English Language Teaching; Vol. 8, No. 5; 2015
ISSN 1916-4742 E-ISSN 1916-4750
Published by Canadian Center of Science and Education

Writing for Learning to Improve Students' Comprehension at the College Level

Fahad Alharbi[1]

[1] The University of Kansas, USA

Correspondence: Fahad Alharbi, The University of Kansas, USA. E-mail: fahad2009@ku.edu

Received: December 17, 2014 Accepted: January 30, 2015 Online Published: April 23, 2015

doi:10.5539/elt.v8n5p222 URL: http://dx.doi.org/10.5539/elt.v8n5p222

Abstract

This literature review will illustrate how writing could improve students' comprehension. Writing is one of the most important skills that students need to master for college level work. Therefore, students should be prepared with these skills before moving to the college level because they are required to write numerous papers that tend to be used for learning assessment. Writing not only helps professors to assess students, but it also helps students to enhance their reading comprehension; this is because students'writing is formedbased on what they have read. Therefore, this means thatreading comprehension is a critical skill for college level success. Reading comprehension is a complex process. In order to understand a text, the reader needs to recognize its words and access their meaning, the reader needs to activate related knowledge must be activated, and the reader needs to generate inferences as information is integrated during the time of reading. Thus, students' writing is affected by their reading, and how they understand what they have read. In this paper on the reading comprehension, the connection between reading and writing and the effects of writing on how students learn content will be discussed in light of the literature to illustrate importance in preparing students for writing they will do in their college classes.

1. Introduction

It is crucial to understand reading comprehension and how it develops because of how strongly it affects students' writing. The RAND Reading Study Group identified reading comprehension as the process of simultaneously extracting and constructing through involvement and interaction with written text (Snow, 2002). They list three elements that affect reading comprehension:

1) A reader who comprehends the text.

2) A text that is comprehended by the reader.

3) Activity, which is the processes of comprehension (Snow, 2002, p. 11).

The reader brings his or herknowledge, abilitiesand experiences to the act of reading while reading the text. During time spent reading, the reader is doing activities, such as determining purposes, processes, and consequences, in order to comprehend the text. Those three elements determine a phenomenon that happens within the larger sociocultural context that is shaped by the reader (see Figure1) (Snow, 2002).

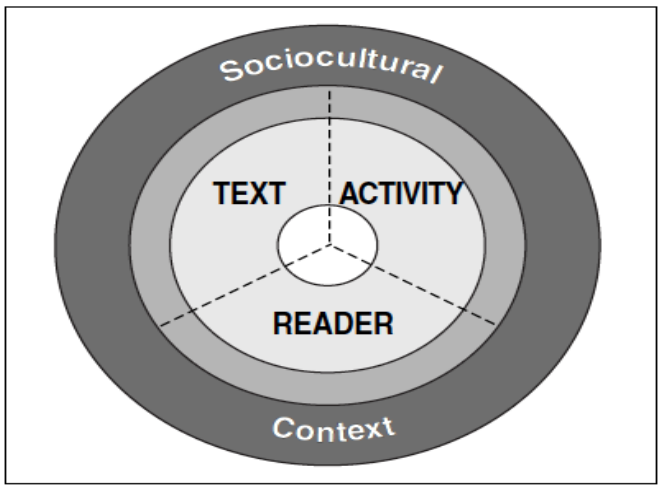

Figure 1. Rand reading study group heuristic

Source: Snow, 2002.

Reader, textand activity is interrelated because the reader brings ideas to the text and then in turn takes ideas from the text. Therefore, it is important to distinguish between what the reader brings and then takes from the text during the processes of reading.Reading comprehension is a macrodevelopmental aspect because it is not stable; it is changeable from time to time based on the reader'smaturity, the developmental of reader's cognitive skills, and the reader's experiences (Snow, 2002).

1.1 The Reader

The reader is at the center of the processes of learning so that person must have particular cognitive abilities such as attention, memory, and criticalanalysis capabilitiesin order to comprehend the text and expand his or her knowledge. Motivation to read is another aspect that affects students' reading comprehension, which means thatstudents benefit from receiving activities to improve their cognitive abilities and increase their motivation to read Snow (2002) notes this, saying, "Thus, although teachers may focus their content area instruction on helping students understand the material, an important concurrent goal is helping students learn how to become self-regulated, active readers who have a variety of strategies to help them comprehend" (Snow, 2002, p. 14).

1.2 The Text

The features of the text have a large influence on students' comprehension. Readers might face different representations such as surface code, text bases and representations of the mental models embedded in the text (Snow, 2002). In addition, text can be easy or difficult to read based on a reader's ability. There are strong relationships between the types of text, knowledge and reader's ability. For example, some content requires a high level of thinking (such as analysis, synthesis, and creativity) to understand the text, while other texts only need basic levels of thinking (such as memorizing and applying). The knowledge about the text has a strong effect on a reader's comprehension because if the reader has no knowledge about what he or she reads, that person will have a difficult time understanding what wasread. For example, when giving a student who has not read any chemistry text one to read, that student will have challenges in trying to understand it. The level of vocabulary of the text might affect a reader's comprehension if it is difficult for him or her (Snow, 2002).

1.3 The Activity

Students read for a specific purpose, and activity refers to this dimension of reading. For example, readers might read to expand their knowledge or to complete a class assignment. They are expected to accept the information that they have read. RAND states how the purpose of reading could affect students' comprehension. For instance, if the purpose of reading a particular text comes from outside of the student, the student might compliantly accept the assignment; however, another possible reaction is that the student may not fully engage with the text because he or she does not see the purpose, which can lead to incomplete comprehension (Snow, 2002). Because classroom reading is often externally mandated, both possible responses to reading need to be anticipated by the teacher. It would be advised that teachers consider ways to help students see the relevance of the text in order to increase the likelihood that they will comprehend that text.

