for student and institutional characteristics, for participation in other educationally purposeful activities, and especially for the amount of writing students do, to what extent are the effective practices in writing assignments and instruction related to college students' participation in Deep Approaches to Learning?
3. After controlling for student and institutional characteristics, for participation in other educationally purposeful activities (including Deep Approaches to Learning), and especially for the amount of writing students do, to what extent are the effective practices in writing assignments and instruction related to college students' Perceived Gains in Learning and Development?

Methods

Data Sources

To begin answering these questions, CWPA collaborated with NSSE to develop a set of questions about writing as an extension to the NSSE instrument, thus capturing data about writing from a broad demographic of students and instructors across a diverse consortium of four-year colleges and universities in the United States.

NSSE measures students' participation in educationally purposeful activities that prior research has found to be linked to desired outcomes of college (Chickering & Gamson, 1987; Pascarella & Terenzini, 2005). The validity and reliability of the instrument have been extensively tested (Kuh, 2002; Kuh, Kinzie, Cruce, Shoup, & Gonyea, 2006; Pike, 2006). The NSSE questionnaire, in the field since 2000, collects data in five general areas. First, it asks students how often they have taken part in a variety of curricular and cocurricular activities, such as studying, service-learning, substantive interactions with peers and faculty, reflective learning, and the arts. A second set of questions asks about institutionally challenging work, such as the amount of reading and writing students have done in the reporting period and the nature of their examinations and course work. Next, students are

asked to rate features of the campus environment that are associated with desired outcomes, including academic support services and the quality of students' relationships with faculty and with each other. Fourth, students report perceptions of the amount their institutions have contributed to their educational and personal growth (since they started college) on a holistic array of topics such as general knowledge, writing and speaking skills, working with others, understanding diversity, ethical development, and acquiring job-related skills. Finally, NSSE asks students for aspects of their background such as age, gender, race or ethnicity, where they live during school, and major field. Such information makes it possible to understand the experiences of different types of students, and whether impediments to success might exist for a particular group.

To make NSSE even more relevant to mission- or context-specific issues, participating institutions are encouraged to form and join consortia of at least six institutions that may then append questions of specific interest to the group. Such was the case with the NSSE/CWPA partnership. The additional writing questions were developed with the assistance of 80 CWPA members, most of whom directed university writing programs and conducted research on student writing in college. They proposed 150 potential questions and helped to narrow them to 27 questions in three categories based on related constructs. These questions were pilot-tested with students in focus groups at one of our institutions and then further refined. This process gave the resulting set of items strong evidence of content validity.

In an effort to make the writing survey transparent and easy to complete, the 27 questions were divided into four sections. In the first two sections, student respondents were asked what they had done to complete their writing assignments during the past school year (their writing processes and strategies). In the third section, they were asked what their teachers had done or asked them to do. In the fourth section, they were asked about more extensive planned or completed writing projects.

Taken together, these 27 questions constituted a consensus model for effective practices in writing. Because writing was hypothesized as a tool for learning, they also constituted a consensus model for effective practices for promoting learning through writing.

Variable Specification

Effective Writing Practices

The coauthors of this paper hypothesized that 22 of the 27 questions indicated three underlying constructs representing effective writing practices. Each construct would be measured by a set of writing behaviors or observations that would form an interrelated pattern of responses to a set of questions. (An example of a construct is intelligence, which is measured through sets of questions on an IQ test.) The three hypothesized constructs for effective writing were as follows:

- *Interactive Writing Processes,* which involve the student writers communicating orally or in writing with one or more persons at some point between receiving an assignment and submitting the final draft. The person

might be their instructor, another student in the class, a friend, a family member, or any other individual or group. The value that most writing specialists place on students' interaction with others while planning, drafting, and revising their assignments is evident in the specialists' emphasis on conferencing with their students, incorporating peer review in their classes, and encouraging their students to visit the campus writing centers to discuss their drafts with the centers' consultants.

- *Meaning-Making Writing Tasks,* which require students to engage in some form of integrative, critical, or original thinking. Examples include asking students to apply a concept learned in class to their past experience, relate knowledge learned in another class to knowledge presented in the current class, support a contestable claim with evidence, or evaluate a policy, practice, or position. For most writing specialists, the importance of assigning meaning-making writing tasks is evidenced, among other places, in the assignments given in writing classes created for first-year college students.
- *Clear Writing Expectations,* which involve instructors providing students with an accurate understanding of what they are asking their students to show that they can do in an assignment and the criteria by which the instructors will evaluate the students' submissions. The value that many writing specialists place on explaining their expectations clearly can be seen in the increasing emphasis on presenting assignments in writing (so they can be referred to at any time in the students' writing process) and on the creation, distribution, and discussion in class of grading rubrics when assignments are first given to students (Anson & Dannels, 2002).

Table 1 shows which of the 22 questions were hypothesized to be associated with each of these hypothetical constructs. The table also identifies the five questions that, although important as individual questions in the assessment of writing and of writing instruction, did not appear to fit within these three constructs and did not have potential to form an additional construct. These included one item that is mostly applicable to seniors: submitting work for publication. The remaining four deleted items were: 1a ("Brainstormed"); 1h ("Proofread"); 3e ("[Were asked] to do short pieces of writing"; 4a ("Prepare a portfolio").

To answer the first research question, which concerned whether the three constructs fit the data, a conceptual model of the hypothesized three-factor structure was developed (Figure 1). The three large circles represent the hypothesized constructs—latent factors that the model predicted would influence students to answer the associated questions (in the rectangles) in certain ways. However, the factors were not assumed to account for all the variance in the responses to the associated questions; the variance that was unaccounted for is represented by the "error terms" shown as small circles to the left. The model also assumed that the three factors are correlated, as shown by the curved bidirectional arrows on the right.

To test the hypothesized three-factor structure, a CFA was conducted using SPSS Amos (22.0.0). First, the validity of the three constructs was examined for

Table 1. Association of the Original 27 Questions with the Three Hypothetical Constructs before Confirmatory Factor Analysis

Question Stem	Item	Construct Assignment
1. During the current school year, for how many of your writing assignments have you done each of the following? (*5 = all assignments, 4 = most assignments, 3 = some assignments, 2 = few assignments, 1 = no assignments*)	a. Brainstormed (listed ideas, mapped concepts, prepared an outline, etc.) to develop your ideas before you started drafting your assignment	X
	b. Talked with your instructor to develop your ideas before you started drafting your assignment	IWP
	c. Talked with a classmate, friend, or family member to develop your ideas before you started drafting your assignment	IWP
	d. Received feedback from your instructor about a draft before turning in your final assignment	IWP
	e. Received feedback from a classmate, friend, or family member about a draft before turning in your final assignment	IWP
	f. Visited a campus-based writing or tutoring center to get help with your writing assignment before turning it in	IWP
	g. Used an online tutoring service to get help with your writing assignment before turning it in	IWP
	h. Proofread your final draft for errors before turning it in	X
2. During the current school year, in how many of your writing assignments did you: (*5 = all assignments, 4 = most assignments, 3 = some assignments, 2 = few assignments, 1 = no assignments*)	a. Narrate or describe one of your own experiences	MMWT
	b. Summarize something you read, such as articles, books, or online publications	MMWT
	c. Analyze or evaluate something you read, researched, or observed	MMWT
	d. Describe your methods or findings related to data you collected in lab or fieldwork, a survey project, etc.	MMWT
	e. Argue a position using evidence and reasoning	MMWT
	f. Explain in writing the meaning of numerical or statistical data	MMWT
	g. Write in the style and format of a specific field (engineering, history, psychology, etc.)	MMWT
	h. Include drawings, tables, photos, screenshots, or other visual content in your written assignment	MMWT
	i. Create the project with multimedia (web page, poster, slide presentation such as PowerPoint, etc.)	MMWT
3. During the current school year, for how many of your writing assignments has your instructor done each of the following? (5 = all assignments, 4 = most assignments, 3 = some assignments, 2 = few assignments, 1 = no assignments)	a. Provided clear instructions describing what he or she wanted you to do	CWE
	b. Explained in advance what he or she wanted you to learn	CWE
	c. Explained in advance the criteria he or she would use to grade your assignment	CWE
	d. Provided a sample of a completed assignment written by the instructor or a student	CWE
	e. Asked you to do short pieces of writing that he or she did not grade	X
	f. Asked you to give feedback to a classmate about a draft or outline the classmate had written	IWP
	g. Asked you to write with classmates to complete a group project	IWP
	h. Asked you to address a real or imagined audience such as your classmates, a politician, nonexperts, etc.	MMWT

