Conditions for Writing to Learn

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Abstract: This paper is a response to an invitation from the editors of the special issue to comment on the ingredients of effective writing to learn interventions as reflected in the contributions to the special issue. The six papers in the issue vary widely in approach and underlying theoretical frameworks but share the broad common theme of writing to learn. Within this, they vary along three main dimensions: (i) how learning is defined and assessed, and in particular whether they assess effects of the writing intervention on content knowledge; (ii) related to this, whether they are primarily focussed on discipline specific skills or on more general effects of writing; and (iii) whether they are designed to carry out a controlled evaluation of the writing intervention or rather are concerned with describing the design and purpose of a specific intervention. In what follows, I will first consider the general characteristics of the papers in relation to these three dimensions. I will then reflect on the findings of the individual papers, and then conclude by relating the papers to my personal understanding of writing to learn in terms of a dual-process model of writing.

Keywords: writing to learn, cognitive processes, writing interventions, dual process model

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1. General characteristics of the papers

Research into writing to learn originally focussed on the question of whether writing distinctively enhanced the learning of subject content (e.g. Applebee, 1984; Bangert-Drowns, Hurley & Wilkinson, 2004; Emig, 1977; Klein. 1999; Langer & Applebee, 1987). A key finding was that the effect of writing depends on the kind of processing carried out during writing (Langer & Applebee, 1987). If writing involves simply recapitulating content in an unelaborated form, effects will be minimal; if it involves more elaborative processes, effects will be larger. Bereiter and Scardamalia (1987) summed this up as a contrast between a knowledge-telling approach, in which content is retrieved from memory and transcribed directly into text, and a knowledge-transforming approach, in which content retrieval and evaluation are mediated by the writer's goals for the text. They particularly emphasized the importance of the writer's rhetorical goals in prompting transformations of content. Bangert-Drowns et al.'s (2004) meta-analysis of writing to learn studies provided some support for this in that it found that interventions which incorporated metacognitive prompts had stronger effects on academic achievement than interventions involving other less directed forms of writing. However, metacognitive prompts in their analysis referred to prompts designed to promote learning strategies rather than prompts about rhetorical goals. Thus, although the meta-analysis does suggest that supporting students to write about learning strategies is beneficial, it does not necessarily support the value of directing writing towards rhetorical goals. A more recent study by Klein and Kirkpatrick (2010) aimed to test whether genre-based writing instruction improved writing performance and the ability to learn from writing, and found evidence that instruction improved genre knowledge and that this was associated with increased text quality and learning during writing.

The first dimension on which these studies vary is whether they adopt this traditional definition of writing to learn. Three of the studies include a measure of content knowledge and assess the effects of a writing intervention on it (Ortoleva & Bétrancourt, this volume; van Drie, Braaksma, & Van Boxtel, this volume; Wäschle, Gebhardt, Oberbusch, & Nückles, this volume). The other three (Corcelles Seuba & Castelló Badia, this volume; Smirnova, this volume; Wilcox, Yu, & Nachowitz, this volume) do not. This means that they do not provide direct evidence about effects on content knowledge. However, they do include measures of effects on domain-specific reasoning skills, and to the extent that a relation between these and effects on content learning can be assumed, do bear on this issue. Further research would be needed, however, to confirm this assumption.

It is possible to see this difference in whether effects on content knowledge are assessed as a consequence of a difference in how learning is defined. Part of the reason for focusing on writing within specific disciplines is because of an assumption that these are associated with distinctive forms of reasoning, and hence that learning within a discipline is not just about learning content but is also about learning how to think in a particular way - how to think like a historian, a philosopher or a scientist. This would

be to expand the traditional focus of writing to learn research from an exclusive focus on content to include the learning of discipline-specific thinking skills. Note, however, that expanding the definition of learning in this way raises the question of how this relates to writing. The strong form of the writing to learn hypothesis is that writing has a distinctive effect on content learning: it is postulated to deepen understanding in a way that other learning activities do not. If this were to be carried over to an expanded definition of learning it would imply that writing in a disciplinary-specific way has distinctive effects on the way that thought is discursively constituted: that one thinks most like a philosopher or historian when one is *writing* as a philosopher or a historian; that writing makes possible deeper forms of philosophical and historical thinking. This suggests two lines of future research. First, does writing, perhaps because of its availability as a fixed external object (Olson, 1996; Olson & Oatley, 2014), enable more effective reasoning than other forms of thinking? Second, given the same content to be learned, do students trained in different forms of writing learn different things from that content?

