

Writing Shapes Thinking: Investigative Study of Preservice Teachers Reading, Writing to Learn, and Critical Thinking

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Abstract

Teacher Preparation Programs must work towards not only preparing preservice teachers to have knowledge of classroom pedagogy but also must expand preservice teachers understanding of content knowledge as well as to develop higher-order thinking which includes thinking critically. This mixed methods study examined how writing shapes thinking and how writing in the content areas can be a tool to promote both critical thinking and learning new content material. This study focused on preservice teachers and utilized structured writing assignment tasks including surveys and rubrics to assess and measure progress throughout the semester. Research questions addressed in this study: 1) Does writing in the content area help preservice teachers learn new material? 2) Does writing in the content area translate to critical thinking for preservice teachers? and 3) If writing shapes thinking, to what degree does it shape critical thinking for preservice teachers? Overall, findings indicate positive correlations between writing to learn and progress towards critical thinking.

Introduction

In an era of digital literacies, where we are constantly overwhelmed with new information and new technologies, classroom teachers are challenged with motivating and challenging students to be both reflective and critical thinkers. Rosenblatt's (1978) reader response theory suggest that readers interrupt and make meaning based on what exists in the mind of the reader and what they bring to the readings. Additionally, research has indicated that we have become a nation that has developed students who can read and summarize information well but only three out of every 100 students enrolled in K-12 academic settings have the ability to critically analyze and synthesize information (Conley, 2012; Mullis, Campbell, & Farstrup, 1993). These statistics mean that

high school students are not college ready (Conley, 2012).

Newell (2006) suggests that helping students to be critical thinkers and college ready could be accomplished if more teachers utilized the constructivist approach. This view of teaching and learning is based on the notion that learning is a process involving tentative explorations of information that could help students to become more thoughtful about their learning. Understanding or knowledge of information grows and changes as the learning process progresses. Newell (2006) further agrees with Langer & Applebee (2007) in that "knowledge out of context often emphasizes memorization and rote learning" (p. 16-17). According to Newell (2006), a constructivist approach of

knowledge in action combines knowledge of current and past ideas, conversations, issues, and areas of concern. With this framework in mind, Newell (2006) suggests that when writing assignments are used within specialized fields or genres they offer new ways of understanding and expanding. The following three research questions are the primary focus of this mixed methods study:

1. Does writing in the content area help preservice teachers learn new material?
2. Does writing in the content area translate to critical thinking for preservice teachers?
3. If writing shapes thinking, as indicated by the literature, then to what degree, if possible, does it shape critical thinking for preservice teachers?

Literature Review

Writing Shapes Thinking and Learning

The act of writing shapes thinking as it develops the metacognitive processes fostering deeper understanding, connections between texts, and higher order thinking (Williams, 2005). Research shows that specific types of writing contribute to the shaping of thinking (Bangert-Drowns, Hurley & Wilkinson, 2004; MacArthur, Graham, & Fitzgerald, 2006; Knipper, 2006; Knipper & Duggan, 2006; Paul, Elder, & Bartell, 1997; Williams, 2005). One example of a specific type of writing that shapes thinking is discussion posts. Discussion posts require students to focus on their analytic writing in order to concisely answer a prompt. At the same time, students are asked to elaborate on their responses adding to their understanding of the topic beyond the textbook definition. This is in contrast to the types of writing which provide a boarder understanding of material, at a more surface level of understanding,

such as journals or summaries (Langer & Applebee, 2007).

Writing shapes thinking in two different ways. First, it molds understanding because one engages in writing to learn. Secondly, it shapes the development of critical thinking (Bangert-Drowns, Hurley & Wilkinson, 2004; Knipper & Duggan, 2006; Langer & Applebee, 2007; Williams, 2005).