TABLE 1. Continued

4. WHICH OF THE FOLLOWING HAVE YOU DONE OR DO YOU PLAN TO DO BEFORE YOU GRADUATE FROM YOUR INSTITUTION? (**4** = DONE, **3** = PLAN TO DO, **2** = DO NOT PLAN TO DO, **1** = HAVE NOT DECIDED)	a. Prepare a portfolio that collects written work from more than one class	X
	b. Submit work you wrote or cowrote to a student or professional publication (magazine, journal, newspaper, collection of student work, etc.)	X

Note. Twenty-two items were assigned to one of three hypothesized constructs: IWP = Interactive Writing Processes, MMWT = Meaning-Making Writing Tasks, CWE = Clear Writing Expectations. The remaining five items (X) were not assigned.

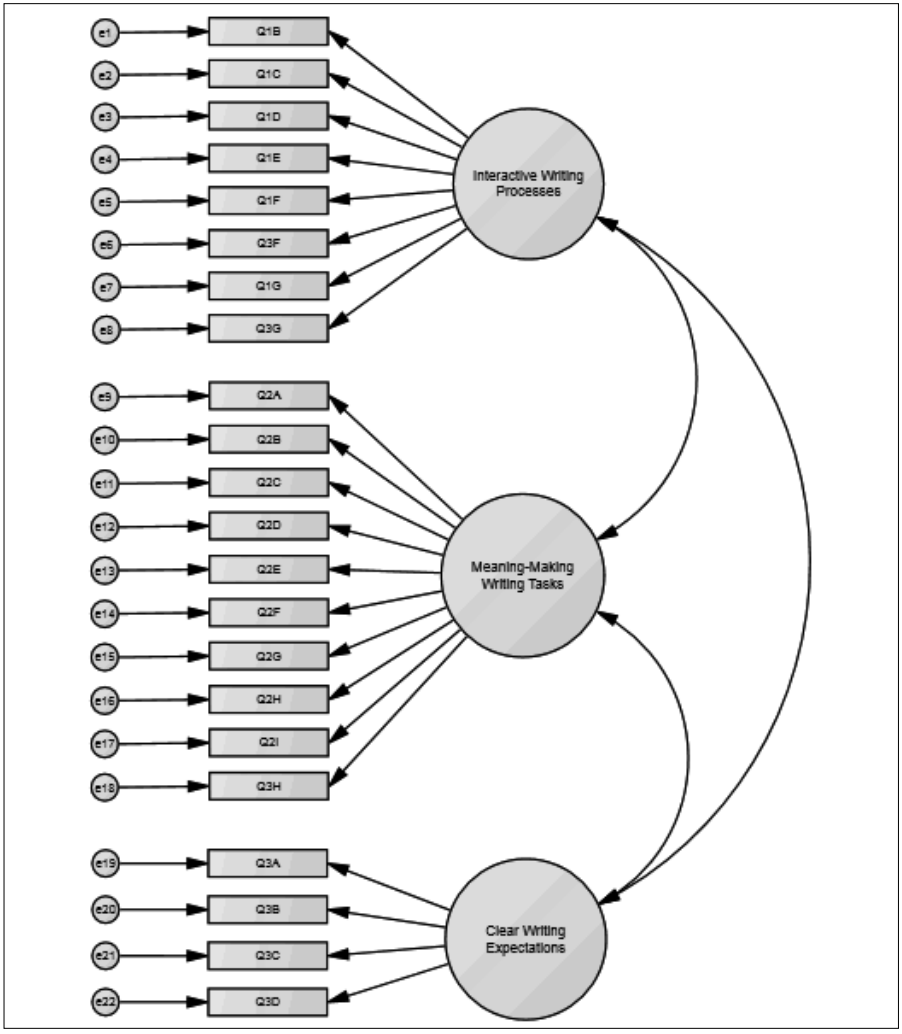

FIGURE 1. *Conceptual model of three effective writing practices. Measured variables (in rectangles) are listed in Table 7.*

seniors. Then, adjustments to the model were made to improve the overall fit. Adjustments included removing some questions due to poor factor loadings or ambiguous cross-loadings. They also included correlating the error terms of conceptually similar questions, provided they were associated with the same factor. Next, the resulting (final) model for seniors was tested on the first-year student data to ensure that both the first-year and senior models had adequate goodness of fit with their corresponding data sets, thus establishing the validity of the writing scales for the characteristically different populations by class level.

Several indicators were used to evaluate the goodness of fit of the models, including the Goodness-of-Fit Index (GFI) (Jöreskog & Sörbom, 1984), the Adjusted Goodness-of-Fit Index (AGFI), the Comparative Fit Index (CFI), the Parsimony-Adjusted CFI (PCFI), the Root Mean Square Error of Approximation (RMSEA), and the χ^2 statistic. Acceptable goodness-of-fit criteria include a GFI and AGFI greater than .70 and a CFI and PCFI greater than .95. An RMSEA of less than .10 is adequate, but less than .05 is preferable. Finally, although a significant χ^2 statistic is an indicator of poor fit, with extremely large sample sizes a nonsignificant χ^2 is very unlikely, so a sizeable reduction in the χ^2 value after a model is adjusted is an indication that fit has improved.

Amount of Student Writing

As pointed out earlier, the *amount* of writing has been associated with student engagement (Light, 2001), reading ability (Graham & Hebert, 2011), and college-level learning (Arum & Roksa, 2011). Among the variables we studied, we included the amount that students wrote in order to compare the potential positive effects of simply writing more with those of the *quality* or *nature* of the assignments. The amount is a composite estimate based on three questions on the regular NSSE that ask students how many papers or reports of "20 pages or more," "between 5 and 19 pages," and "fewer than 5 pages" they wrote. Students were given five response options ranging from "none" to "more than 20." The midpoints of both the page length options (using 25 for the upper value) and the numbers of papers or reports (using 25 for the upper value) were multiplied to create total written page estimates. While this approach cannot accurately estimate an *individual* student's amount of writing, it produces a relatively normal, continuous scale *in the aggregate* that can be adequately used as a general measure of writing quantity.

Deep Approaches to Learning

In order to determine whether the three hypothesized effective writing practices were positively associated with student learning, we examined their relation to specific constructs connected to learning. We chose six dependent variables. The first three are NSSE scales that measure student engagement in Deep Approaches to Learning (Nelson Laird, Garver, Niskodé-Dossett, & Banks, 2008; Nelson Laird, Shoup, & Kuh, 2006). Students who engage in *deep learning* are focused not only on substance but also on the underlying meaning of the information. Deep Approaches to Learning are evident when students genuinely commit to understanding the material by engaging in strategies such as drawing ideas from multiple sources

(including the student's experience), talking about the material with others, breaking down concepts into their basic parts, synthesizing information into more complex wholes, evaluating the quality of information, applying knowledge in real-world situations, engaging in self-reflection and other-centeredness, and creating new perspectives (Biggs, 1989). Also characteristic of deep learning is integrating and synthesizing information with prior learning in ways that become part of one's thinking and approaching new phenomena, and efforts to see things from different perspectives (Ramsden, 2003; Tagg, 2003). NSSE contains a valid and reliable measure of deep learning that consists of a reliable structure of a primary factor with three secondary factors: Higher-Order Learning, Integrative Learning, and Reflective Learning (Nelson Laird, Shoup, & Kuh, 2006).

