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Domain-specific cognitive development through written genres in a teacher education program*

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Previous studies of initiatives in Writing to Learn and Writing Across the Curriculum/Writing in the Disciplines, while showing gains in knowledge retention and improvement in general writing skills, have not yet investigated the more fundamental issue of how writing supports development of domain-specific forms of thinking. Written samples were gathered from prospective teachers engaged in a year-long program of classroom observation and participation designed to advance their understanding of student success and failure. Ethnographic and quantitative methods provided evidence that their written accounts indicated an increased understanding that was aligned with the goals of the program.

Keywords: writing to learn, writing in reflective practice, developing domain-specific thinking, Writing to Learn, Writing Across the Curriculum/Writing in the Disciplines

1. Introduction

Writing for millenia has been associated with the cultivation of the intellect. As the teaching of writing gained greater attention over the last century, early theorists such as Moffett (1968), Emig (1977), and Berthoff (1982) theorized rationales for this association, underpinning hopes for the writing-to-learn (WTL) and Writing Across the Curriculum/Writing In the Disciplines (WAC/WID) movements of recent decades (see Bazerman et al. 2005 for a review). Sociocultural approaches to writing (Bazerman 1981, 1988; Langer and Applebee 1987; Nystrand 1986)

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* This article is dedicated to the memory of Patrick Michael Ewing (1977–2012).

further proposed that practice in specific forms of writing were associated with specific forms of cognitive development. Survey and interview studies (Carroll 2002; Thaiss and Zawacki 2006; Carter et al. 2007) confirm that both faculty and students perceive that engagement in disciplinary writing tasks supports students in developing disciplinary modes of meaning and adopting academic identities. Other studies have examined specific student writing responses to assigned tasks as competently displaying the kinds of thought expected on the assignments (for examples, Kelly and Bazerman 2003; Kelly et al. 2010). However, these studies have yet to demonstrate that participation in these tasks in fact fosters the kind of thinking desired, only demonstrating that some students seem to display the thinking better than others.

Coming at this problem from a different direction, research on writing-to-learn has shown the impact of information rehearsal writing tasks (such as note-taking and summary) on rote memory as measured on multiple choice or content repetition exams (reviewed by Bangert-Drowns et al. 2004). While there has been some evidence of information integration, the evidence has been equivocal and only of general effects (for example, Newell 2006). Similarly, some research on writing across the curriculum and in the disciplines, has shown improvement in writing over time when students have engaged in structured sequences of assignments (Johnstone et al. 2002). Yet neither the WTL nor WAC/WID research has demonstrated the kinds of cognitive development which link writing to development of thought, particularly in academic areas, nor which stand behind many WAC practices (see Ackermann 1993, but also note, in contrast, Carter et al. 2007). Ochsner and Fowler (2004), accordingly, call for more detailed studies of how discipline-based writing activities lead to specific changes in thinking, within the full multi-modal experience of educational programs.

Studying such situated development of thinking within discipline-based *in situ* writing activities, however, presents a number of theoretical and methodological challenges. Such studies call for refined measures of cognition that are specific to the discipline and genre. At the same time, the complex multi-causality of situated writing performance and the extended exposure of students to forms of academic writing and the specific discipline in question make it difficult to identify the effect of particular writing tasks or sequences of writing tasks on cognitive development.

Rhetorical Genre Studies have characterized genres as typified actions within typified situations (Miller 1984) and have led to the identification of specific forms of literate action within many organized activity systems in academic, professional, workplace and public spheres (see Bawarshi and Reiff 2010 for an overview of various approaches to genre and the relation of the approach here to other traditions of genre studies). This work, within a Vygotskian socio-cultural framework has been largely ethnographic, with little investigation of the cognitive consequences

of these practices. Bazerman (2009), however, hypothesized mechanisms that suggest ways of investigating cognitive development within situated written genres. Bazerman, following Vygotsky (1986), has proposed individuals might internalize genres they write in, thereby reorganizing internal thought and influencing perception. Specifically, Bazerman proposed that genres direct thinking and cognitive development by placing writers in defined problem spaces which give shape to the work to be accomplished and provide specific tools to solve the problem. The thinking and learning may at some junctures reorganize and reintegrate the writer's mode of thinking in a new functional cognitive system, thereby moving the writer to a new stage of cognitive development.