Writing for purposes of constructing meaning across content areas is a powerful approach for learning subject matter (Knipper & Duggan, 2006). While there is a consensus that writing is beneficial for students, there is a still a debate on how writing instruction can increase course content understanding and knowledge. Some research supports that writing to learn has an impact on student achievement, especially related to critical thinking (Bangert-Drowns, Hurley & Wilkinson, 2004). A meta-analysis study conducted coded 17 variables related to writing to learn, which were then sorted into the following categories: intensity of treatment, features of writing tasks, contextual, methodological, and publication. Metacognitive stimulation and feedback on writing assignments showed significant effect sizes within the category of features of writing tasks (Bangert-Drowns, Hurley & Wilkinson, 2004). The significant effect sizes indicate that the greatest amount of growth occurs when students receive feedback on their work as well as when the writing assignments required the students to engage in higher order thinking in order to answer writing prompts. Findings also showed significant effect sizes for the length of the treatment and minutes per writing tasks within the category of intensity of treatment. This shows a correlation between the amount of time students spent on a writing task and the number of times the

student repeated the same task. This correlation indicates that repeated practice helps students to improve their writing and critical thinking as they are repeatedly engaged in the writing process.

Construct of Critical Thinking

Critical thinking is defined in a variety of ways depending on the context in which it is utilized. McPeck (1981) defines critical thinking as discipline specific problem solving skills in a specific area. Solon (2003) refers to critical thinking as skills inclusive of the following:

“1) inferences 2) assumptions and conclusions 3) consistent and inconsistent statements 4) deductive and inductive reasoning 5) valid and invalid arguments 6) credible versus questionable claims 7) meaningful versus vague or meaningless language 8) relevant versus irrelevant evidence and 9) scientific versus pseudoscientific procedures” (p.26-27).

Critical thinking is broken down into two equally important components: cognitive disposition and ability. Cognitive disposition is characterized by a willingness to explore abstract ideas, controlling impulsivity, being open to new ideas, and a desire to be challenged and to challenge (Halpern, 2005; Halpern, 1998; Paul & Elder, 2003; Winn, 2004). The ability to think critically is characterized by the process of evaluating, synthesizing, analyzing and drawing logical conclusions or understandings based on the information (Williams, 2005). In order to be a critical thinker one must have both the cognitive disposition and the ability to think critically.

While definitions of critical thinking may vary, they all support the notion that it takes time to develop the skills that lead towards the development of becoming a critical thinker. In addition, one must be a problem

solver who is capable of evaluating information in order to make meaning from it, and be open to seeking out new understandings based on evidence (McPeck, 1981; Paul & Elder, 2003; Solon, 2003).

Challenges towards developing critical thinking include failure to identify creditable sources which in turn affects the quality of the conclusions, as society as a whole tends to be over eager to accept information as true without first identifying the reliability of the source (Williams, 2005). Debate is also centered on the best method for teaching critical thinking skills. Some feel that critical thinking is domain specific, while others feel it can be sought separately and applied cross-curricula (Behar-Horensein & Niu, 2011; Williams, 2005). Yet, both sides of the debate agree that the greatest gains in critical thinking occur when there is explicit instruction (Behar-Horensein & Niu, 2011).

Critical Thinking within Teacher Preparation Programs

The importance of being able to think critically is proclaimed over and over, both in the educational setting and the real world (Forehand, 2005; Mullis, Campbell, & Farstrup, 1993). In the state of Texas, the Texas College Readiness Standards, which are cross disciplinary, encourage research, synthesis, and analysis within the standards prompting critical thinking. Therefore, it stands to reason that within the field of teacher preparation programs that teaching and learning through critical thinking would be a priority. However, studies show that few teacher educators have a deep understanding of critical thinking (Forehand, 2005; Paul, Elder, & Bartell, 1997; Williams, 2005), as 89% of higher education teachers in one study indicated that critical thinking was a priority, yet only 9% focused

on critical thinking on a daily basis (Forehand, 2005; Paul et al, 1997).

Deliberate, systematic approaches are needed in order to address critical thinking in teacher preparation programs (Williams, 2005). Critical thinking must be introduced, reinforced, and mastered throughout the coursework as it is not a skill that is simply absorbed by the student. The greatest gains in critical thinking occur when it is embedded in the course content over time. Preservice teachers are being prepared to teach K-12 students content material. Thus, content knowledge is critical to the development of critical thinking. Without the content knowledge, it becomes challenging to critically think about a specific subject. Once there is a content knowledge base, however, one must learn to question the information so that new understandings can be made. This is best accomplished by relating course content to student experiences, current events, and sources beyond the textbook. Writing provides an outlet for this questioning of content, making meaning and formulating new ideas. Writing promotes synthesis and analysis of content, whether it is through reflections, summaries, essays or research papers.