- *Higher-Order Learning* is measured by four questions about how much students say their course work emphasizes analyzing experiences and theories, synthesizing concepts and experiences into more complex relationships, making judgments about the value of information, and applying learned concepts to practical problems.
- *Integrative Learning* survey items measure the student's engagement in combining ideas from various sources, such as including diverse perspectives in course work, using ideas from different courses in assignments or class discussions, and discussing course concepts with either faculty members or others outside of class.
- *Reflective Learning* is measured by three questions that center on the student's self-examination of views on a topic, understanding the perspectives of others, and learning that changes the way the student understands an issue.

Perceived Gains in Learning and Development

The other three dependent variables are NSSE scales that measure how strongly students believe their experience at their institution contributed to their knowledge and development in three broad areas: Practical Competence, Personal and Social Development, and General Education Learning. The items in these scales may be used to assess the impact of writing on a student's satisfaction and sense of accomplishment as a result of his or her educational experiences at the institution (Gonyea & Miller, 2011).

- *Practical Competence*, including acquiring job- or work-related knowledge and skills as well as the ability to work effectively with others; using computing and information technology; analyzing quantitative problems; and solving complex real-world problems.
- *Personal and Social Development,* including learning independently, understanding oneself, understanding other people, developing a personal code of values and ethics, and contributing to the community.
- *General Education Learning*, including the ability to write and speak clearly and effectively, and to think critically and analytically.

Control Variables

In order to better isolate the net effects of the writing constructs on Deep Approaches to Learning and Perceived Gains in Learning and Development, we entered student characteristics, institution characteristics, and other measures of engagement in each model as control variables. Student characteristics included gender, enrollment status, age, race or ethnicity, residence, international status, transfer status, area of study, and self-reported grades. Carnegie classification was included as a control for institutional differences because it incorporates dimensions of institutional size and mission. These measures have been found by NSSE to correlate with the engagement of students in general (e.g., National Survey of Student Engagement, 2006, 2008, 2010), and to the extent that they are related to all of the constructs in the model, such effects were removed from the net relationships of the writing scales with each dependent variable.

Other measures of engagement in NSSE were also included as controls, again to cover any variance in the dependent variables that might be attributed to activities other than writing (Table 2). These included both curricular and co-curricular experiences and perceptions, including the amount of assigned reading; experiences with diversity, group work, and high expectations; and involvement in high-impact practices (Kuh, 2008) such as service-learning, internships, learning communities, and research with a faculty member. Finally, because of moderate correlations between the deep learning activities and perceived gains on NSSE, the composite score for Deep Approaches to Learning (i.e., the primary factor made up of the items from the three subscales) was added to the Perceived Gains models as a control variable. Because these additional engagement activities are also considered important educational practices, including them in the models as control variables represents a more rigorous test to isolate the net effects of the writing practices. Thus, even smaller relationships may be interpreted as having practical meaning.

Sample

The sampling frame consisted of all first-year and senior students enrolled at 80 institutions that participated in the NSSE Consortium for the Study of Writing in College in 2010 or 2011. These students were invited by email to complete an online version of the NSSE questionnaire, followed by the consortium's additional questions about writing. Students were contacted directly by the Center for Postsecondary Research at Indiana University, and were either randomly sampled from institution population files provided to the Center, or the entire first-year and senior classes were surveyed.

Data were collected from 41,616 first-year students and 54,187 seniors. Response rates for the 80 participating institutions ranged from 12.1% to 63.6%, with a mean of 32.1%. The distribution of institutional response rates was approximately normal, with the median response rate at 31.9%; 4 in 5 institutions had a response rate above 21.0%, and 1 in 5 institutions had a response rate above 42.4%. Respondents with missing data on one or more of the three writing scales were excluded from the analysis. After these adjustments, 29,634 first-year students and 41,802 seniors remained in the sample for analysis.

Table 2. Additional Measures of Engagement Used as Control Variables

Variable	Description	First-Year		Senior	
		Mean	*SD*	Mean	*SD*
Amount of reading	Number of assigned textbooks, books, or book-length packs of course readings, calculated from the midpoints of the item	10.81	6.98	10.30	7.42
Diverse interactions[a]	Combination of two items about having serious conversations with students who were different in terms of race or ethnicity, or in terms of religious beliefs, political opinions, or personal values	2.62	0.92	2.67	0.91
Group work[a]	Combination of three items about how often students participated in class discussions, worked on group projects in class, and worked on group projects outside of class	2.54	0.59	2.81	0.61
High expectations[b]	Combination of two items about the perceived challenge presented by academic work and exams	2.99	0.56	3.01	0.59
Service-learning[c]	Participation in a community-based project as part of a regular course	0.42	0.49	0.50	0.50
Internship[c]	Participation in a practicum, internship, field experience, co-op experience, or clinical assignment	0.06	0.24	0.52	0.50
Learning community[c]	Participation in a formal program where students took two or more classes together	0.19	0.39	0.28	0.45
Research with faculty[c]	Work on a research project with a faculty member outside of course or program requirements	0.04	0.20	0.20	0.40

[a]Scored by taking the mean of the component items; values ranged from 1 to 4, where 1 = never, 2 = sometimes, 3 = often, and 4 = very often. [b]The original "exams" item was a 7-point anchored scale about the perceived degree of challenge presented by exams, ranging from 1 (very little) to 7 (very much). The "work" variable asked how often the student had to work hard to meet an instructor's standards, coded as 1 = never, 2 = sometimes, 3 = often, and 4 = very often. After "exams" was collapsed to a 4-point scale, the "high expectations" variable was the mean of the component items. [c]Binary variable where those who participated in the activity were coded as *1* and those who did not were coded as *0*. Thus, the mean is the proportion of students who participated in the activity.

The distribution of first-year and senior respondents by demographic characteristics (Table 3) shows a diverse sample that approximates the population of students enrolled in baccalaureate programs in the United States (National Center for Education Statistics, 2011). Nearly two-thirds of respondents were female, which is higher than the U.S. baccalaureate female enrollment rate but a common result for NSSE and other surveys. The large majority of respondents were enrolled full-time, and over a quarter were students of color (7% African American, 5% Asian/Pacific Islander, 8% Latino, and 9% multiracial, multiethnic, or other races or ethnicities). Almost three-quarters of first-year students and 12% of seniors lived on campus, 2 in 5 seniors had transferred to their current institution from another college or university, and about 2 in 5 respondents were first-generation college

Table 3. Respondent Characteristics

		First-Year		Senior	
Category	**Characteristic**	**Count**	**%**	**Count**	**%**
Sex	Male	10,311	35%	16,169	39%
	Female	19,322	65%	25,628	61%
Enrollment status	Part-time	815	3%	5,821	14%
	Full-time	28,819	97%	35,981	86%
Race or ethnicity	African American	1,841	7%	2,277	6%
	Asian/Pacific Islander	1,367	5%	1,867	5%
	White	19,330	72%	27,769	73%
	Latino/Latina	2,098	8%	3,058	8%
	Other	2,326	9%	3,166	8%
Transfer	Started here	27,762	94%	25,099	60%
	Started elsewhere	1,807	6%	16,646	40%
Residence	Off campus	8,140	28%	34,786	88%
	On campus	20,726	72%	4,866	12%
Age	Traditional (first-year, < 21; senior, < 25)	28,057	95%	30,666	74%
	Nontraditional (first-year, 21+; senior, 25+)	1,546	5%	11,033	27%
First-generation (neither parent has baccalaureate degree)	Not first-generation	18,609	63%	24,728	60%
	First-generation	10,728	37%	16,764	40%
Primary major category	Arts and Humanities	3,686	13%	6,246	15%
	Biological Sciences	3,100	11%	3,466	8%
	Business	3,872	13%	7,057	17%
	Education	2,563	9%	3,519	9%
	Engineering	2,010	7%	2,433	6%
	Physical Sciences	1,166	4%	1,452	4%
	Professional (other)	3,688	13%	4,052	10%
	Social Sciences	3,597	12%	6,311	15%
	Other	4,025	14%	6,935	17%
	Undecided	1,357	5%	18	0%
International	No	28,132	95%	39,872	96%
	Yes	1,350	5%	1,745	4%
Grades (self-reported)	Mostly *A*'s	13,510	46%	20,040	48%
	Mostly *B*'s	13,390	45%	19,433	47%
	Mostly *C*'s	2,675	9%	2,246	5%