Based on the purposes of reading, a reader will process and find a level of comprehension. For example, if the reader only wants to find specific information, that person might skim the text to unearthwhat is wanted. However, if the purposes of reading are summarizing the text and critiquing it, that person may need to read more carefully and use high processes of thinking in order to find that type of information (Snow, 2002). In addition, RAND believes consequences of reading are tied into aspects of the activity. For example, certain activities lead to increased reader's knowledge even though the purpose of reading could be either enjoyment or studying. Another purpose of reading is to figure out how to use or do something. The consequence for the reader is to know the application of how to undertake that action, such as repairing a car or install a dryer hose. This information all points to the idea that reading will have a purpose, although that purpose can have different levels of use; knowledge, application, and engagement can be viewed as direct consequences (Snow, 2002).

Barton et al. (2002) state that teaching reading through the content area is not only about teaching students basic reading skills, but it is also teaching students to use reading as a tool to think about their learning. As students move up from one grade to the next grade, their academic demands increase as well, and the greatestdemand comes in the form of reading. The ability to comprehend atext in the content area is critical to students' academic success. When students move from level to level, the content becomes more challengingand more difficult. For example, when students graduate from high school and enroll for college classes, the texts that they are required to read will be more complex and difficult, so it is crucial to teach students strategies that might help them to understand what they read in the content area (Ness, 2007). Research clearly indicates that reading comprehension instruction is helpful for students at all levels (Collins, 1991; Deshler, Ellis, & Lenz, 1996; Schorzman & Cheek, 2004; Snow & Biancarosa, 2004; Stevens, 2003). It is highly recommended to teach students explicit instruction in comprehension strategies in order to improve their reading comprehension (Panel, Health, & Development, 2000). The National Reading Panel (2000) states that "The idea behind explicit instruction of text comprehension is that comprehension can be improved by teachingstudents to use specific cognitive strategies or to reason strategically when they encounter barriers to comprehension when reading" (pp. 4-39).

Research indicates that reading instruction in a specific area such as science (Barton, Heidema, & Jordan, 2002; Greenleaf & Schoenbach, 2004) or social studies (Mosborg, 2002; Perfetti, Britt, & Georgi, 1995) can help students to understand the concept of those areas and improve their reading comprehension.

Reading is key to learning as it helps students to improve their knowledge more effectively (Othman & Jaidi, 2012). In the context of learning at auniversity level, examining a students' reading process is necessary not only for the purpose of understanding the content but also to come up with inferences (Othman, 2010). When readers use metacognitive strategies during the reading process, theyhave to perform construction in term of awareness and control (Kuhn, 2000). Kuhn (2000) believes mature readers need to know the function of remembering and how knowledge can be related to the capacity to remember. Metacognitive is defined as cognition about cognition, which is the second level of cognition where a learner thinks about thinking, considers knowledge about knowledge, and reflects about actions (Papleontiou-louca, 2003). Louca (2003) also states that when cognition is associated with understanding, remembering, and perceptions, metacognition involves thoughts that an individual has about the same areas of understanding, remembering, and perceptions. The reading process places emphasis on cognitive approaches, and readers are required to apply their cognitive ability in order to comprehend what they read. The reading process is not only reading the text word by word but also drawing meaning about what has been read and thinking about thinking while reading the text (Othman & Jaidi, 2012).

Comprehension also can be viewed as a process of constructing understanding of a text. Two important features go into comprehending a text. First, comprehending a text should be an active and intentional thinking process where the reader constructs the meaning (Alexander & Jetton, 2000; Panel et al., 2000). Second, when readers comprehend the text, it is expected that that comprehensive will vary as of the result of their differing background knowledge and experiences. However, not all readers' interpretations of a text can be valid (Pressley, 2006). Therefore, it is important for the comprehension process to consider what readers bring to the text and the ideas that are conveyed through the text. Comprehension of a written text is a complex process of thinking within the reader that depends on the ability of the reader to identify words quickly, accurately, and effortlessly. It is also a factor that comes fromthe reader's background about the topic that he or she read (Adams, 1994). This indicates the importance of teaching students active reading strategies in order to be expert readers for their content area so that they can then master what they are required to read for their classes. Pressley (2006) believes that expert readers use a variety of consciously controlled strategies when they read difficult and complex texts. For example, expert readershave a clear idea about the purpose of their reading, and they have the ability to activate their prior knowledge about the topic. Expert readers also have the ability to ask and answer questions

about the topic they have read, and they canrelate the information in the text to their understanding of the topic. In addition, expert readers make an appropriate summary and response to a text, and they can take useful notes from the text. Expert readers are self-regulated, and they are flexible enough to use different strategies during the meaning-making process (Pressley et al., 1992).

Being an expert reader and having the ability to use and activate strategies with flexibility does not develop easily with most students (Neufeld, 2005). Therefore, teachers need to explicitly introduce students to strategies and continue to share these ideas with their students until they master them in order for students to use those strategies in a flexible, coordinated, and self-regulated fashion when they read by themselves. Comprehension strategy instruction is mostly effective when it is taught within contexts where students apply strategies through actual text they are expected to read (Gambrell, Kapinus, & Wilson, 1987; Neufeld, 2005). Research indicates that by teaching students a variety of strategies while and after reading, their comprehension of complex texts can be improved (Pressley & Wharton-McDonald, 1997; Schuder, 1993). Teaching students those strategies through the phases of reading process has two major goals: first, to helpreaders to understand and memorize what they read, and second, to helpthem to monitor their comprehension and use strategies when breakdowns in understanding happen (Neufeld, 2005).

Writing is one tool that can be used to improve students' comprehension. For example, teaching students how to summarize what they have read has a positive impact on improving students' comprehension (Armbruster, Anderson, & Ostertag, 1987; Bean & Steenwyk, 1984; Berkowitz, 1986; Brown, 2002).

2. The Relationship between Reading and Writing

The relationship between reading and writing has been studied for long time (Berninger, R. Abbott, S. Abbott, Graham, & Richards, 2002; Fitzgerald & Shanahan, 2000; Shanahan, MacArthur, Graham, & Fitzgerald, 2006). Some researchers suggest that reading and writing are separate processes from each other as reading is receptive and writing isproductive (e.g., Tompkins, 1997). However, many studies indicate the connection between reading and writing, and they view these two activitiesas essentially similar processes of meaning construction (Tierney & Pearson, 1983). Reading comprehension canbe improved through writing instruction (Graham & Hebert, 2011). Reading comprehension also canbe enhanced when students write about texts, because reading and writing share a close and reciprocal relationship (Fitzgerald & Shanahan, 2000). Research shows how reading instruction also can improve students' writing skills (Graham, 2000; Krashen, 1989). It appears that because of the strong relationship between reading and writing, teachers could have both areas inform each other.