Another component of becoming a critical thinker is developing problem-solving skills (McPeck, 1981; Paul & Elder, 2003; Solon, 2003). Problem-solving skills are developed when a student can identify an important issue in society and then research several possible resolutions to the problem. One study found that preservice teachers who scored high on critical thinking skills sought out information sources of high quality to support their writings, which translated into more accurate and thorough responses, while those who rated lower in critical thinking skills, often identified fewer and

weaker sources, while relying on their personal understandings to support their responses (Williams, 2005).

Another challenge to teaching critical thinking is the resistance from the students (Keeley, Shemberg, Cowell, & Zinnbauer, 1995; Williams, 2005). Students resist ambiguity and are uncomfortable when there is not a single correct answer. Yet, it is only when one begins to question one's understanding that critical thinking can occur. Writing is a perfect vehicle to foster critical thinking as prompts can be open-ended or scaffold questions. Open-ended questions provide critical thinking opportunities to students as there is not a single right or wrong answer. Rather, the purpose of open-ended questions is to spark discussion and critical thinking. Students support their answers using textbooks or research, but then expand on the idea by adding their own synthesis and analysis. Scaffold questioning is a differentiating process where the teacher provides assistance to students with the goal of transitioning the student to becoming an independent learner. The teacher provides support based on the individual needs of the student (Ellis, 2000).

Writing assignments are an excellent way to cultivate critical thinking skills. Critical reflective writing has proven to be an effective way to develop critical thinking skills in teacher preparation programs. Dewey (1933) was one of the earliest supporters of the use of reflection during teacher preparation programs. He identified three components of reflection: open-mindedness, responsibility, and wholeheartedness. When a person uses these components to evaluate their work it results in an individual's cognitive growth. In current society, some teachers make decisions and deliver content instruction

without understanding the why, or reflecting on their decisions or the happenings in the classroom (Shulman, 1998; Yost, Sentner & Forlenza-Bailey, 2000). Teacher preparation programs must promote both content knowledge and critical thinking skills, as teachers need to be both knowledgeable and critical thinkers in order to pass on these skills to their students (Darling-Hammond, Bransford, LePage, Hammerness, & Duffy, 2007).

Research shows that critical reflection results in gradual growth evolving from technical writing to more complex writing (Guillaume & Rudney, 1993). Critical reflections provide opportunities for preservice teachers to draw on content knowledge and skills, apply their critical thinking, in order to create new understanding. This process involves using problem-solving skills, which is one of the key components of critical thinking (Yost, Sentner & Forlenza-Bailey, 2000). By engaging students in critical reflection, one is operating at the highest level of Bloom's Taxonomy. "The end result of critical reflection for the individual is cognitive change" (Yost et al, 2000, p. 41).

Literature reflects the power of writing to shape thinking and learning (Behar-Horenstein & Niu, 2011; Guillaume & Rudney, 1993; Yost, et al, 2000). Using writing assignments in teacher preparation programs are well documented to have positive effects on critical thinking and learning (Shulman, 1987; Williams, 2005). Yet, teacher preparation programs still have not fully embraced writing as a tool to teach critical thinking (Shulman, 1987; Williams, 2005). "It is unlikely that future teachers will promote students' critical thinking unless future teachers themselves become skilled critical thinkers. It is equally unlikely that teacher education students will

become skilled critical thinkers if critical thinking practices are not emphasized in their teacher education programs" (Williams, 2005, p. 164). Thus, it is critical that educational institutions embrace this change, and shift to the paradigm that the objective of teacher preparation programs is to teach preservice teachers how to think rather than what to think (Daud & Husin, 2004, p.478).

Method

Participants

This study took place in the southwestern Texas region. The bilingual students were predominately Hispanic with first or second-generation college students. The participants were undergraduate preservice teachers enrolled in two different upper-level writing intensive (WIN) diversity courses taught by two different professors. At the beginning of the study, there were 93 participants, but due to attrition, only eighty-eight (67 female and 21 male) participants were included due to completion of both pre and post surveys.