Percentages may not add to 100 due to rounding.

attendees. The participants represented a fairly traditional college-going population in terms of age: 95% of first-year students were under 21 years of age, and 74% of seniors were under 25. Participants majored in a broad array of disciplines, with the largest percentages of seniors in business (17%), arts and humanities (15%), and the social sciences (15%).

Institutions self-selected to participate in NSSE, and a subset of those elected to join the consortium and utilize the additional questions about writing. Because institutions were not randomly selected, no robust claims can be made about the national representativeness of results. However, participating institutions represented a wide range of types of bachelor's-granting institutions in the United States, including 26 doctorate-granting research universities, 31 master's colleges and universities, 20 baccalaureate colleges, and three other types of institutions (Table 4). Forty-six institutions were public and 34 were private. Institutions ranged widely in terms of enrollment size, with about a quarter enrolling fewer than 2,500 undergraduate students and about a third enrolling more than 10,000 students. Compared with the U.S. population, research and doctoral universities were overrepresented among sample participants, as were public institutions and institutions with larger enrollments.

Table 4. Characteristics of Participating Institutions

Category	Characteristics	Participating Institutions (Total = 80)		All US Institutions[a]
		Count	% of Total	
Basic 2010 Carnegie classification[b]	Research universities (very high research activity)	11	14%	6%
	Research universities (high research activity)	9	12%	6%
	Doctoral/research universities	6	8%	5%
	Master's colleges and universities (larger programs)	20	26%	25%
	Master's colleges and universities (medium programs)	6	8%	11%
	Master's colleges and universities (smaller programs)	5	6%	8%
	Baccalaureate colleges—arts and sciences	14	18%	16%
	Baccalaureate colleges—diverse fields	6	8%	23%
Institutional control	Public	46	58%	34%
	Private	34	43%	66%
Total undergraduate enrollment	Fewer than 1,000	5	6%	18%
	1,000–2,499	15	19%	33%
	2,500–4,999	14	18%	19%
	5,000–9,999	18	23%	14%
	10,000–19,999	15	19%	10%
	20,000 or more	13	16%	6%

[a]US percentages are based on the 2011 Digest of Education Statistics (NCES, 2011) for institutions in one of the eight Carnegie classifications in the table. [b]Percentages are based on 77 institutions; 3 institutions classified as "other" types were excluded from the Carnegie classification section of this table for comparison purposes.

Hierarchical Regression Analysis

To answer the second and third research questions, given our primary interest in the relationships of effective writing practices with deep learning experiences and perceived gains, we structured the analytical models in blocked hierarchical regressions to provide information on how these variables related to the outcome measures, after first controlling for student background characteristics, institutional type, and other conditions that might also influence the dependent measures. The analysis consisted of twelve separate models—six dependent variables analyzed for both first-year students and seniors. Each model was built in four hierarchical blocks. The first block entered included all student and institutional characteristics. The second block entered included the other engagement variables (Table 2). The third block entered was the number of written pages, to assess its unique influence, and also to be used as a control variable for the writing scales. Finally, the three writing scales were entered as the fourth block, after all other statistical controls were applied, so that their unique influence on the dependent variables could be assessed.

With each block, a significant increase in the R^2 statistic—an estimate of the amount of total variance in the dependent variable that is explained by the independent variables in the model—indicates how much additional variance was explained by entering the new variables into the model. Thus, the change in the R^2 statistic is interpreted as an effect size of the influence of the study's key variables on the dependent variable. To interpret the change in R^2, researchers often refer to the values proposed by Cohen (1992), where a small effect is .02, a medium effect is .15, and a large effect is .35.

In addition, because the variables were measured using different response sets and ranges, all dependent variables and nondichotomous independent variables were standardized before the analysis, making it possible to compare and interpret the coefficients as effect sizes (Ferguson, 2009; Schielzeth, 2010). The standardized regression coefficient represents the proportion of a standard deviation change in the dependent variable as a result of a one-unit change in an independent variable. Larger coefficients suggest that the relationships had a greater unique effect, and may be more meaningful and worthy of discussion.

To interpret the coefficients as effect sizes, we adopted Cohen's (1992) proposed small, medium, and large *r* values of .10, .30, and .50, respectively—keeping in mind that the standardized regression coefficients in this study represent the unique relationships between the independent and dependent variables after rigorously controlling for a wide range of variables, so they are inevitably smaller (Ellis, 2011).

Results

Results for Research Question 1

Do constructs measured by a set of writing-specialist-generated questions added to the NSSE fit the observed data?

Because our sample included two distinct groups, first-year and senior students, CFA was conducted on data from each, beginning with the seniors. First,

results showed that the initial conceptual model shown in Figure 1 did not meet the goodness-of-fit criteria defined in the Methods section (Table 5). While the GFI and AGFI were at acceptable levels (greater than .70), the CFI and PCFI values were much lower than the desired criteria (greater than .95), and the RMSEA was slightly above the threshold of .10. The χ^2 value was also significant and unacceptably high, although this was expected due to the very large number of cases.

Upon examination of factor loadings for the individual items, seven items with weak loadings or ambiguous cross-loadings (i.e., items that drew from two different factors) were removed from the model. These included the use of online tutoring services; assignments that asked students to narrate their own experiences, to include visual content, and to create the project using multimedia; instructors asking students to write with classmates to complete a group project, and to address a real or imagined audience; and instructors providing a sample of a completed assignment written by the instructor or a student. Also, to improve fit statistics, error terms for some within-factor items were allowed to correlate, thus explaining more of the model variance. The resulting, more parsimonious model for seniors included 15 items and showed acceptable goodness of fit. Both the CFI and PCFI now exceeded .95 and the RMSEA was very good at .05. The χ^2 value, although still high due to the large number of cases, decreased considerably ($p < .001$).

With good model fit with the senior data, the next task was to test the model on the first-year student data to see if the writing scales would also be acceptable for that population. Results showed a model fit that was essentially the same for first-year students as for seniors (Table 5). The GFI and AGFI were well above .70, the CFI and PCFI both exceeded .95, and the RMSEA was very good at .05. The χ^2 value was even lower than the value in the senior model.

TABLE 5. Goodness of Fit for the Senior Initial, Senior Final, and First-Year Models

		X^2	*df*	GFI	AGFI	CFI	PCFI	RMSEA	Changes to Goodness of Fit			
									Δ X^2	*p*	Δ *DF*	Δ CFI
SENIOR	Initial Model (22 items)	84,039	206	.810	.767	.744	.664	.104				
	Fitted Model (15 items)	7,054	79	.974	.961	.965	.726	.048	-76,984	.000	-127	.221
FIRST-YEAR MODEL		5,872	79	.969	.954	.962	.724	.052				
	GOODNESS-OF-FIT CRITERIA			> .7	> .7	> .95	> .7	< .10, preferably < .05				

Note: The first-year model replicated the senior fitted model using first-year student data.