The second dimension on which the papers vary is that, although they all focus on writing within specific disciplines – science, history, philosophy and vocational learning – they differ in whether it is disciplinary-specific features of writing that are used to promote learning. Two papers (Corcelles Seuba & Castelló Badia, this volume; Smirnova, this volume) focus on the development of discipline-specific skills, with the implication that learning these skills will lead to differences in how content is processed. Two papers use writing more generically: Ortoleva & Bétrancourt (this volume) asked writers to write about a specific incident in the workplace, with some guidance about aspects of the experience to write about; Wäschle et al. (this volume) provided specific prompts designed to activate learning goals rather than rhetorical goals. In neither case were participants required to produce rhetorically appropriate text. Thus, although all can be seen as providing some form of metacognitive prompts for writing, as recommended by Bangert-Drowns et al. (2004), they differ as to whether these are directed towards rhetorical goals or not. The study by van Drie et al. (this volume) combined both approaches, and compared their effects. The study by Wilcox et al. (this volume) does not fit neatly into this division between rhetorical and non-rhetorical goals as it was correlational in design and the writing tasks they examined varied in their rhetorical constraints.

The third – composite - dimension on which the studies can be distinguished is the nature of the research design and how this relates to the specific research questions addressed. Two of the papers (van Drie et al.; Wäschle et al.) use experimental designs, and include a knowledge measure, which enable effects of their intervention on learning to be directly assessed. These studies also focus most exclusively on writing itself, as opposed to when it is embedded as part of a more elaborate learning activity. Wilcox et al. use a correlational design and examine the extent to which "epistemic complexity" is displayed in texts, and how this related to a number of factors. The remaining three papers (Corcelles Seuba & Castelló Badia; Ortoleva & Bétrancourt;

Smirnova) are less concerned with establishing the effectiveness of a particular intervention compared to others, and more concerned with designing interventions which incorporate writing as part of the learning activities and with establishing the extent to which the intervention achieves its goals.

2. Findings of individual papers

This section considers the individual papers and explores their implications for writing to learn and the questions they raise for future research.

2.1 What kinds of writing do secondary school students do?

Wilcox et al. investigated the extent to which secondary school science students purposively selected from high achieving schools produced epistemically complex texts in their writing. An interesting feature of this paper is the measure of epistemic complexity itself. In assessing the texts in terms of the extent to which they displayed this elaborated and disciplinary specific form of reasoning, rather than a more generic measure of how "well-written" the texts were, this paper reflects a "writing to learn" perspective. The aim is to produce good scientific reasoning rather than necessarily good writing. Their findings suggest that an important influence on this is the kind of writing tasks that students are required to undertake: informational tasks, particularly "reading reflections" and "analyses", were associated with texts of greater epistemic complexity than mechanical tasks (note though that "reading reflections" may score higher, in part, because students take over forms of thinking from the texts they are reading). This finding reinforces the importance of the task assigned, and echoes Bereiter and Scardamalia's (1987) attribution of knowledge telling to the broader school-environment just as much as to individual writers. However, there was also evidence that this effect varied depending on individual writers, with some writers showing evidence of epistemic complexity on simple tasks, and others not showing it on more demanding tasks. Furthermore, there was also the suggestion that the effect of the tasks may depend on how the teacher specifically defined and contextualized it. Above all, although, in the absence of an independent measure of content knowledge change, the study does not address the narrow writing to learn question, the fact that the texts surveyed displayed relatively low levels of epistemic complexity overall demonstrates a clear need for the kinds of intervention described in the other papers in this special issue.