Survey Instruments

Preservice teachers completed a pre/post Likert-scale Writing Self-Assessment Survey developed by the researchers. The Writing Self-Assessment Survey previously piloted was to determine the clarity and quality of the questions in the survey. The survey instrument consisted of a variety of responses including 19 demographic questions and 31 questions related to student writing practices, writing grammar and skill components, and self-reflection on writing growth over the semester. In some cases, participants were asked to scale/rank themselves according to the Likert scale, which included: Almost always (5), Sometimes (4), Once in a while (3), Rarely (2), and Never (1).

Structured Writing Assignment: Rubrics for Measuring Learning and Critical Thinking

Preservice teachers in the study were assigned ten chapter-writing assignments throughout the semester. The assignment requirements included: accurate descriptions of issues and ideas from chapters, inferences on three main points from chapters, additional reference support, collective synthesis and reflection that expands on teaching and learning, and grammar and format (APA). The structured writing assignment was the same for each chapter summary and students received feedback on each chapter summary as a means of improving their understanding of the content as well as their critical thinking skills.

Student data analyzed for purposes of this study included the first and last chapter summaries submitted by students. The researchers scored 25 sets of writing samples, which were randomly selected from the various course sections. The writing samples were scored utilizing both a rubric for measuring learning (Sanchez & Lewis, 2013; see Appendix A) and a rubric for measuring critical thinking (see appendix B) which were developed by the researchers reflective of current literature (McPeck, 1981; Solon, 2003; Tomasek, 2009).

The rubric measuring learning focused on 5 categories: description, inference, reference source, synthesis and grammar/formatting, related to writing to learn content. Each component was scored on a scale of 1-3 points depending on the criteria (see Appendix A). The rubric measuring critical thinking focused on 6 categories: Focus: Clarify ambiguous meanings, Logic: Interpret and draw conclusions, Logic: Examine ideas of self and other authors, Content: Show evidence of analysis and evaluations of text, Reasoning: Questions

truth, and Research: makes connections from text to other texts. Each component was scored on a scale from 4-1 depending on the criteria. The superior level 4 demonstrated mastery at the highest level. Level 3 skill ranking represents effective application of skills. Level 2 adequate level indicates novice use of critical thinking criteria. Inadequate level 1 represents little to no understanding of the critical thinking categories (see Appendix B).

To establish a consensus in scoring the essays, both examiners independently scored a sample of 10 essays applying both rubrics prior to the study. The inter-rater reliability for the examiners was $r = .90$ for initial ratings of the essays.

Results

The results of this pre/post mixed methods study address the following research questions. First, the questions are provided then how the data were analyzed and reported.

Research Question #1

Research Question #1 asked if writing in the content area helped preservice teachers learn new material. The quantitative question "Writing can help me learn" was selected from the entire Writing Self-Assessment Survey to answer this question specifically and descriptive analysis was applied.

The data indicated that almost half of all the students surveyed perceived writing as a tool for helping them learn content material. There was no increase in mean scores from pre to post. Table 1 provides quantitative data for the structured writing samples scored with the rubric for measuring learning. A comparative analysis was applied to the data collection.

Table 1
Writing can help me learn

	Pre-Survey Results		Post-Survey Results	
	<i>M</i>		<i>M</i>	
	<i>SD</i>	.784	<i>SD</i>	.789
Almost Always	42 (46.2%)		42 (47.2%)	
Sometimes	33 (36.6%)		33 (37.1%)	
Once in a While	11 (12.9%)		11 (12.4%)	
Rarely	2 (3.2%)		1 (1.1%)	
Never	0%		1 (1.1%)	

Student data, seen in Table 2, analyzed 25 sets of writing samples for the pre/post data. Calculated effect sizes for all categories from pre to post summaries provided meaningful insights. Small effect range sizes (*ES*) were seen in the category on Grammar/ Formatting $r = .148$. This is an indication that little growth occurred in this

area over the semester. Moderate effect size was seen in the three different categories: Description $r = .358$; Reference Sources $r = .415$; and Synthesis $r = .488$. This means there was moderate change in preservice teachers using these skills.