Factor loadings for the first-year standardized model ranged from .50 to .81, and for the senior standardized model, from .41 to .81. Scale reliabilities were very acceptable, ranging from .796 to .835 for first-year students and from .762 to .837 for seniors (Table 6).

Table 6. Loadings and Reliabilities for the Three Writing Scales

		First-Year		Senior	
Scale	Items	Loading	Scale Reliability	Loading	Scale Reliability
Interactive Writing Processes	Q1B	.77	.829	.77	.828
	Q1C	.55		.56	
	Q1D	.76		.80	
	Q1E	.66		.66	
	Q1F	.54		.53	
	Q3F	.66		.59	
Meaning-Making Writing Tasks	Q2B	.60	.796	.53	.762
	Q2C	.56		.61	
	Q2D	.63		.59	
	Q2E	.62		.59	
	Q2F	.50		.41	
	Q2G	.51		.48	
Clear Writing Expectations	Q3A	.79	.832	.80	.837
	Q3B	.81		.81	
	Q3C	.77		.77	

Notes. Factor loadings are from the standardized models. Items are detailed in Table 7. Scale reliabilities are Cronbach's alphas.

Table 7 lists the 15 component items of each of the confirmed writing scales with collapsed frequencies summarizing how students responded to the questions. Among Interactive Writing Processes, students were most likely to talk with classmates and others about their ideas before drafting an assignment, and they were least likely to visit a campus-based writing or tutoring center to get help. Among the Meaning-Making Writing Tasks, fully 9 out of 10 first-year students and seniors said they were asked to analyze or evaluate something they read in at least some of their assignments, while fewer students were asked to explain the meaning of numerical or statistical data. Finally, about 9 in 10 students across the board reported that *at least some* of their instructors provided clear instructions, explained what they wanted the students to learn, and described the criteria they would use to grade the assignment.

Table 7. Final Effective Writing Practice Scales and Responses

Scales	Items	Item Name	First-Year	Senior
Interactive Writing Processes	*For how many writing assignments have you:*			
	Talked with your instructor to develop your ideas before you started drafting your assignment	Q1B	64%	63%
	Talked with a classmate, friend, or family member to develop your ideas before you started drafting your assignment	Q1C	79%	77%
	Received feedback from your instructor about a draft before turning in your final assignment	Q1D	75%	64%
	Received feedback from a classmate, friend, or family member about a draft before turning in your final assignment	Q1E	75%	65%
	Visited a campus-based writing or tutoring center to get help with your writing assignment before turning it in	Q1F	33%	21%
	For how many writing assignments has your instructor:			
	Asked you to give feedback to a classmate about a draft or outline the classmate has written	Q3F	68%	43%
Meaning-Making Writing Tasks	*In how many of your writing assignments did you:*			
	Summarize something you read, such as articles, books, or online publications	Q2B	80%	80%
	Analyze or evaluate something you read, researched, or observed	Q2C	90%	91%
	Describe your methods or findings related to data you collected in lab or fieldwork, a survey project, etc.	Q2D	58%	65%
	Argue a position using evidence and reasoning	Q2E	80%	74%
	Explain in writing the meaning of numerical or statistical data	Q2F	42%	52%
	Write in the style and format of a specific field (engineering, history, psychology, etc.)	Q2G	56%	73%
Clear Writing Expectations	*In how many of your writing assignments has your instructor:*			
	Provided clear instructions describing what he or she wanted you to do	Q3A	95%	95%
	Explained in advance what he or she wanted you to learn	Q3B	90%	89%
	Explained in advance the criteria he or she would use to grade your assignment	Q3C	93%	92%

Note. Response options included: 1 = no assignments, 2 = few assignments, 3 = some assignments, 4 = most assignments, and 5 = all assignments. Values are the percentages responding "some," "most," or "all."

In sum, CFA showed that the final version of our model was robust enough to fit the observed data for two distinct groups: first-year and senior college students. Each of the three effective writing practices is a construct identified by examining the content and testing relationships among the questions that constituted the original survey. While the 27 additional questions represented a consensus model of effective practices established with the help of writing specialists in the Council of Writing Program Administrators, the three effective writing practices were empirically established latent constructs, components of an evidence-based model of writing.

Results for Research Question 2

After controlling for student and institutional characteristics, for participation in other educationally purposeful activities, and especially for the amount of writing students do, to what extent are the effective practices in writing assignments and instruction related to college students' participation in Deep Approaches to Learning?

First, bivariate correlations between the writing scales and Deep Approaches to Learning (Higher-Order Learning, Integrative Learning, and Reflective Learning) were calculated (Table 8). The results were positive and generally moderate in strength (Cohen, 1992). For example, correlations ranged from .20 to .42 for first-year students, and from .19 to .41 for seniors. In other words, as students interacted meaningfully with instructors, classmates, and others during the writing process; were challenged by writing tasks that required meaning-making; and received clear expectations for their written work, they experienced more course work that emphasized deep learning strategies. Because increasing the amount of writing students do has long been advanced as a major way to positively affect student learning, we also calculated the correlations between amount of writing and the Deep Approaches to Learning. The results were considerably smaller, ranging from .15 to .27 for first-year students, and from .11 to .22 for seniors.

Thus, absent any controls, effective writing practices had a more robust relationship with deep learning experiences than did the quantity of writing. However, we assumed that other variables related to the students' experiences both with effective writing practices and with Deep Approaches to Learning could account for these relationships. The hierarchical regression models were designed to remove any shared variance with the deep learning scales that other variables had in common with the writing scales, and therefore to detect the unique influence of the writing variables on the dependent variables.

Tables 9 and 10 show results for six blocked hierarchical regressions with the Deep Approaches to Learning as dependent variables—three models for first-year students and three models for seniors (detailed results are in Appendices A and B). Table 9 reports the percentage of additional explained variance for the student and institutional characteristics (entered as Block 1), other forms of engagement (Block 2), amount of writing (Block 3), and effective writing practices (Block 4). While the student and institutional background characteristics explained a small but meaningful percentage of the total variances in the three deep learning scales, the other forms of engagement captured moderate to large percentages

Table 8. Summary of Bivariate Correlations, Means, and Standard Deviations for Key Study Variables for First-Year Students and Seniors

													Senior	
	Measure		**1.**	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**	**Mean**	***SD***
1.	Interactive Writing Processes			.53	.32	.20	.31	.41	.22	.37	.42	.34	41.5	20.3
2.	Meaning-Making Writing Tasks		.57		.29	.26	.37	.40	.25	.37	.33	.30	51.2	18.3
3.	Clear Writing Expectations		.34	.25		.05	.27	.27	.19	.34	.31	.38	71.1	19.4
4.	Amount of Writing (Number of Pages)		.18	.23	.02		.11	.22	.11	.07	.10	.10	143.8	136.8
5.	Higher-Order Learning		.31	.35	.27	.18		.53	.37	.46	.37	.45	73.1	21.6
6.	Integrative Learning		.41	.42	.25	.27	.51		.50	.37	.40	.42	61.4	19.1
7.	Reflective Learning		.22	.26	.20	.15	.40	.51		.26	.35	.30	62.9	23.9
8.	Perceived Gains in Practical Competence		.41	.39	.35	.08	.47	.40	.32		.63	.72	69.5	22.0
9.	Perceived Gains in Personal and Social Development		.40	.37	.31	.12	.38	.40	.39	.67		.59	53.9	25.0
10.	Perceived Gains in General Education Learning		.39	.31	.38	.14	.45	.41	.32	.75	.58		74.0	21.8
	First-Year	**Mean**	49.0	47.5	71.9	95.8	68.5	54.4	59.3	64.1	53.1	70.1		
		SD	21.0	18.5	19.2	104.7	21.5	18.6	24.0	22.3	23.9	21.9		

Notes. Bivariate correlations, means, and standard deviations for first-year students are presented below and to the left of the diagonal. Bivariate correlations, means, and standard deviations for seniors are presented above and to the right of the diagonal. All correlations are significant at $p < .001$. The number of written pages is a composite estimate calculated from three questions which asked students how many papers or reports of "20 pages or more," "between 5 and 19 pages," and "fewer than 5 pages" they wrote. All other measures are the combination of multiple items that were first adjusted to a 100-point scale, and then averaged.