2.2 Development of disciplinary-specific forms of reasoning.

Kuhn and Crowell (2011) have provided convincing evidence that an extended intervention involving dialogic argumentation in groups can have a strong impact on the development of students' thinking skills, and that these skills transfer to the production of individual argumentative essays. The fundamental premise of this research (carried out in philosophy classes) was that students are better able to develop

these skills if they are developed in, and from, their experiences in everyday argumentative talk, rather than as prescriptions about the form that argumentative writing should take.

Corcelles Seuba and Castelló Badia's study (this volume) shares this premise, and involved a case study comparing the processes involved in two groups' writing of a collaborative text (also in a philosophy class). An important point to note about this approach is that it turns the traditional writing to learn premise on its head. Rather than writing itself being used as a means of deepening the student's understanding of content, collaborative dialogue is used as a means of engaging students in the exploration of content, with the intention that the skills developed in this dialogic interaction will be transferred to individual writing. To that extent, this is essentially about learning to write rather than writing to learn. That is not to deny that once students have internalized these skills so that they can be carried out individually, individual writing may become a means for writers to deepen their understanding of content. Just that the focus is on an earlier stage of this process, designed to make writing a knowledge-transforming process, and the hypothesis that this does enable writers to learn through their writing is taken for granted.

Corcelles Seuba and Castelló Badia (this volume) identify some common properties of productive collaboration, as well as some differences between the groups producing the better and worse collaborative texts. The common property was that both groups engaged in an integrating construction strategy, which enabled the students to relate abstract philosophical concepts to their own experience, and to amalgamate philosophical concepts and their own understandings in their discourse. The distinctive feature of the group who produced the better collaborative text was that they engaged in more exploratory talk and a more recursive process of developing their ideas. They also appeared to regulate their interaction and the development of the text more effectively. To an extent, these differences are similar to the contrast between knowledge-telling and knowledge-transforming approaches observed in individual writing (Bereiter & Scardamalia, 1987). Despite these differences, however, both groups showed similar improvements in the quality of the individual texts they produced. This study suggests then that collaborative dialogue may enable students to relate disciplinary practices to their own experience, and to better incorporate these practices in their own argumentation.

Key questions for future research are about how this scales up? Can this be developed into a general procedure for productive collaboration? And does this form of productive collaboration transfer to students' individual writing? Finally, if this does indeed transfer to individual writing, does this enable writers to use writing as a means of deepening their understanding of content?

Smirnova (this volume) describes a different approach to the development of disciplinary thinking skills in the context of history, and focuses in particular on transfer from L1 to L2. Since this study did not include a control group and combined direct lecturing with writing activities it does not provide evidence about the contribution of

writing to learning. Rather, it illustrates how writing to learn activities can be incorporated in a disciplinary-specific course, and a method for combined L1 and L2 learning. It provides a basis for future research aimed at identifying the specific contribution of writing to learning in this context. For example, one might compare versions of the course in which seminar activities were focused on oral discussion of topics with those - like the version described in the paper - which involve writing-based activities. Furthermore, the paper prompts interesting questions about whether writing in L2 might reduce the effects of writing on learning.

One feature of the studies considered so far is that they have not assessed whether changes in disciplinary-specific thinking skills are associated with changes in the writer's understanding of content. This is the key question from a writing to learn point of view. Van Drie et al.'s paper set out to do precisely this by comparing an intervention focused on the development of historical reasoning skills with an intervention focused on general writing skills, and assessing their effects on measures of historical reasoning skill, general text quality and knowledge of the content in the course. They found that, although the discipline-specific intervention did lead to greater increases on their measure of historical reasoning skill than the general writing course, it was not associated with greater increases in content knowledge or improvements in text quality. At first sight, then, this suggests that developing discipline-specific thinking skills does not lead to improved writing to learn. However, as the authors themselves stress, the fact that the effects on learning were measured across the whole course makes it difficult to distinguish relative effects of the writing conditions from general effects of the course material itself. Furthermore, the brief nature of the intervention may not be sufficient for any change in historical reasoning to be associated with deeper content changes. Intensity of intervention was one of the important factors that Bangert-Drowns et al. (2004) identified as influencing the effectiveness of writing to learn interventions. It would therefore be premature to conclude that learning disciplinary-specific skills does not lead to any greater content learning than more generic forms of writing instruction. Rather the paper raises the interesting question for future research of whether disciplinary-specific instruction has different effects on content learning compared to more general writing instruction, and provides an illustration of how such research might be designed.