The present study attempts to combine a situated socio-cultural approach to the cognitive development of individual *participants* with quantitative evidence from the study of individual *subjects* favored in the tradition of cognitive psychology. To provide such evidence, however, this study has had to negotiate the border of sociocultural and cognitive studies in ways that do not always fully meet the conventional expectations of either tradition. Our basic strategy is to use sociocultural ethnographic methods to identify the socially embedded sites of writing and the modes of thought expected and valued within the situation and then use cognitive measures to demonstrate and evaluate sophistication of thought and changes across assignments and over time.

2. The two-year study

2.1 Requirements of the research site

To meet the demands of both cognitive psychological and situated sociocultural research, we sought an academic program that had well-defined cognitive goals within a well-formed sequence of activities and assignments directed toward those goals. Identifying a program with focused and novel cognitive goals would allow us to develop a specific set of rubrics to assess the kinds of thinking sought in the program. In contrast to generalized models of cognitive development, such as proposed by Bloom (1956) or Perry (1970), our study rests on the assumption that disciplinary or practice-based thinking is differentiated according to the nature of the domain (Vygotsky 1986; Scribner & Cole 1981). Even within specialized disciplines and areas of practice, there are different perspectives on the best modes of thought to develop (for example, in the domain of this study, teacher education, see Darling-Hammond et al. 1983).

In order to examine the development of new forms of thought over time, it was necessary to study a domain that was largely new and unfamiliar to subjects.

Further, by following subjects within the same program it was possible to trace cognitive change to specific forms of experience. Finally we sought a program that was long enough to allow observations of cognitive change across several major related activities.

2.2 Setting and participants

A site that combined these characteristics was a one-year teacher education program at a major public university in California. In California, teacher education and credentialing occurs after completion of the B.A. While teacher candidates in the program would have had the benefit of an undergraduate education, they would have had little experience teaching and would be unlikely to have had disciplined induction into professional modes of thinking. In fact all the focal students in our study came to this teacher education program immediately after completing their undergraduate degrees, and although they had engaged in volunteer tutoring as a requirement of admission, none had had formal induction into a professional pedagogic discipline.

The program is a small cohort-based program with a tightly structured full-time 12 month curriculum (mid-July to mid-July). In the second year of our study we followed six of the cohort of the twelve secondary English Education teacher candidates, who all took the exact same course work, and we collected all major written assignments across the year, including credential documents. We also observed them in selected classes, recorded large samples of their classroom discussion, and collected informal writing samples.

The program faculty has worked together over the years to develop a common set of objectives that structures coursework and internship experiences to provide a trajectory of development across the year. The program provides three cycles of internship and student teaching, with increasing responsibilities, from observation through full take over of a classroom for an entire semester. Although we did not directly observe the internship experiences, students reported experiences, perceptions, and puzzles from their internships in the class discussions and written assignments. The credentialing requirements include the completion of a teaching portfolio. Finally, if students complete an action research project and write an acceptable thesis they receive a Masters of Education in addition to the teaching credential. About 95% of the teacher candidates complete their M.Ed. thesis immediately upon completion of the program, with almost all completing the project within three years to gain the M.Ed.

2.3 Data collection

Our study was carried out over two academic years. In the initial year (2008–9) we carried out an ethnographic study to understand the program goals and structure. In the second academic year (2009–10) we followed six teacher candidates and systematically collected writing samples from three major assignments and additional writing, and recorded class discussion.