Table 9. Percentage of Additional Explained Variance in Deep Approaches to Learning for Each Block of Variables

		First-Year Students			Seniors		
Block	Variable	Higher-Order Learning	Integrative Learning	Reflective Learning	Higher-Order Learning	Integrative Learning	Reflective Learning
Block 1	Student and institutional characteristics	2%	4%	3%	3%	6%	4%
Block 2	Other forms of engagement	23%	39%	23%	26%	41%	19%
Block 3	Amount of writing (number of pages)	0%	1%	0%	0%	1%	0%
Block 4	Effective writing practices	5%	5%	2%	5%	4%	1%

Notes. Additional explained variance is the change in the R^2 statistic after the variables were entered into the model, and indicates the magnitude of the variables' *net* effect on the dependent variable. The number of written pages was added after institutional type, student characteristics, and other forms of engagement. Effective writing practices were entered last, and thus were also controlled for by the number of written pages.

ranging from 19% to 41%. The amount of writing had practically no additional influence on any of the deep learning variables for first-year or senior students, while the effective writing practices had a small but meaningful influence (between 4% and 5% of additional explained variance) on the Higher-Order Learning and Integrative Learning scales. The effective writing practices had a trivial effect on the Reflective Learning scale (between 1% and 2%).

Table 10 summarizes the standardized regression coefficients for the amount of writing and for the three effective writing scales. While the amount of writing had a trivial impact at best, findings indicate that some of the effective writing practices had positive, though small, relationships with Deep Approaches to Learning. For both first-year and senior students, the strongest relationship with all three Deep Approaches to Learning was observed for the frequency with which students reported being given Meaning-Making Writing Tasks. For both groups of students, Clear Writing Expectations had a stronger relationship with participation in Deep Approaches to Learning activities associated with Higher-Order Learning than with Integrative Learning and Reflective Learning.

Taken together, the results summarized in Tables 8, 9, and 10 suggest that writing assignments and instructional practices represented by each of our three writing scales were associated with increased participation in Deep Approaches to Learning, although some of that relationship was shared by other forms of engagement. First-year and senior students who reported that more of their writing assignments required meaning-making were especially likely to report greater participation in all three forms of Deep Approaches to Learning. In addition, students who reported that more of their writing assignments involved clearly explained expectations were more likely to report greater experience with Higher-Order Learning in the classroom.

Table 10. Summary of Unique Effects on Deep Approaches to Learning

	First-Year Students			Seniors		
Variable	Higher-Order Learning	Integrative Learning	Reflective Learning	Higher-Order Learning	Integrative Learning	Reflective Learning
Amount of Writing	*ns*	+	*ns*	+	+	+
Interactive Writing Processes	+	++	*ns*	*ns*	+	+
Meaning-Making Writing Tasks	++	++	++	++	++	++
Clear Writing Expectations	++	+	+	++	+	+

Notes. Regression results controlled for institutional type, student characteristics (gender, enrollment status, transfer status, residence, age, international status, parental education, race/ethnicity, self-reported grades, and major), and other forms of engagement (amount of assigned reading, service-learning, diversity experiences, group work, academic challenge, internships, learning communities, and research with faculty).

Key:
+ = $p < .001$ and unstandardized $B > 0$ (trivial)
++ = $p < .001$ and unstandardized $B \geq .10$ (small, positive effect)
- = $p < .001$ and unstandardized $B < 0$ (trivial)
ns = not significant

Results for Research Question 3

After controlling for student and institutional characteristics, for participation in other educationally purposeful activities (including Deep Approaches to Learning), and especially for the amount of writing students do, to what extent are the effective practices in writing assignments and instruction related to college students' Perceived Gains in Learning and Development?

Like the deep learning results above, correlations between the writing scales and Perceived Gains in Learning and Development (Practical Competence, Personal and Social Development, and General Education Learning) showed, absent any controls, that substantial bivariate relationships existed (Table 8). For example, correlations for both first-year students and seniors ranged between .30 and .42. However, recognizing that other variables could share common variance with effective writing practices in their relationships with perceived gains, we designed multivariate regression models to identify if a net relationship existed for the writing scales.

Tables 11 and 12 show results for the hierarchical regressions with the perceived gains scales as dependent variables (detailed results are in Appendices C and D). Table 11 reports the percentage of additional explained variance for the four blocks of independent variables. The student and institutional background characteristics explained a small but meaningful percentage of variances in the perceived gains scales, and the other forms of engagement captured moderately sized percentages ranging from 24% to 29%. The amount of writing had practically no additional

Table 11. Percentage of Additional Explained Variance in Perceived Gains in Learning and Development for Each Block of Variables

Block	Variable	First-Year Students			Seniors		
		Practical Competence	Personal and Social Development	General Education Learning	Practical Competence	Personal and Social Development	General Education Learning
Block 1	Student and institutional characteristics	3%	5%	3%	7%	7%	4%
Block 2	Other forms of engagement	29%	25%	27%	27%	24%	26%
Block 3	Number of written pages	0%	0%	0%	0%	0%	0%
Block 4	Effective writing practices	6%	5%	6%	5%	6%	5%

Notes. Additional explained variance is the change in the R^2 statistic after the variables were entered into the model, and indicates the magnitude of the variables' *net* effect on the dependent variable. The number of written pages was added after institutional type, student characteristics, and other forms of engagement (including Deep Approaches to Learning). Effective writing practices were entered last, and thus were also controlled for by the number of written pages.

influence on students' perceptions of their learning and development, while the effective writing practices had a small but meaningful influence (between 5% and 6% of additional explained variance) on all three dependent variables.

Table 12 summarizes the standardized regression coefficients for the amount of writing and for the three effective writing scales. Similar to the deep learning models, the amount of writing had virtually no impact, while almost all of the writing scale coefficients in the first-year models were nontrivial in size, with only two under the established threshold of .10. While the experience of Meaning-Making Writing Tasks—in contrast with the results for the deep learning experiences reported above—had the weakest relationships with all three Perceived Gains in Learning and Development scales, both Interactive Writing Processes and Clear Writing Expectations had small but meaningful effects.

Taken together, the results reported in Tables 8, 11, and 12 suggest that effective writing instruction is associated with more favorable perceptions of learning and development, although other forms of engagement share some of that relationship. First-year students and seniors whose writing assignments involved interactive processes and provided clear expectations were more likely to perceive greater progress in learning and development.

Table 12. Summary of Effects on Perceived Gains in Learning and Development

	First-Year Students			Seniors		
	Practical Competence	Personal and Social Development	General Education Learning	Practical Competence	Personal and Social Development	General Education Learning
Amount of Writing	-	-	*ns*	-	-	*ns*
Interactive Writing Processes	++	++	++	++	++	+
Meaning-Making Writing Tasks	++	+	+	+	+	+
Clear Writing Expectations	++	++	++	++	++	++

Notes. Regression results controlled for institutional type, student characteristics (gender, enrollment status, transfer status, residence, age, international status, parental education, race/ethnicity, self-reported grades, and major), and other forms of engagement (amount of assigned reading, service-learning, diversity experiences, group work, academic challenge, internships, learning communities, research with faculty, and Deep Approaches to Learning).