2.3 Writing to learn

The paper by Wäschle et al. (this volume) is the latest addition to a growing, and impressive body of research (see references in their paper) establishing the value of learning journals as a means of deepening students' understanding. An important feature of this approach is that students' writing about content is guided by cognitive and metacognitive prompts. Students are not just left to write whatever they like about the content of their classes but are directed to consider how this content is organized and how it relates to their existing knowledge, as well as to monitor their understanding and develop strategies for overcoming problems of understanding. Thus, the goals of

this form of writing are the development of understanding rather than rhetorical goals: students are prompted to explore their understanding rather than how to write in an appropriate disciplinary way.

This paper extends previous research by examining the effects of writing a learning journal, not just on the students' understanding of content, but also on their interest in the topic and on the quality of their critical reflection about the topic. The first study established that a standard learning journal strategy was associated with greater increases in understanding, higher levels of interest and better quality critical reflection than a control group. The second study actively manipulated interest by prompting students to write about the personal relevance of the material and compared this with a standard learning journal consisting of cognitive and metacognitive prompts alone. This personal utility prompt led to similar developments of understanding but greater increases in interest and in quality of critical reflection. Mediation analysis indicated that the development of understanding led to increased interest and better quality critical reflection. The intriguing feature of this result is that, although students were not given explicit instructions or prompts for critical thinking, but were instead prompted to deepen their understanding and identify personal relevance of material, the students ended up with improved quality critical thinking. The quality of the critical thinking appeared to be driven by the writer's developing understanding of the material.

Ortoleva and Bétrancourt (this volume) describe an intervention designed to help students to integrate their formal learning with their practical work experience. This is similar to Wäschle et al. (this volume) insofar as, although students were prompted to write about specific aspects of their experience, these prompts were designed to promote critical reflection rather than writing skill. It differed, however, in that writing was incorporated as part of an extended activity involving peer response and collaborative discussion. As the authors emphasize, their aim was to explore the overall effectiveness of the intervention rather than to pinpoint the effects of writing per se. An interesting line for future research would be to measure changes in competence and self-efficacy at different time points within the intervention, something which could be feasible given its extending duration. This might enable the effects of different components to be disentangled from one another. A second feature of the findings was the apparently differential effects for first and second year students. Thus, first year students showed an improvement in their ability to answer multiple-choice questions after the intervention, second year students did not. Although this finding needs to be interpreted cautiously because there was no direct test for an interaction, the pattern of results suggests that this may be a consequence of the first-year students' low level of initial understanding. By contrast, for self-efficacy, where first year students showed consistent increases but second year students did not, the first year students' self-efficacy was higher than second-year students' self-efficacy at both pre- and post-test. This suggests that the writing intervention may have less impact on self-efficacy for students who have more experience of the workplace, perhaps because this direct experience makes a bigger contribution to feelings of self-efficacy.

3.   Components of understanding

In this section, I will take a leaf out of Wäschle et al.'s (this volume) book, and try to relate these studies to my personal understanding of writing to learn. This is based on a dual process model of writing (Baaijen & Galbraith, under review; Galbraith, 2009; Galbraith & Baaijen, in press). I will give a sketch of this and then consider how it might relate to the studies described in this volume.

An important point to stress first is that the dual-process model focusses on the development of the writer's subjective understanding as a function of writing. Although one would expect this to be related to learning it is not necessarily the same thing. For example, Keil and his colleagues (Keil, 2003; Mills & Keil, 2004; Rozenblit & Keil, 2002) have consistently found that writing explanations of "how things work" can lead to decreases in subjectively-rated understanding, a phenomenon which they call the "illusion of explanatory depth". Arguably, however, this decrease in understanding may make an important contribution to the students' learning, particularly if it prompts remedial strategies as in the learning journal intervention described by Wäschle et al. (this volume). Equally, increases in a writer's subjective understanding might not be related to increases in an objective measure of learning; indeed they might hypothetically lead to the deepening of a writer's misconceptions and hence to poorer learning.