According to Fitzgerald and Shanahan (2000), research that studiesthe connections between reading and writing have been formed around three basic theories. The first theory is the rhetorical relations theory, which is based on the idea that reading and writing are communication skills, and readers and writers gain insight to communicate words by receiving and sending (Nelson & Calfee, 1998). The second theoryis the procedural connection approach (Slotte & Lonka, 1999). This theoryviews reading and writing as functional activities that canbe combined to complete a goal. This theory illustrates how reading and writing could be usedtogether within academic tasks. The third theory is the cognitive processes between reading writing (Fitzgerald & Shanahan, 2000). According to Fitzgerald and Shanahan (2000), reading and writing are constellations of a cognitive process that depend on knowledge representations at various linguistic levels (phonemic, orthographic, semantic, syntactic, pragmatic). Reading and writing are connected, according to such views, because they depend on identical or similar knowledge representations, cognitive processes, and contexts and contextual constraints (Fitzgerald & Shanahan, 2000, p. 39).

Thus, reading and writing are similar in the way they develop; they have a similar process, and they share common ideas and knowledge. Reading and writing are dependent on upon common cognitive substrate abilities such as visual, phonological, and semantic systems. In fact, anything that develops those abilities might have implications for both reading and writing (Berninger & Swanson, 1994; Shanahan et al., 2006). Therefore, some researchers state that common cognitive resources could be used for better teaching (Fitzgerald & Shanahan, 2000; Graham & Hebert, 2011; Robert & Pearson, 1983).

According to the theory of shared knowledge on reading and writing connections, reading and writing are not matching skills, but instead they rely on common knowledge and process (Fitzgerald & Shanahan, 2000). Reading and writing are dependent on upon cognitive substrate abilities such as visual, phonological, and semantic systems. Fitzgerald and Shanahan (2000) state that reading and writing share four common knowledge bases that readers and writers rely on. The first common knowledge is the domain of knowledge (content), which is the most obvious one (Flower & Hayes, 1984). Spivey (1997) explain show readers use the domain of knowledge with greater attention than writers. They think prior knowledge impacts reading comprehension to a

greater extent with the content of knowledge in understanding the ability to remember, infer, and organize information. It seems cognition reliesupon a single universe of substantive domain knowledge thatmight be drawn for variety functional purposes, including reading and writing (Shanahan et al., 2006). For example, when applying the basic processes of memory toreading and writing, the domain knowledge works as a typeof generalizable substratum to both reading and writing (Shanahan et al., 2006).

The second common knowledge that connectsreading and writing "refers to several subcategories of knowledge, including knowing about the functions and purposes of reading and writing; knowing that readers and writers interact; monitoring one's own meaning-making" (Fitzgerald & Shanahan, 2000, p. 40). Tierney and Shanahan (1991) explain how the processes of writing influence the processes of reading by providing readers insights into the intention of the writers, and how being a reader could help a writer to anticipate confusion and miscommunication.

The third common knowledge is the component of written language that might underlie reading and writing (Shanahan et al., 2006). Researchers found ahigh correlation between linguistic features in reading and writing in several areas, including phonemic, orthographic, morphological, lexical, syntactic, and discourse features (Berninger, 2000; Shanahan, 1984; Shanahan & Lomax, 1986). Some studies note that spelling influences and could improve reading comprehension (Berninger et al., 2002; Shanahan, 1984). The last common knowledge where both reading and writing share knowledge is knowing how to use, access, and generate information while reading and writing. It includes awareness of intentional strategies such as summarization, questioning, and prediction (Shanahan et al., 2006).

Because of that strong relationship between reading and writing, it needs to be mentioned that advanced readers and writers apply cognitive strategies for finishing their literacy tasks (Flower & Hayes, 1981). Researchers recommend that teachers provide explicit instruction to help readers and writers develop declarative, procedural, and conditional knowledge of theses cognitive strategies; thus, it is necessary to build students' metacognitive control of specific strategies (Baker & Brown, 1980; Paris, Lipson, & Wixson, 1983). Block and Pressley (2002) state the agreement among scholars over 20 years of studies on comprehension strategies: this is that the scholars believe students should be taught cognitive processes that include modeling, scaffolding, guided practice, and independence in order to be self-regulated. Research recommendsteaching reading and writing together because when they are taught together, students are more likely to apply a variety of cognitive strategies than if they are taught separately (Tierney & Shanahan, 1991).

In fact, anything that develops those abilities might have implications for both reading and writing (Berninger & Swanson, 1994; Shanahan et al., 2006). Thus, instructions for improving writing might be improved both reading and writing. In their research, Neville and Searls (1991) found that when students learn how to construct complex sentences, they improve their understanding of thetext. Graham and Hebert (2011) used meta-analysis to find the effect of writing on reading. They found that 94% of studies that they looked at indicate a positive effect in studies that looked at whether or not writing about material enhances reading comprehension, and this effect was statistically significant. In addition, they found twelve studies that indicated writing about reading hasa positive influence on the comprehension of weaker readers and writers. As they continued their work, the researchers sought to find out if more writing improves reading comprehension. From the collection of studies that they examined, they found nine studies where this extra writing produces a positive effect.

Olson and Land studied the effect of writing in students' learning and reading by providing the Pathway Project. Over almost a decade (1996-2004), the Pathway Project provided an intensive professional-development program in order to help English Language Learner students improve essential academic literacy skills to succeed in their advanced educational settings. Students were asked to use cognitive strategies to reinforce the reading-writing connection. Students were enrolled in the 6th grade when they began in Transitional English Language Development and moved up to the 12th grade. Students were given explicit instructionsintended toimprove their academic literacy skills in order to succeed in college; in addition, it was believed that their college-acceptance rate wouldbe improved. Teachers designed their reading and writing curriculum by using a cognitive strategies approach. Students cultivated deep knowledge and appliedthose reading and writing strategies over time (Olson & Land, 2007). Underwood and Pearson (2004) think the Pathway Project is designed to stimulate higher-order cognitive behavior of expert readers, asit considersthe relationship between the social context and cognitive behavior.