The Inference category results indicated a large effect size $r = .867$ which indicates increases in how preservice teachers collectively and effectively engaged in reflecting on information learned and expanding on teaching and learning concepts by making inferences based on collective information. Synthesis and inferencing, which changed the most, are ranked among the higher order thinking skills categories, which contribute to critical thinking (Forehand, 2005). Large effect sizes are an indication that there is less overlapping from pre to post and differences indicating change in utilizing and applying these skills from pre to post.

Table 2
Rubric for Measuring Learning on the Structured Writing Samples

	<i>M</i>		<i>SD</i>		<i>Cohen's d</i>	<i>Effect Size r</i>
	<i>Pre</i>	<i>Post</i>	<i>Pre</i>	<i>Post</i>		
Description	2.68	2.96	.48	.20	.767	.358
Inference	2.32	2.64	.48	.49	3.48	.867
Reference Source	2.12	2.68	.73	.48	.912	.415
Synthesis	2.12	2.64	.44	.49	1.12	.488
Grammar/ Formatting	2.20	2.36	.50	.57	.299	.148

Research Question #2
Research Question 2 asked if writing in the content area translated to critical thinking

for preservice teachers. Table 3 below provides quantitative data from the structured writing samples scored with the

rubric used for measuring critical thinking. Comparative analyses were used to examine this data.

Table 3 provides data results on the means and standard deviations of the first and last summaries of the structured writing assignments. Calculated effect sizes for all categories from pre to post summaries provided meaningful insights. Small effect range sizes (*ES*) were reported for the Logic category $r=.285$ as well as for the Research category $r=.280$. Medium effect range sizes

(*ES*) were reported for the Focus category $r=.389$. Medium effect sizes for Logic category were reported $r= .304$. The Content category $r= .377$ and Reasoning category $r= .320$ both reported medium effect size ranges. All categories reporting medium effect size ranges are an indication of moderate overlapping from pre to post with signifies a change in the critical thinking skills application while still a moderate advancement towards practicing and utilizing critical thinking skills applications.

Table 3
Rubric for Measuring Critical Thinking on Structured Writing Samples

	<i>M</i>		<i>SD</i>		<i>Cohen's d</i>	<i>Effect Size r</i>
	<i>Pre</i>	<i>Post</i>	<i>Pre</i>	<i>Post</i>		
FOCUS: Clarify ambiguous meaning	2.48	3.00	.59	.65	.843	.389
LOGIC: Interpret & Draw Conclusions	2.40	2.80	.58	.50	.594	.285
LOGIC: Examine ideas of self and other authors	2.36	2.84	.81	.69	.684	.304
CONTENT: Show evidence of analysis & evaluations of text	2.32	2.76	.56	.52	.815	.377
REASONONG: Questions truth	1.96	2.60	.89	1.00	.677	.320
RESEARCH: Makes connections from text to other resources	2.40	2.84	.71	.80	.583	.280

Research Question #3

Research Question #3 asked if writing shaped one’s thinking, and if so, to what degree does it shape critical thinking for

preservice teachers. Tables 2 and 3 provide quantitative data from structured writing samples scored with a rubric for measuring

critical thinking. Comparative analysis was applied to this data.

Williams (2005) suggest that it takes time to develop skills that serve as catalyst for critical thinking skills and that problem solving skills as part of this process that leads toward new understandings based on evidence. Table 3 indicates moderate growth from pre to post in Focus: Clarify meaning, Logic: Examine ideas of self and other authors, Content: Show evidence of analysis and evaluations of text, and Reasoning: Questions truth. This category collectively reflects learning of content material but expands beyond surface learning towards higher order levels of thinking for preservice teachers. Synthesis and Inferences (Table 2) also support the findings reported in Table 3. Definitions of critical thinking vary, but according to Solon (2003) critical thinking includes the ability to inference, raise conclusions, question claims, and examine evidence, which this data supports the preservice teachers used.

Overall, findings in Tables 2 and 3 are indications that the structured writing tasks student are engaging in, contributes to shaping their thinking, as well as contributes towards increasing their content area knowledge.

Discussions and Conclusions

As Knipper and Duggan (2006) stated writing across content areas is a powerful approach for learning subject matter. This is aligned with the data of students pre-surveyed, as 77 (83%) indicated that they sometimes or almost always used writing to help them learn content course material. With this said, there was a small gradual increase in this perception post surveyed 75 (84%, Table 1).