2.3.1   *Initial Ethnographic study*

In order to understand the goals and structure of the program before we began our full study, in the summer of 2008 we interviewed the leadership of the program and the instructors of the courses. Additionally, we surveyed all the completing secondary single-subject teacher candidates about their perceptions of what experiences in the program were most formative and what they gained from those experiences. Then we interviewed a small group of now credentialed teachers who had just completed the program and who the program leaders identified as having developed in accordance with the goals of the program. We also observed the program in operation over the 2008–9 academic year in order to confirm and specify the detailed sequences of assignments and activities.

From this initial inquiry we found that the program goals for both primary and secondary teachers and in all subject areas were to develop inquiry-driven reflective practitioners based on evidence gathered from classroom experience. Additional program goals were to develop awareness of the diversity of the students and cultures in classrooms and to act as change agents in schools. We identified a series of three major writing experiences that were viewed as important by faculty and program leaders, particularly with the aim of helping the student teachers make sense of their classroom experience and develop their ability to think like teachers (that is, to develop their "teacher cognition"). The three major writing experiences consisted of the Hiding-out paper, a teaching portfolio, and an M.Ed. thesis.

The Hiding-out paper is an example of a common educational genre, where, guided by a theoretical essay, teacher candidates are asked to gather evidence about a case in their experience or professional practice and then interpret that life-evidence through the lens of the theory. In this case the theory comes from Brozo (1990) which identifies a class of coping behaviors students exhibit when they have difficulties in reading and seek to avoid being exposed as poor readers. To complete the assignment the teacher candidates gather information about a hiding-out student in the classes they are observing through observations, interviews, collection of student work, and classroom interactions with the student. In late October the teacher candidates make an oral presentation of what they have

learned about the student and the implications for teaching. Over the next several weeks while they are observing a second class, the teacher candidates collect information about a second hiding-out student. At the end of November they submit a paper of 4–6 pages comparing the two students.

The Teaching Portfolio is an outgrowth of the portfolio assessment model (Tierney et al 1991) adapted to teaching. Although the teaching portfolio has only recently emerged, it has rapidly become a robust genre, often tied to state credentialing standards (Anderson & DeMuelle 1998) as it is in California. The particular version used, Performance Assessment for California Teachers (PACT) is one of several systems for completing the state requirement (Chung 2008) and used by at least 30 teacher education programs in the state (see http://www.pacttpa.org/). A national version is currently implemented as edTPA (http://edtpa.aacte.org/).

In the program studied, teacher candidates worked on parts of the portfolio throughout the winter with final submission in April. Specifically students, guided by questions, are required to complete the following components:

1. Context commentary, describing such things as the institutional and community setting, relevant school policies, and student demographics.
2. Planning commentary, including a lesson plan and a rationale for the choices as well as identification of the state standards addressed.
3. Two videotaped segments of no more than ten minutes each selected from a week's sequence of lessons to demonstrate preparation and discussion of a complex text. The videotape is to be accompanied by a narrative account of what is happening and the decisions made by the teacher candidate.
4. Assessment commentary, reflecting on the work produced by students in the class to determine what aspects of the lesson sequence is helping students learn and meet standards.
5. Daily reflections, written after each day's lesson, on what is working, what is not, and what to do next.
6. Overall reflective commentary on the teaching event, citing relevant literature and theory.

The M.Ed. thesis presents a structured action research inquiry (Sagor 2004), worked on throughout the year. Teacher candidates submit it in completed written form at the end of June and defend it orally in early July. In a supporting course throughout the winter and spring with associated small facilitation groups, teacher candidates formulate and modify their inquiry question, start the initial collection of artifacts that display some aspect of teaching, learning, or other classroom issue in their internship placements, and analyse their findings. At various times throughout the winter and spring students write drafts of parts of the thesis, which then undergo peer critique in the facilitation groups. The final thesis is structured

around the sequence of narratives and interpretations of the collected artifacts as the teacher candidate develops in thinking and problem solving as a teacher. The final thesis also must include an introductory narrative of personal development describing evolution of thinking about the inquiry question. Students have available files of previous years' theses to provide further modeling.