Key:
+ = $p < .001$ and unstandardized $B > 0$ (trivial)
++ = $p < .001$ and unstandardized $B \geq .10$ (small, positive effect)
- = $p < .001$ and unstandardized $B < 0$ (trivial)
ns = not significant

Limitations

The generalizability and utility of this study are limited by at least three design and methodological characteristics. First, institutions' self-selection into the consortium compromises our ability to assert unequivocally that the results are nationally representative. While the data were from a sizeable and diverse set of colleges and universities, an overrepresentation of research universities in the consortium may have resulted in a bias toward institutions that devote more attention and resources to writing across campus (although their research missions are often said to divert attention away from teaching). Second, part of the study relies on perceived gains rather than observed, direct student learning outcomes. Perceived gains do not always correlate with direct tests of cognitive gains, but they are valid in their use as important attitudinal measures about learning experiences (Gonyea & Miller, 2011; Pascarella & Terenzini, 2005). Finally, like all survey research, our study is limited by the time and effort respondents were willing to expend on the questionnaire. The writing questions, which were appended to the end of NSSE's online survey (which by itself asks students to respond to over 100 questions), could not probe as deeply into students' writing experiences as we would have liked. Substantial attrition from the questionnaire, evidenced by the number of missing responses to the writing questions, introduces potential nonrespondent bias. However, NSSE researchers have found that even a small number of respondents

to the survey provided stable results estimates for institutions (Fosnacht, Sarraf, Howe, & Peck, 2013).

Discussion

Our investigation of the three research questions yielded new ways of understanding the contribution that writing makes to learning in undergraduate education. Despite the limitations previously cited, we believe that it is reasonable to generalize from the 70,000 respondents in our study to the responses we would likely receive from all U.S. bachelor's degree–seeking students. Our sample did not replicate exactly the population of institutions offering bachelor's degrees (Table 4) or the population of undergraduates in those institutions (Table 3), but the sample seems close enough and large enough to justify this generalization. When interpreting our results, readers may want to adjust for the fact that a higher percentage of participating schools were large, public, research universities.

Research Question 1

In answering Research Question 1, we used elements of a consensus model of effective writing practices, and we used CFA to identify three constructs that have not previously been used in discussions of writing's contributions to learning: Interactive Writing Processes, Meaning-Making Writing Tasks, and Clear Writing Expectations. Further, use of these constructs is valid for two very different populations of undergraduates: first-year and senior students.

Research Question 2

The regressions conducted to answer our second research question demonstrate that the three constructs can be extended to three established NSSE scales that indicate students' participation in Deep Approaches to Learning: Higher-Order Learning, Integrative Learning, and Reflective Learning. Kane (2013) has named this kind of extension an *elaboration* because it involves the application of results developed in one domain (i.e., effective writing practices) to results developed independently in another domain (i.e., participation in Deep Approaches to Learning), usually through regression. For both first-year and senior students, each of these three effective writing practices explained a larger variance in each of the three Deep Approaches to Learning than did the number of written pages (Table 9). For first-year students, the effective writing practices explained an additional 5% of the variance for Higher-Order Learning, while the number of written pages accounted for 0%; for Integrative Learning the results were 5% versus 1%, and for Reflective Learning, 2% versus 0%. The results for seniors were similar.

Table 10 shows that the three effective writing practices had different effects on each of the Deep Approaches to Learning. Meaning-Making Writing Tasks had the strongest effect ($p < .001$ and unstandardized $B \geq .10$) on all three deep approaches for both first-year students and seniors. For the other two effective writing practices, the effect sizes were more varied. However, all three of the effective writing practices had a small, positive effect on at least one of the activities associated with

Deep Approaches to Learning for first-year students and for seniors. Further, in all but one case, the effect size of the effective writing practices was either greater than (10 of 17 instances) or equal to (7 of 17 instances) the effect sizes of number of written pages. The single exception was the effect size of Interactive Writing Processes for seniors.

In sum, the regressions used to answer Research Question 2 demonstrate that the three constructs of Interactive Writing Processes, Meaning-Making Writing Tasks, and Clear Writing Expectations are associated with students' engagement in deep learning activities, adding a new set of variables to consider when examining the contribution of writing to learning. Moreover, the R^2 values in Table 9 suggest that these constructs are much more strongly associated with engagement in deep learning activities than the number of pages written.

Research Question 3

Regression analyses conducted to answer the third research question indicate that the three constructs are also meaningfully related to three established NSSE scales for students' Perceived Gains in Learning and Development: Practical Competence, Personal and Social Development, and General Education Learning. This extension of the three constructs is also an elaboration as defined by Kane (2013). As Tables 11 and 12 indicate, the effects of the three constructs were even greater for the perceived gains than for engagement in deep learning activities. The percentage of additional variance (R^2) in perceived gains was 5% or 6% for all scales for both first-year students and seniors. In contrast, the additional variance for these scales that was explained by the number of written pages was 0% in every instance. Similarly, the effect size for number of written pages was either negative or not significant in every instance, whereas each of the three effective writing constructs had a nontrivial or greater impact on each of the perceived gains scales.

Of special interest is the impact of the three effective writing constructs on the scale for Personal and Social Development. Research into writing's contribution to learning has focused on students' acquisition of the knowledge and skills taught in courses. The indication that the three constructs can also affect students' perceived development personally and socially opens a new category of the benefits of writing in college. This scale asks students if their experience at their institution contributed to their "knowledge and skills and personal development in the following areas: developing a personal code of values; understanding yourself; understanding people of other racial and ethnic backgrounds; voting in local, state (provincial), or national federal elections; learning effectively on your own; contributing to the welfare of your community; and developing a deepened sense of spirituality."

In sum, the regressions conducted to answer Research Question 3 indicate that the three constructs for effective writing practices are positively associated with students' Perceived Gains not only in two key areas of learning—Practical Competence and General Education Learning—but also in Personal and Social Development.

Other Considerations

Our findings suggest one possible reason for the discrepancy between the large-scale studies and some quasi-experimental research. Some quasi-experimental studies may have failed to find associations between writing and increased learning because they used ineffective writing practices rather than effective ones for their independent variables, or they may have used as their independent variable only the amount of writing, not the nature of the writing assignments and supporting activities. Our findings also suggest that in the large-scale studies, the extent of writing's potential to increase learning may be strong enough that the positive results from well-designed assignments overpower the negative results of the poorly designed assignments.

While our findings are consistent with the studies of Astin (1992) and Arum and Roksa (2011), these findings extend and refine their results. For both of those studies, the independent variable was the amount of writing. Also, Arum and Roksa defined learning solely in terms of specific intellectual abilities. Our study suggests a broader range of educational benefits that include social and personal development.

Implications

This study adds three constructs to the discourse about writing's contribution to learning, and it demonstrates that these constructs have a positive effect on established markers for undergraduate students' learning as defined by the three scales for engagement in Deep Approaches to Learning and the three scales for Perceived Gains in Learning and Development.

The first question to be asked about the effects of these constructs is whether they are substantial. The R^2 values (effect sizes) in Tables 9 and 11 show that they are: The constructs explain a considerable amount of variance in the dependent variables, even after variances due to institutional characteristics, students' personal characteristics, and other forms of engagement have been accounted for. With the exception of one subscale (Reflective Learning), the R^2 values ranged from 4% to 6%. In every case, the effects of the constructs were much greater than the effects of the number of written pages, which were 0% in all but one dependent variable.

A separate and important question is whether the knowledge gained about the positive relationship of these constructs with learning and development can be used to guide faculty, departments, writing-across-the-curriculum specialists, institutions, and other stakeholders. Some researchers might suggest that because this study examines correlation, not causation, there is no justification for extending its results to application. In contrast, Kane's (2013) reconceptualization of validity leaves questions of application and use open to discussion and argument. We believe that our results can serve as a guide because of the nature of the questions associated with the three constructs.