Eventually, Olson and Land examined if reading and writing ability for English Language Learnersin secondary school improved after they were provided with declarative, procedural, and conditional knowledge with cognitive strategies through the Pathway Project program. They divided students into two groups; the first group

was a control group without any intervention, and the second group was taught the Pathway Project program. The researchers tested both groups from 1996-2004 and compared them at the end of each grade. The results showed that students who received the interventionscored significantly higher than the students in the control group. Moreover, by the 9th grade, over 50% of the students who were in the Pathway Program werehigher by at least onehalf score while the highest percentage of scores for control group range from 17% to 35% and never exceeded 50% at any level (Olson & Land, 2007). To conclude, teachers should use take advantage of the common processes that reading and writing share and build their curriculum based on those ideas in order to improve their students' literacy skills.

3. The Effect of Writing on Students' Learning

Writing activities are important not only to assess students' learning but also to help students to learn content at the K-12 and university level.Writing activities have been implemented at all educational levels from elementary through college (Audet, Hickman, & Dobrynina, 1996; Beins, 1993; Rosaen, 1990). During the latter part of elementary school and through high school, students' writing increasingly becomes under control of metacognitive processes (Bereiter & Scardamalia, 2013; Berninger & Swanson, 1994; Berninger, Whitaker, Feng, Swanson, & Abbott, 1996). When students write about content, they use a complicated process that requires them to connect their thinking to the content learned. Langer and Applebee (1987) believe that writing shapes thinking through the natural act of writing. However, some researchers believe that when writers are aware of their thinking during the writing process, they are better able to learn the content (Hebert, Simpson, & Graham, 2013). Bangert-Drowns, Hurley, and Wilkinson (2004) state that writers can make improvements in their learning because writers must apply metacognitive and self-regulation activities in order to write effectively. That is, students who are able to think about writing during the writing process will be able to plan, evaluate, and adapt the strategies that they use in order to organize their knowledge more than students who do not employ this method of thinking.

When students write, they learn from their writing because they create a text that includes ideas with relationships among them. In addition, when students are expected to write a text with a specific goal in mind, this methodwill help them to better understand relationships among ideas and then evaluate them in order to make new meaning from those ideas (Klein, 1999). Although Klein (1999) believes that writing produces a positive effect on learning, there are inconsistencies, and the reasons for theinconsistenciesare unknown. However, Klein (1999) states four hypotheses about writing to learn: a) writers generate knowledge, b) writers express ideas in text and then reread them in order to generate new inferences, c) writers use genre structures to organize the relationship among ideas, and d) writers set rhetorical goals.

In addition to the four hypotheses about writing to learn, Klein (1999) believes the writing processes can be explained through cognitive theory. First, writing creates knowledge by encouraging the writer to structure thinking. Therefore, the absence of an immediate audience encourages the writer to maximally expand and syntactically differentiate. Second, any written materials can be reviewed and compared with other texts or thought. When a writer reviews a text, he or she will transform the ideas and beliefs during the process of writing. Third, some types of writing require writers to make relationships among ideas, so when the writers read a text, they may shape how the knowledge is represented and relate the information to their perspective. For example, certaintypes of writing require writers to choose and defend a position to present assumptions and evidence to support those assumptions. All those activities provide writers with opportunities to think and reshape their knowledge about a topic. Fourth, writers must think about the knowledge and interests their audience brings to the task and generate rhetorical goals to provide accommodation for their audience. During the process of writing about content, writers may reread what they wrote and revise or change their ideas as they transform their knowledge and understanding of the topic (Klein, 1999).

Wang and Margaret's (1993) meta-analysis supports Klein's assumptions that metacognitive and cognitive factors affect learning and that writing is one tool that can improve students learning. They showed that a model of cognitive processes such as having students think about what they read in writing could help educators to design instructions and assignments. When teachers use writing as one tool for their students to learn, they have a clear plan of what they want to do and how to do it.

Studies indicate that writing activities can improve learning or create new learning opportunities because whenstudents writes about a text, they needs to gather and organize information, which in turn enhances knowledge or understanding (Durst & Newell, 1989; Klein, 1999). Writing activities, such as answering questions, note-taking, writing a summary, and journal writing, not only can be assigned to assess students but also can be used to extend students' knowledge of content and improvecontent area learning (Bangert-Drowns et

al., 2004; Graham & Perin, 2007a; Hebert et al., 2013). Based on the goal of learning and the different disciplines, writing activities can take many forms to help students to think critically about what they read and to construct new knowledge (Klein, 1999).

Writing activities can help students to learn content, and they can help students improve their comprehension on the content.Studies, for example, showthat writing canimprove students' comprehension in content areas such as science and history (Bangert-Drowns et al., 2004; Rivard, 1994; Wiley & Voss, 1999). When students write about content, they have a better understanding of the text they have read. A strong positive relationship exists between writing and reading comprehension, and writing activities are influences on reading comprehension. Graham and Hebert (2011) conducted a meta-analysis to determine the effect of writing on reading. They identified experimental studies that had a control group, where students only read the test and did not do any kind of writing activity, and a treatment group, where students wrote about the text through various activities such as summary writing, answering questions, and extended writing activities. The result shows that writing about the text improvesstudents' comprehension as measured with both norm-referenced (ES=.40) and researcher-created (ES=51) measures that assess students' comprehension of the texts. The measures of reading comprehension include multiple-choice questions, short answers essay questions, summarizing, and retelling orally or in writing what is read. The researcher took the average of the outcomes of all those measures on the treatment groups. Graham and Hepert (2011) found that each writing activity (e.g., summary writing, generating and answering questions, note taking, and extended writing activities) was found to have a statistically significant effective on improving reading comprehension but with a different effect size. The effect size ranged from 0.27 for generating and answering questions to .77 for writing extended responses to a text.