The dual-process model attributes discovery through writing to a combination of explicit planning processes and implicit text production processes operating on two different kinds of knowledge representations. In combination, these two processes lead to the development of a coherent knowledge object which both satisfies the writer's goals (rhetorical goals when "proper" text is the aim) and captures the writer's implicit understanding (for overviews, see Galbraith, 2009; Galbraith & Baaijen, in press). For present purposes, this has three main features.

First, knowledge is assumed to have two separate components – an explicit memory system consisting of an organised representation of individual ideas, and an implicit memory system consisting of a distributed representation of content in which knowledge is stored in the connections between semantic features (see McClelland, McNaughton, & O'Reilly, 1995 for an account of these complementary learning systems, and Norman, 2010 for an overview of recent research).

Second, two independent but interacting processes operate on these different representations in long-term memory. The first of these is an explicit planning process. This involves the retrieval of content from the explicit store of ideas and the goal-directed manipulation of these ideas in working memory in order to create a coherent knowledge object that satisfies the writer's goals. Although this process can lead to the development of understanding when it leads to the reorganization of content in long-term memory, it does not by itself lead to the creation of new content. The second is an implicitly controlled text production process defined as dispositionally-driven text production (Galbraith, 2009). This spontaneous text production process involves synthesizing content during text production guided by the implicit organization of

material in semantic memory. It is this process which is assumed to be responsible for the creation of new content during writing. Support for this assumption comes from a recently completed study (Baaijen, 2012; Baaijen & Galbraith, under review), using key-stroke logging as an indicator of writing processes, which found that increases in subjective understanding through writing were associated with both global revision of text structure during writing and with dispositionally-guided text production. Importantly these made additive, and independent, contributions to the development of the writer's understanding, suggesting that they involved two independent processes.

Third, although both these processes are assumed to contribute to the development of understanding, they operate best under different conditions, and this is the source of a fundamental conflict in writing. The explicit planning process operates best when writing is directed towards explicit goals and ideas are represented in abbreviated note-form to ease manipulation of content in working memory. The text production process operates best when thought is formulated in full text, and when the sequence of sentences is allowed to unfold guided by the implicit organization of semantic memory. This leads to a conflict between explicit and implicit organizing processes which writers resolve in different ways. Important factors here are individual differences in how writers combine the processes and varying effects of different drafting strategies. Baaijen, Galbraith and de Glopper (2014) found that writers with high transactional beliefs about writing – whose writing is assumed to be directed towards the development of their understanding – showed greater increases in understanding than writers with low transactional beliefs – whose writing is assumed to be directed towards translating ideas into text. Furthermore, outline planning reduced the development of understanding during writing compared to synthetic planning, in which the writer establishes their central goal before writing but does not impose an explicit organisation on their ideas.

Looking at the studies in this volume through this lens prompted two broad questions. First, although the studies were all designed to assess effects on educationally related outcomes, to what extent was it possible to distinguish different aspects of knowledge representation in the measures? The first measure of interest here is the measure of epistemic complexity used by Wilcox et al. (this volume). Although this was not an independent measure of content knowledge it did assess the kinds of knowledge displayed in the texts produced to different prompts. The particularly interesting feature of the epistemic complexity scale is that it appeared to assess a combination of organisation and understanding in a single scale. Thus, the first three items on the scale ranged from "separated pieces of facts" at level 1, through "partially organized facts" at level 2, up to "well-organized facts" at level 3. The remaining two items referred to "partial explanation" at level 4, and "well-organized explanation" at level 5. I wondered whether understanding and organization could be measured independently – perhaps using a scale asking about degree of organisation of the content, and a separate scale asking about degree of understanding – and whether

these might be differentially affected by different writing prompts and other independent variables.