The questions associated with the Clear Writing Expectations construct asked students to indicate for how many of their writing assignments their instructor performed each of the three actions associated with the construct. That is, the students reported the behaviors of their instructors. Our regression analysis indi-

cates that the students who reported that their instructors had performed these actions more often also reported that they themselves engaged more often in Deep Approaches to Learning, and reported greater perceived gains from their experience at their institution. Thus, there appears to be a reasonable basis for finding a causal relationship: the more actions instructors take to explain their assignments clearly (independent variable), the more the students will report positive behaviors and perceptions (dependent variables). The questions associated with the second construct, Meaning-Making Writing Tasks, asked students how often their writing assignments required them to analyze or evaluate something they read, researched, or observed; argue a position using evidence and reasoning; and summarize something they read, such as articles, books, or online publications. While instructors sometimes provide writing assignments that allow students to choose what they do, it is more common for them to ask students to perform certain types of intellectual work, including the kinds asked about in our questions. Consequently, we believe that the students' responses reflected to a high degree what their instructors asked them to do. The questions associated with the third construct, Interactive Writing Processes, asked students how often they interacted in various ways with their instructors, friends, family members, and others while working on an assignment. While some students—perhaps many—engage in such interactions on their own initiative, faculty can design their assignments to require peer review, instructor consultations, or other forms of interaction. Because each of the three constructs is associated with positive results and because instructors can increase the extent to which their assignments incorporate these constructs, we believe that the results of our study provide instructors with valid guidance for teaching.

Readers unpersuaded by this line of reasoning may observe that, based on our regression analyses, the effective writing practices are associated much more strongly than the amount of writing with greater student learning and development. There are undoubtedly instances where there is no student writing or so little that more would be salutary. However, the important lesson from our study is that quality matters—that in many situations it would be better to place more emphasis on the design and use of the assignments than on the number or size of them. Melzer's (2014) examination of 2,101 writing assignments from 400 courses at 100 colleges across the United States revealed a substantial need for more attention to assignment design, an outcome we hope our study will also inspire.

If our study does not show conclusively that employing our constructs in assignment design is effective, it at least *suggests* that the constructs are among the key characteristics of effective writing assignments. One way to test this suggestion is to use other research methods to examine the constructs—quasi-experiments, longitudinal studies, case studies, and so on. The outcomes would open the possibility of refuting, qualifying, supporting, or refining the constructs. The work of comparing our results with those of studies conducted through other methods could begin by looking at published studies related to the constructs. For example, Walker and Elias (1987) found that instructor-student conferences were most effective at helping students improve their writing when the instructor focused on articulating the criteria for success and evaluated the students' work against these

criteria, a finding that is consistent with our construct of Clear Writing Expectations. Much less effective were conferences in which the instructor repeatedly asked students to explain what they meant in parts of their papers. New studies using other research methods could also explore the ways and extent to which the constructs apply to various specific contexts in undergraduate education.

Because the constructs' origin is in a list of effective writing practices identified by members of CWPA, one might ask whether the constructs merely reflect practices that are already widely used across the curriculum. That impression may be strengthened by a table in a report on an early stage of our study (National Survey of Student Engagement, 2008) and reproduced in Addison and McGee (2010). The table indicated the collective percentage of students who answered our questions with one of the three highest options on our five-point Likert scale: "Some," Most," or "All." (The other responses were "Rarely" and "Never.") By reporting the collapsed scores, the table suggested that faculty, overall, are using the effective assignment practices very conscientiously. For example, 93% of first-year students and 92% of seniors reported that their instructors explained the criteria for some, most, or all of their writing assignments. However, examining the frequency distributions revealed that 21% of first-year students and 20% of seniors answered "Some," meaning that approximately 1 in 5 students do not receive this information on a regular basis. The frequency with which students reported encountering all of the other effective practices was lower still. In some cases, this could be because the particular practice is more relevant in some fields than others. But most of the effective practices can be implemented for writing assignments in any field. Thus, our results suggest that there is ample opportunity to improve undergraduates' learning and development by applying our three constructs more widely.

The nature of constructs raises an important implication of our study. The instructor behaviors that our questions asked about are not an exhaustive list of the behaviors that might be related to the three constructs. Our constructs are best conceived of as heuristics that instructors can use when designing writing assignments. For example, Table 9 indicates a strong relationship between Meaning-Making Writing Tasks and all three subscales for engagement in Deep Approaches to Learning. This result is grounded in how often the first-year and senior students reported that they performed the specific writing activities inquired about in the six questions associated with the Meaning-Making construct. However, in every discipline, there are many other forms of cognitively complex tasks that faculty could incorporate into their writing assignments. In future research and in teaching, there is no need to stick with the six tasks we asked about.

Our study suggests avenues for further research beyond those already mentioned. Surely, there are more constructs of effective assignment practices than the three we have identified. Characterizing them could expand our knowledge of writing and learning, as well as provide evidence to strengthen the consensus list of effective assignment practices. Also, our study results might be explored with different populations, including K–12 students, graduate students, and students in other countries.

Future research could also investigate contributions that our findings might make to other studies of factors that promote learning and specifically the transfer

of learning. For example, in *Education for Life and Work: Developing Transferable Knowledge and Skills for the 21st Century*, the National Research Council (NRC) (Pellegrino & Hilton, 2012) placed "deeper learning" at the heart of the educational enterprise, describing it as the kind of learning that enables the intellectual and practical transfer that is essential in our era. Learner activities that the NRC associated with deeper learning include synthesizing, applying, integrating, and reflecting—which are also items in the NSSE scales for Deep Approaches to Learning that are positively related to the use of our three constructs in writing assignments. In addition to the cognitive dimension of transfer, the NRC argued that various intrapersonal and interpersonal developments also increase people's ability to transfer knowledge and skills. Thus, our study's finding that writing assignments incorporating our constructs have a positive relationship with Perceived Personal and Social Development suggests another area for exploration related to transfer. Of course, the NRC's study of the general nature and conditions of transfer (Pellegrino & Hilton, 2012) would apply also to transfer in specific fields, including the active and important research on teaching for transfer by writing specialists (Wardle, 2012; Yancey, Robertson, & Taczak, 2014). This research might be enriched by considering the ways our findings can increase students' writing abilities and flexibility through transfer in college and after graduation.

Finally, the questions related to each of these constructs have been used to create the NSSE module "Experiences with Writing." Any college that administers NSSE can ask these questions to determine how extensively students perceive that these effective practices are being used on its campus. There is also a set of parallel questions in a module of the Faculty Survey of Student Engagement that can be used to obtain faculty reports on the extent to which they use these practices. The availability of these questions enables researchers to conduct additional research related to these constructs, including research that investigates relationships between their students' responses to these questions and other data the university holds about the students in its own records.

Conclusion

Taken together, the results of our three research questions indicate that, based on students' experiences across a variety of institutional types, sizes, missions, and geographic locations, writing assignments that involve the three constructs of Interactive Writing Processes, Meaning-Making Writing Tasks, and Clear Writing Expectations enhance undergraduate students' participation in Deep Approaches to Learning (Higher-Order Learning, Integrative Learning, and Reflective Learning) and their Perceived Gains in Learning and Development as defined by the acquisition of Practical Competence, Personal and Social Development, and General Education Learning. These results persist after controlling for student characteristics such as gender, parental education, race, grades, and major, as well as the amount of writing students were assigned. The results can underwrite modified and new approaches to designing and presenting the writing assignments given to undergraduates in any course, and they could be used as a basis for future research that might extend, refine, and qualify our findings.

APPENDIXES

There are four additional tables on the *RTE* website (www.ncte.org/journals/rte) that show the regression results for Dependent Variables in the Deep Approaches to Learning Scales and the Perceived Gains in Learning and Development Scales, for both first-year students and seniors.

AUTHORS' NOTES

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