Moderate growth from pre to post occurred in the Description and Reference Source categories reflected in growth of content material (Table 2). Additionally, large effect size growth for Synthesis and Inference categories were also shown. The structured writing assignment tasks from pre to post suggest that throughout the semester preservice teachers developed their understanding of the content material as well as created new understandings of the material. Langer and Applebee (2007) suggest that writing shapes thinking and it fosters deeper understandings of connections between texts, which lead to higher order thinking. Table 2 pre-surveyed indicates that preservice teachers are average/above average in course content knowledge and potentially college ready. Based on the moderate to large effect sizes reported, the data here supports the research that writing can be an effective mechanism to learn content material.

The value of writing to learn is recognized in current literature and is supported by the findings of this research study, where there were moderate to large areas of growth pre to post. This study expands on and supports the findings in a previous study, "Writing to Learn: A Study of Preservice Teachers Demonstrated Increased Content Knowledge through the use of Structured Writing Assignments" conducted by Sanchez and Lewis (2013). The correlations between the two studies further supports the positive effects found in connection to writing to learn content material.

The positive effects related to critical thinking are encouraging as it demonstrates that preservice teachers are being provided systematic instruction to develop their critical thinking skills over time. This is a necessary step, for developing as a critical thinker, which is well-documented in the

literature (Solon, 2003). This is also encouraging data as research suggests that there is a disconnect between preservice teachers using critical thinking skills in the k-12 classroom and college professors integrating critical thinking skills in the coursework (Darling-Hammond, Bransford, LePage, Hammerness, & Duffy, 2007; Keeley, Shemberg, Cowell, & Zinnbauer, 1995; Yost, Sentner & Forlenza-Bailey, 2000).

The structured writing tasks assigned to preservice teachers were designed to guide their learning and understanding of course material while nurturing their development towards critical thinking. The writing tasks were repeated multiple times throughout the semester, which allowed for repeated practice of these skills. Paul, Elder, and Bartell (1997) indicated that critical thinking must be introduced, reinforced, and mastered throughout the coursework as it is not a simple skill that is immediately absorbed. Furthermore, Williams (2005) found that critical thinking cannot be confined to course material alone, but rather must be inclusive of outside resources, references, and media. Collectively these mediums serve as connections or opportunities to question truths, which help shape critical thinking for preservice teachers.

The findings in this study suggest that Teacher Preparation programs can promote critical thinking of preservice teachers by opportunities to write. Further, research is needed to evaluate the long term effects of systematically providing instruction for preservice teachers in critical thinking skills.

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Appendix A: Rubric: Measuring Learning

Assignment Requirements	Excellent/Good 3	Average 2	Below Average/Poor 1
Description	Accurate descriptions of issues/ideas within the chapters	Limited descriptions of issues/ideas within the chapters	Inaccurate/errors in descriptions of issues/ideas within the chapters
Inference	Implication of 3 main points from chapters	Implication of less than 3 main points from chapters	Inaccurate/errors of implications of main points from chapters
Reference Source	Additional reference(s) supports inferences	Additional reference provides minimal support of inferences	Additional reference does not support inferences
Synthesis	Description, inference, and reference source collectively and effectively reflect and expand on teaching and learning	Description, inference, and reference source collectively and moderately reflect and expand on teaching and learning	Description, inference, and reference source include inaccuracies/errors and fail to expand on teaching and learning
Grammar & Formatting (APA)	Grammar & format (APA) correct	Minor grammar and/ format (APA) errors	Multiple grammar and/ format (APA) errors

Sanchez and Lewis (2013)

Appendix B: Rubric for Measuring Critical Thinking

Critical Thinking Rubric	Superior 4: Mastery highest level	Skilled 3: Effective application of skills	Adequate 2: Novice use of critical thinking criteria	Inadequate 1: Little to no understanding
FOCUS: Clarify ambiguous meaning				
LOGIC: Interpret and draw conclusions				
LOGIC: Examine ideas of self and other authors				
CONTENT: Show evidence of analysis and evaluation text				
REASONING: Questions truth				
RESEARCH: Makes connections from text to other text				