Of the remaining papers, three included explicit measures of content knowledge. Van Drie et al. (this volume) included a measure of topic knowledge, but this appeared to be directed towards primarily factual knowledge of material studied in the course rather than understanding. Ortoleva and Bétrancourt (this volume) included a multiple choice question, which might be expected to tap into explicit knowledge, as well as more open-ended questions, which might be expected to tap into more implicit knowledge, and did find some evidence of differential effects on these two measures. However, it was unclear what the origins of these differences were. Finally, Wäschle et al. (this volume) used both a comprehension test and a test of critical reflection. Although both of these can be seen as tapping into explicit and implicit knowledge, the critical reflection task may perhaps be more dependent on implicit knowledge. It is interesting, therefore, that the two learning journal conditions had differential effects on these measures: the condition including the personal utility prompt had similar effects on the comprehension test to the condition without the personal utility prompt, but was associated with better critical reflection.

The second question prompted by these studies was about the effect of the different interventions on writing processes and on how these were combined. These were not directly assessed in most of the studies so this is primarily speculation about the kinds of processes that might be involved. One distinction that was apparent was in the nature of the goals that were specified for the writing activities. In general, these can be seen as providing guidance for what to write about and how to put this content together in an appropriate way, and as being dependent on the explicit organising process. These will either lead to the direct retrieval of relevant existing content, or require the writer to constitute content to satisfy these goals. The key question from a dual-process point of view is how freely the writer is able to articulate their implicit understanding in relation to these goals. The interventions described in this volume ranged from ones which focussed primarily on rhetorical goals (Smirnova; the discipline specific condition of van Drie et al.), through those which focussed on a combination of goals (Ortoleva & Bétrancourt), to the study by Wäschle et al. which focused exclusively on learning goals. This raises questions about how the text production process varies under these different conditions. Is discourse produced more spontaneously in the collaborative discussions which formed the initial part of the intervention described by Corcelles Seuba and Castelló Badia? How does this change when the writers turn to producing a well-formed text? Does the text production process differ when it is directed towards "understanding goals" as in Wäschle et al.'s study compared to when it is directed towards rhetorical goals?

The paper by Wäschle et al. (this volume) is the one study that provided some evidence about the processes involved as it included an analysis of the learning strategies applied in the writers' journals. Although this is not a direct measure of the writing processes involved it does provide some evidence about the goals towards

which they were directed. A particularly interesting finding here was that the two learning journal conditions in study 2 differed, not just in the extent to which they involved articulating the personal utility of the content, which was after all the target of the intervention, but also in the extent to which they involved explicitly organising ideas. Thus, the students in the standard learning condition engaged in more explicit organisation of ideas than the students in the personal-utility condition. This prompts two questions about the processes involved. Does a focus on personal utility lead to a greater emphasis on the implicitly guided text production process at the expense of explicit organisation? Does this reduced level of explicit organisation mediate the increased critical reflection apparent in the personal-utility condition?

4. Conclusion

These papers provide a range of examples of approaches to developing writing as a process of learning. These approaches vary in how much they focus on learning as an end in itself or as part of learning to write and think in a disciplinarily appropriate way. This can be seen as a contrast between writing that is designed to articulate the writer's implicit understanding of a topic, and writing that is designed to satisfy external criteria for disciplinarily specific thinking. A key goal for future research is to carry out controlled investigations of the effects these have on different components of learning and on how these are associated with different components of the writing process. The ultimate aim is to develop strategies that enable students to use disciplinary-specific forms of thought as a vehicle for developing their distinctive understandings of a topic.

References

Applebee, A. (1984). Writing and reasoning. *Review of Educational Research*, 54, 577–596. http://dx.doi.org/10.3102/00346543054004577

Baaijen, V. M. (2012). *The development of understanding through writing*. Groningen Dissertations in Linguistics.

Baaijen, V. M., & Galbraith, D. (under review). Discovery through writing: Relationships with writing processes and text quality.