When students read a text, they generate relations among all parts of a text and between texts and the writers' experiences (Wittrock & Alesandrini, 1990). When teachers give students specific writing activities in response to reading, students will only think about the content of a text with the writing expectations in mind (Odell, 1980). However, all those writing activities can expand the students' comprehension of the text that they have read. This occurs because when students write about what they have read, they relate the content to their experiences and they therefore live with that information causing their memories to bealive and active. Therefore, writing can become a powerful means for students to rethink, revise, and reform what they know (Durst & Newell, 1989; Langer & Applebee, 1987; Marshall, 1987; Newell, 1984).

When students comprehend the information that they have read, they can organize the information in their mind, but teachers cannot assess the students' comprehension until they students have a means of expressing that in order to see if they understand the content, they have read about it. Writing is a useful skill to organize learning and is one of the most important tools to help teachers check their students' comprehension and memorization. Taylor and Beach (1984) found that memorizing a text is related to organizational skills in writing. Newell (1984), compared note taking, answering questions, and writing essays, and she found that writing essays is the more effective means to assist high school students in integratingmaterial that they have read.

Science content is one of the most important areas where students canexpand their comprehension through specific types of writing activities. When students are given opportunities to use writing activities under a teacher's supervision, they will develop their understanding of the science content (Connolly & Vilardi, 1989; Prain, 2006; Saul, 2004; Wallace, Hand, & Prain, 2004). In science classes, it is important to have students practice how to design and investigate data and then learn how to write in the expected scientific format (Carter, Ferzli, & Wiebe, 2007; Wallace et al., 2004; Yore, Bisanz, & Hand, 2003) In fact, when students write, they describe their understanding of the content, theories, laws, concepts, and so on. For example, when students are given opportunities to use writing activities such as reflection, justification, interpretation, and synthesis, they think about the content deeply (Connolly & Vilardi, 1989; Glynn & Muth, 1994; Hand, 2004; Yore et al., 2003). Moreover, the process of writing an argumentative text can help students improve their understanding of science. However, many students fail to support their ideas and provide evidence about their ideas and argument when they are required to craft an argumentative text in science areas (Kelly & Bazerman, 2003; Kelly, Bazerman, Skukauskaite, & Prothero, 2009; Kelly, Regev, & Prothero, 2007). Consequently, students need to be taught academic writing across all academic classes including science content.

Research shows that writing activities have a positive impact on students' learning in geography classes (Chappell, 2006; Dummer, Cook, Parker, Barrett, & Hull, 2008; Hooey & Bailey, 2005; McGuinness, 2009; Slinger-Friedman & Patterson, 2012; Thompson, Pilgrim, & Oliver, 2005). Writing is important for geographers in its subareas as GIS, cogitative mapping, and mathematical modeling, so students need to be taught how to express their thoughts clearly through writing (Hooey & Bailey, 2005; McGuinness, 2009).

4. Preparing Students for Writingthrough K-12

Writing is important for students at all grade levels, beginning in elementary school until graduate levels. Research revealedthat for each grade level, students can improve their learning through writing (Benson, 1991; Dillon, O'Brien, Moje, & Stewart, 1994; Fellows, 1994). Thus, for each grade, students should be required to do writing activities with different goals in mind and across content areas. Researchers have offered teaching suggestions (Benson, 1991; Dillon et al., 1994; Ford, 1990; Jolley & Mitchell, 1990). In elementary school, for example, Fellows (1994) examined the effect of writing for sixth grade students on varied academic abilities, socioeconomic levels, and ethnicity over a twelve-week science unit concerning states of matter. At the beginning of the study, students had a hard time accepting scientific conception. Fellows (1994) found that when students wrote about the relationships among concepts, they produced better understanding at post-test levels than other groups of students who were assigned with non-writing activities. It seems clear how students grasped the scientific conception after writing about it: when students read the concept, they thought about how to write and summarize what they had read, so they had an understanding that allowed them summarize those ideas (Fellows, 1994).

Because of the importance of writing, Graham and Perin (2007b) believe writing should be taught with explicit instructions at K-12 to prepare students for college level. They think student who have difficulty with writing are not equipped to meet the requirements of college. Therefore, in their meta-analysis study, Graham and Perin (2007b, pp. 5-6) determined eleven elements for writing instruction that can be effective for helping students to learn writing and use writing as tool for learning:

1) Writing strategies that include planning, revising and editing for composition.

2) Summarization, where teachers should teach explicitly and systematically show students how to summarize texts.

3) Collaborative writing, where teachers ask students to work together to plan, draft, revise, and edit their writing.

4) Specific product goals, where students are assigned specific goal for writing to reach and complete.

5) Word-processing, where students use computers and word processors as instructional supports for writing activities.

6) Sentence combining, where students are assigned to construct more complex, sophisticated sentences.

7) Prewriting, where students are encouraged to engage in activities to generate or organize ideas for their writing assignment.

8) Inquiry writing, where students analyzeimmediate, concrete data in order to help them to develop their ideas and content for a specific writing task.

9) Process writing approach, where students have a workshop environment in which theyare given a number of writing instructional activities to stress extended writing chances, personalized instruction, writing for authentic audiences, and cycles of writing.

10) Study of models, in which students are provided with models of good writing in order to read, analyze and emulate.

11) Writing for content learning, where students use writing as a tool for learning the content.

5. Using Different Types of Activities

In most classes, students are assigned writing activities to help them develop their understanding of contents or to assess their knowledge. However, writing activities have different effects on students' comprehension based on the types of writing. Marshall (1987) claims that using different writing activities encourage students to think about texts differently. Langer and Applebee (1987) found that students think differently based on the type of writing activity for the text. When students were asked to answer short questions, they focused on specific ideas from the text; in contrast, when they tooknotes, they focused on large concepts presented across the text. Moreover, students who were asked to write an essay, integrated ideas in text and engaged in complex thoughts.