Baaijen, V. M., Galbraith, D. & de Glopper. K. (2014). Effects of writing beliefs and planning on writing performance. *Learning and Instruction,* 33, 81-91. http://dx.doi.org/10.1016/j.learninstruc.2014.04.001

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*, 29-58. http://dx.doi.org/10.3102/00346543074001029

Bereiter, C., & Scardamalia, M. (1987). *The psychology of written composition.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Corcelles, M. & Castelló, M. (2015). Learning philosophical thinking through collaborative writing in secondary education. *Journal of Writing Research, 7*(1), 157-200. http://dx.doi.org/2010.17239/jowr-2015.07.01.07

Emig, J. (1977). Writing as a mode of learning. *College Composition and Communication,* 28, 122-128. http://dx.doi.org/10.2307/356095

Galbraith, D. (2009). Writing as discovery. *British Journal of Educational Psychology Monograph Series II 6 - Teaching and Learning Writing*, 5-26. http://dx.doi.org/10.1348/978185409x421129

Galbraith, D., & Baaijen, V.M. (in press). Conflict in writing: Actions and objects. In G. Cislaru (Ed.), *Writing(s) at the crossroads: The process/product interface*. Amsterdam: John Benjamins Publishing.

Keil, F. (2003). Folkscience: Coarse interpretations of a complex reality. *Trends in Cognitive Sciences, 7,* 368-373. http://dx.doi.org/10.1016/S1364-6613(03)00158-X

Klein, P. D. (1999). Reopening inquiry into cognitive processes in writing-to-learn. *Educational Psychology Review*, 11, 203-270. http://dx.doi.org/10.1023/A:1021913217147

Klein, P. D., & Kirkpatrick, L. C. (2010). A framework for content area writing: Mediators and moderators, *Journal of Writing Research*, 2 (1), 1-46. http://dx.doi.org/10.17239/jowr-2010.02.01.1

Kuhn, D., and Crowell, A. (2011). Dialogic argumentation as a vehicle for developing young adolescents' thinking. *Psychological Science*, 22, 4, 545–552. http://dx.doi.org/10.1177/0956797611402512

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

Mills, C., & Keil. F. (2004). Knowing the limits of one's understanding: The development of an awareness of an illusion of explanatory depth. *Journal of Experimental Child Psychology, 87,* 1–32. http://dx.doi.org/10.1016/j.jecp.2003.09.003

Olson, D. (1996). *The world on paper: The conceptual and cognitive implications of writing and reading.* Cambridge, UK: Cambridge University Press.

Olson, D., & Oatley, K. (2014). The quotation theory of writing. *Written Communication*, 31, 4-26. http://dx.doi.org/10.1177/0741088313515164

Ortoleva, G., Bétrancourt, M. (2015). Computer-supported collaborative writing in vocational education: Effects of peer feedback on learning and self-efficacy. *Journal of Writing Research,* 7(1), 95-122. http://dx.doi.org/10.17239/jowr-2015.07.01.05

Rozenblit, L., & Keil, F. (2002). The misunderstood limits of folk science: an illusion of explanatory depth. *Cognitive Science, 26,* 521-562. http://dx.doi.org/10.1207/s15516709cog2605_1

Smirnova, N.V. (2015). Writing-to-learn instruction in L1 and L2 as a platform for historical reasoning. *Journal of Writing Research,* 7(1), 65-93. http://dx.doi.org/10.17239/jowr-2015.07.01.04

Van Drie, J., Braaksma, M., & Van Boxtel, C. (2015). Writing in History: Effects of writing instruction on historical reasoning and text quality. *Journal of Writing Research,* 7(1), 123-156. http://dx.doi.org/10.17239/jowr-2015.07.01.06

Wäschle, K., Gebhardt, A., Oberbusch, E.M., & Nückles, M. (2015). Journal writing promotes critical reflection in science education. *Journal of Writing Research,* 7(1), 41-64. http://dx.doi.org/10.17239/jowr-2015.07.01.03

Wilcox, K. C., Yu, F., & Nachowitz, M. (2015). Epistemic complexity in adolescent writing. *Journal of Writing Research*, 7(1), 5-39. http://dx.doi.org/10.17239/jowr-2015.07.01.02