In their meta-analysis study, Hebert, Simpson, and Graham (2013) examined if particular writing activities have more effect than others in improving reading comprehension outcomes and if writing activities improve reading comprehension differentially based on how closely the reading comprehension measureswerealigned with types of writing that students complete. The results indicate that after comparing summary writing and question answering, question answering and note-taking, summary writing and note-taking, and answering questions and

extended writing on average outcomes, there is no evidence to support that one type of writing activity enhanced reading comprehension more than others. In addition, the researchers found that when comparing the effectiveness of different types of writing on specific measures, summary was statistically significant effective more than question answering comparison for free recall measures. The extended writing was statistically more effective than question answering for extended writing measures of reading comprehension. Langer and Applebee (1987) believe that the effects of a specific type of writing on learning is depend on the purpose of the assessment as each type of writing guides students to focus on different information.

Horton, Frank, and Walton (1985) randomly assigned college students studying biology to one of the two groups. The first group was assigned to write summaries of lectures during class sessions, while the second group was assigned to write summary notes during different lectures. The results showed that the students who wrote summaries of lectures during class sessions had greater comprehension of material in the post-test than the control group who were asked to write summary notes during a different lecture set. Another study conducted by McCrindle and Christensen (1995) divided first year biology students randomly into two groups. The first group was asked to do journal writing that included describing the content that they had learned and to reflect on process that they had been taught. The second group was assigned to write conventional laboratory reports. The results show that students who wrote journal entries earned higher scores than students who only wrote reports on their final multiple-choice content exam.

6. Conclusion and Pedagogical Implications

Writing to learn is a great tool that college students should be taught within different disciplines, so they can find it beneficial for college learning. In fact, teachers, in different disciplines, should be prepared in writing skills in their content area to teach their students how to write in their specific subjects. In addition, students will improve their learning when they are asked to write about text. Therefore, when students write about what they read, they will comprehend what they have read. Writing is very useful as an important skill for students to improve their comprehension for their disciplines because students can communicate and share their ideas not only for academic purposes, but also for their lives. The most important implication can be given at the end is that designing an effective writing program for students at college level that might help them to succeed.

References

Adams, M. J. (1994). *Beginning to read: Thinking and learning about print*. MIT press.

Alexander, P. A., & Jetton, T. L. (2000). Learning from text: A multidimensional and developmental perspective. *Handbook of reading research*, *3*, 285-310.

Armbruster, B. B., Anderson, T. H., & Ostertag, J. (1987). Does text structure/summarization instruction facilitate learning from expository text? *Reading research quarterly*, 331-346.

Audet, R. H., Hickman, P., & Dobrynina, G. (1996). Learning logs: A classroom practice for enhancing scientific sense making. *Journal of Research in Science Teaching*, *33*(2), 205-222.

Baker, L., & Brown, A. L. (1980). *Metacognitive skills and reading*. University of Illinois at Urbana-Champaign.

Bangert-Drowns, R. L., Hurley, M. M., & Wilkinson, B. (2004). The Effects of School-Based Writing-to-Learn Interventions on Academic Achievement: A Meta-Analysis. *Review of educational research*, *74*(1), 29-58.

Barton, M. L., Heidema, C., & Jordan, D. (2002). Teaching Reading in Mathematics and Science. *Educational leadership*, *60*(3), 24-28.

Bean, T. W., & Steenwyk, F. L. (1984). The effect of three forms of summarization instruction on sixth graders' summary writing and comprehension. *Journal of Literacy Research*, *16*(4), 297-306.

Beins, B. C. (1993). Writing assignments in statistics classes encourage students to learn interpretation. *Teaching of Psychology*, *20*(3), 161-164.

Benson, B. P. (1991). Effective tests: Let them write! *English Journal*, 74-79.

Bereiter, C., & Scardamalia, M. (2013). *The psychology of written composition*. Routledge.

Berkowitz, S. J. (1986). Effects of instruction in text organization on sixth-grade students' memory for expository reading. *Reading research quarterly*, 161-178.

Berninger, V. W. (2000). Development of language by hand and its connections with language by ear, mouth, and eye. *Topics in Language Disorders*, *20*(4), 65-84.

Berninger, V. W., Abbott, R. D., Abbott, S. P., Graham, S., & Richards, T. (2002). Writing and reading connections between language by hand and language by eye. *Journal of Learning Disabilities*, *35*(1), 39-56.

Berninger, V. W., & Swanson, H. L. (1994). Modifying Hayes and Flower's model of skilled writing to explain beginning and developing writing. *Advances in cognition and educational practice*, *2*, 57-81.

Berninger, V., Whitaker, D., Feng, Y., Swanson, H. L., & Abbott, R. D. (1996). Assessment of planning, translating, and revising in junior high writers. *Journal of School Psychology*, *34*(1), 23-52.

Block, C. C., & Pressley, M. (2002). *Comprehension instruction: Research-based instruction*. New York: Guilford.

Brown, R. (2002). Straddling two worlds: Self-directed comprehension instruction for middle schoolers. *Comprehension instruction: Research-based best practices* (p. 339).

Carter, M., Ferzli, M., & Wiebe, E. N. (2007). Writing to learn by learning to write in the disciplines. *Journal of Business and Technical Communication*, *21*(3), 278-302.

Chappell, A. (2006). Using the 'grieving' process and learning journals to evaluate students' responses to problem-based learning in an undergraduate geography curriculum. *Journal of Geography in Higher Education*, *30*(1), 15-31.

Collins, C. (1991). Reading instruction that increases thinking abilities. *Journal of Reading*, 510-516.

Connolly, P. H., & Vilardi, T. (1989). *Writing to learn mathematics and science*. ERIC.

Deshler, D. D., Ellis, E. S., & Lenz, B. K. (1996). *Teaching adolescents with learning disabilities: Strategies and methods*. Love Publishing Company.

Dillon, D. R., O'Brien, D. G., Moje, E. B., & Stewart, R. A. (1994). Literacy learning in secondary school science classrooms: A cross-case analysis of three qualitative studies. *Journal of Research in Science Teaching*, *31*(4), 345-362.

Dummer, T. J. B., Cook, I. G., Parker, S. L., Barrett, G. A., & Hull, A. P. (2008). Promoting and assessing 'deep learning'in geography fieldwork: An evaluation of reflective field diaries. *Journal of Geography in Higher Education*, *32*(3), 459-479.

Durst, R. K., & Newell, G. E. (1989). The uses of function: James Britton's category system and research on writing. *Review of educational research*, *59*(4), 375-394.

Fellows, N. J. (1994). A window into thinking: Using student writing to understand conceptual change in science learning. *Journal of Research in Science Teaching*, *31*(9), 985-1001.

Fitzgerald, J., & Shanahan, T. (2000). Reading and writing relations and their development. *Educational Psychologist*, *35*(1), 39-50.

Flower, L., & Hayes, J. R. (1981). A cognitive process theory of writing. *College Composition and Communication*, 365-387.

Flower, L., & Hayes, J. R. (1984). Images, Plans, and Prose The Representation of Meaning in Writing. *Written communication*, *1*(1), 120-160.

Ford, M. I. (1990). The Writing Process: A Strategy for Problem Solvers. *Arithmetic Teacher*, *38*(3), 35-38.

Gambrell, L. B., Kapinus, B. A., & Wilson, R. M. (1987). Using mental imagery and summarization to achieve independence in comprehension. *Journal of Reading*, 638-642.

Glynn, S. M., & Muth, K. D. (1994). Reading and writing to learn science: Achieving scientific literacy. *Journal of Research in Science Teaching*, *31*(9), 1057-1073.

Graham, S. (2000). Should the natural learning approach replace spelling instruction? *Journal of Educational Psychology*, *92*(2), 235.

Graham, S., & Hebert, M. (2011). Writing to Read: A Meta-Analysis of the Impact of Writing and Writing Instruction on Reading. *Harvard Educational Review*, *81*(4), 710-744, 784-785.

Graham, S., & Perin, D. (2007a). *Effective strategies to improve writing of adolescents in middle and high schools*. A report to Carnegie corporation of New York, New York: Alliance for Excellent Education.

Graham, S., & Perin, D. (2007b). *Writing Next: Effective Strategies to Improve Writing of Adolescents in Middle and High Schools*. A Report to Carnegie Corporation of New York. Alliance for Excellent Education.

Greenleaf, C., & Schoenbach, R. (2004). Building capacity for the responsive teaching of reading in the academic disciplines: Strategic inquiry designs for middle and high school teachers' professional development. *Improving reading achievement through professional development*, 97-127.

Hand, B. (2004). *Cognitive, constructivist mechanisms for learning science through writing: Writing and learning in the science classroom* (pp. 21-31). Springer.

Hebert, M., Simpson, A., & Graham, S. (2013). Comparing effects of different writing activities on reading comprehension: A meta-analysis. *Reading and Writing*, *26*(1), 111-138.

Hooey, C. A., & Bailey, T. J. (2005). Journal writing and the development of spatial thinking skills. *Journal of Geography*, *104*(6), 257-261.

Horton, P. B., Fronk, R. H., & Walton, R. W. (1985). The effect of writing assignments on achievement in college general chemistry. *Journal of Research in Science Teaching*, *22*(6), 535-541.

Jolley, J. M., & Mitchell, M. L. (1990). Two psychologists' experiences with journals. *Teaching of Psychology*, *17*(1), 40-41.

Kelly, G. J., & Bazerman, C. (2003). How students argue scientific claims: A rhetorical-semantic analysis. *Applied Linguistics*, *24*(1), 28-55.

Kelly, G. J., Bazerman, C., Skukauskaite, A., & Prothero, W. (2009). 20 Rhetorical features of student science writing in introductory university oceanography. *Traditions of writing research*, 265.

Kelly, G. J., Regev, J., & Prothero, W. (2007). Analysis of lines of reasoning in written argumentation *Argumentation in science education* (pp. 137-158). Springer.

Klein, P. D. (1999). Reopening Inquiry into Cognitive Processes in Writing-To-Learn. *Educational Psychology Review*, *11*(3), 203-270.

Krashen, S. (1989). We acquire vocabulary and spelling by reading: Additional evidence for the input hypothesis. *The modern language journal*, *73*(4), 440-464.

Kuhn, D. (2000). Metacognitive development. *Current directions in psychological science*, *9*(5), 178-181.

Langer, J. A., & Applebee, A. (1987). *How writing shapes thinking : A study of teaching and learning*. Urbana, Ill.: Urbana, Ill.: National Council of Teachers of English.

Marshall, J. D. (1987). The Effects of Writing on Students' Understanding of Literary Texts. *Research in the Teaching of English*, *21*(1), 30-63.

McCrindle, A. R., & Christensen, C. A. (1995). The impact of learning journals on metacognitive and cognitive processes and learning performance. *Learning and instruction*, *5*(2), 167-185.

McGuinness, M. (2009). Putting themselves in the picture: Using reflective diaries in the teaching of feminist geography. *Journal of Geography in Higher Education*, *33*(3), 339-349.

Mosborg, S. (2002). Speaking of history: How adolescents use their knowledge of history in reading the daily news. *Cognition and Instruction*, *20*(3), 323-358.

Nelson, N., & Calfee, R. C. (1998). *The reading-writing connection*. Chicago: NSSE: Distributed by the University of Chicago Press.

Ness, M. (2007). Reading comprehension strategies in secondary content-area classrooms. *Phi Delta Kappan*, *89*(3), 229.

Neufeld, P. (2005). Comprehension instruction in content area classes. *The Reading Teacher*, *59*(4), 302-312.

Neville, D. D., & Searls, E. F. (1991). A metaanalytic review of the effect of sentence-combining on reading comprehension. *Literacy Research and Instruction*, *31*(1), 63-76.

Newell, G. E. (1984). Learning from Writing in Two Content Areas: A Case Study/Protocol Analysis. *Research in the Teaching of English*, *18*(3), 265-287.

Odell, L. (1980). The Process of Writing and the Process of Learning. *College Composition and Communication*, *31*(1), 42-50.

Olson, C. B., & Land, R. (2007). A Cognitive Strategies Approach to Reading and Writing Instruction for English Language Learners in Secondary School. *Research in the Teaching of English*, *41*(3), 269-303.

Othman, Y. (2010). Application of metacognition strategies and awareness when reading texts. *The International Journal of Learning*, *17*(3), 457-471.

Othman, Y., & Jaidi, N. H. (2012). The employment of metacognitive strategies to comprehend texts among pre-university students in Brunei Darussalam. *American International Journal of Contemporary Research*, *2*, 134-141.

National Institute of Child Health and Human Development, National Institutes of Health. (2000). *Report of the national reading panel: Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction*. Reports of the subgroups: National Institute of Child Health and Human Development, National Institutes of Health.

Papleontiou-louca, E. (2003). The concept and instruction of metacognition. *Teacher Development*, *7*(1), 9-30.

Paris, S. G., Lipson, M. Y., & Wixson, K. K. (1983). Becoming a strategic reader. *Contemporary Educational Psychology*, *8*(3), 293-316.

Perfetti, C. A., Britt, M. A., & Georgi, M. C. (1995). *Text-based learning and reasoning: Studies in history*. Psychology Press.

Prain, V. (2006). Learning from writing in secondary science: Some theoretical and practical implications. *International Journal of Science Education*, *28*(2-3), 179-201.

Pressley, M. (2006). *Reading instruction that works: The case for balanced teaching*. Guilford Press.

Pressley, M., El-Dinary, P. B., Gaskins, I., Schuder, T., Bergman, J. L., Almasi, J., & Brown, R. (1992). Beyond direct explanation: Transactional instruction of reading comprehension strategies. *The Elementary School Journal*, 513-555.

Pressley, M., & Wharton-McDonald, R. (1997). Skilled Comprehension and Its Development through Instruction. *School Psychology Review*, *26*(3), 448-466.

Rivard, L. O. P. (1994). A review of writing to learn in science: Implications for practice and research. *Journal of Research in Science Teaching*, *31*(9), 969-983.

Rosaen, C. L. (1990). Improving Writing Opportunities in Elementary Classrooms. *Elementary School Journal*, *90*(4), 419-434.

Saul, W. (2004). *Crossing borders in literacy and science instruction: Perspectives on theory and practice*. International Reading Assoc.

Schorzman, E. M., & Cheek, E. H. (2004). Structured Strategy Instruction: Investigating an Intervention for Improving Sixth-Graders' Reading Comprehension. *Reading Psychology an international quarterly*, *25*(1), 37-60.

Schuder, T. (1993). The genesis of transactional strategies instruction in a reading program for at-risk students. *The Elementary School Journal*, 183-200.

Shanahan, T. (1984). Nature of the Reading-Writing Relation: An Exploratory Multivariate Analysis. *Journal of Educational Psychology*, *76*(3), 466-477.

Shanahan, T., & Lomax, R. G. (1986). An analysis and comparison of theoretical models of the reading–writing relationship. *Journal of Educational Psychology*, *78*(2), 116.

Shanahan, T., MacArthur, C. A., Graham, S., & Fitzgerald, J. (2006). Relations among oral language, reading, and writing development. *Handbook of writing research*, 171-183.

Slinger-Friedman, V., & Patterson, L. M. (2012). Writing in geography: Student attitudes and assessment. *Journal of Geography in Higher Education*, *36*(2), 179-195.

Slotte, V., & Lonka, K. (1999). Review and process effects of spontaneous note-taking on text comprehension. *Contemporary Educational Psychology*, *24*(1), 1-20.

Snow, C. (2002). *Reading for understanding: Toward an R&D program in reading comprehension*. Rand Corporation.

Snow, C. E., & Biancarosa, G. (2004). *Reading next: A vision for action and research in middle and high school literacy*. A report to the Carnegie Corporation of New York. Washington, DC: Alliance for Excellent Education.

Spivey, N. N. (1997). *The constructivist metaphor: Reading, writing, and the making of meaning*. Academic Press San Diego.

Stevens, R. J. (2003). Student team reading and writing: A cooperative learning approach to middle school literacy instruction. *Educational Research and Evaluation*, *9*(2), 137-160.

Taylor, B. M., & Beach, R. W. (1984). The Effects of Text Structure Instruction on Middle-Grade Students' Comprehension and Production of Expository Text. *Reading research quarterly*, *19*(2), 134-146.

Thompson, G., Pilgrim, A., & Oliver, K. (2005). Self-assessment and reflective learning for first-year university geography students: A simple guide or simply misguided? *Journal of Geography in Higher Education*, *29*(3), 403-420.

Tierney, R. J., & Shanahan, T. (1991). Research on the reading-writing relationship: Interactions, transactions, and outcomes. In M. L. R. Barr, P. M. Kamil, & P. D. Pearson (Eds.), *The handbook of reading research* (Vol. 2, pp. 246-280). New York: Longman.

Tierney, R. J., & Pearson, P. D. (1983). Toward a composing model of reading. *Language arts*, 568-580.

Tompkins, G. E. (1997). *Literacy for the Twenty-First Century: A Balanced Approach*. ERIC.

Underwood, T., & Pearson, P. D. (2004). Teaching struggling adolescent readers to comprehend what they read. *Adolescent literacy research and practice*, 135-161.

Wallace, C. S., Hand, B. B., & Prain, V. (2004). *Writing and learning in the science classroom* (Vol. 23). Springer.

Wang, M. C., Haertel, G. D., & Walberg, H. J. (1993). Toward a knowledge base for school learning. *Review of Educational Research*, *63*, 249-294.

Wiley, J., & Voss, J. F. (1999). Constructing Arguments From Multiple Sources: Tasks That Promote Understanding and Not Just Memory for Text. *Journal of Educational Psychology*, *91*(2), 301-311.

Wittrock, M. C., & Alesandrini, K. (1990). Generation of Summaries and Analogies and Analytic and Holistic Abilities. *American Educational Research Journal*, *27*(3), 489-502.

Yore, L., Bisanz, G. L., & Hand, B. M. (2003). Examining the literacy component of science literacy: 25 years of language arts and science research. *International Journal of Science Education*, *25*(6), 689-725.