We also identified the places in the curriculum where informal writing occurred with the aim of reflection.

2.3.2 *Data collection during second year*

On the basis of these preliminary findings about the goals, structure, and activity of the program, we designed a more detailed and structured data collection for the 2009–2010 academic year focusing on major formal and informal writing throughout the year, and discussion in course settings.

As we were attempting to study the changes in thinking associated with particular forms of writing, we wanted to get independent evidence of changes of thinking beyond statements made in the assigned genres. Expressed thoughts within the assigned genres would only provide evidence that the subjects could produce statements of the kinds required by the assignment and expected within the genre. As independent measures of cognitive change we sought evidence of related changes in expressed thought in other samples of writing and speech, particularly in more open-ended situations, where teacher candidates could frame observations and thoughts as they occurred to them, rather than in fulfillment of genre and assignment expectations. To examine the independent expression of thoughts and perceptions in another context we compared the kinds of thoughts expressed in response to the hiding-out assignment to the statements of the teacher candidates in another course occurring at the same fall term. For this English Education course we collected the class discussions and online forum comments. The classroom discussions were wide ranging in the area of teacher-education and centered on their internship experiences. Additionally, teacher candidates would post weekly observations in an electronic forum about their internship placements, their readings, and class discussions. The first author of this paper was the instructor of this course, but all data were collected independently by the second author, who attended all sessions of these classes and made both ethnographic field notes and audio recordings. This was the only course in the program any of the authors were engaged in; they were not involved in the instruction, design, or supervision of the major assignments that were examined as the sites of cognitive change, nor were they principals in the design or leadership of the program as a whole.

2.4 Analytical rationale and coding procedures

To examine changes across the whole year in candidates' understanding of students, teachers, and classroom interactions in the core assignments, we analyzed the text of the hiding-out paper, the textual components of the PACT, and the text of the M.Ed. thesis. We further analyzed specific sections of these papers to see the effect of the internal structure of each genre. Figure 1 indicates the timing of when teacher candidates were working on the various genres that are part of this study.
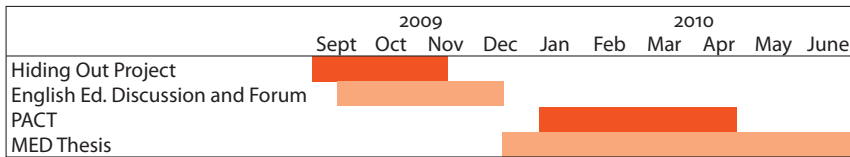

	2009				2010				
	Sept Oct Nov	Dec	Jan	Feb	Mar Apr	May	June		

Hiding Out Project
English Ed. Discussion and Forum
PACT
MED Thesis

Figure 1. Timeline of teacher candidate activities

We aggregated and analyzed coded data across our six subjects using the activity-specific cognitive scale. After becoming familiar with the ethnographic data about the program and its goals, the first and second authors tentatively adopted a coding scheme to characterize expressed thoughts representing actors and actions in the classroom. For written texts the sentence was taken as the appropriate unit of analysis while for oral utterance a speaker's turn was taken as the appropriate unit. For analysis both were considered statements expressing the speaker's intent. Once we had developed a workable scheme, the second author coded all the data, who then brought all questions and problematic coding cases to the first author. Differences and difficulties were then discussed between the two, leading either to refinement of the code or elaboration of the criteria so that there was common agreement on all cases. After the final coding was stabilized, all data were recoded.

The first author at several points independently coded test samples that were compared to the coding by the second author. Because of the collaborative work done in creating and refining the coding, agreement was over ninety percent on these tests; the remaining difficulties were resolved readily through discussion. Because the codes are embedded in the values and practices of the research site, coders need to be ethnographically familiar with the site. For such situations Garrison and colleagues (2006) argue for the value of negotiated coding as we used here.

As we refined the coding scheme in relation to the actual expressions in the papers, forum comments, and class discussion, we developed ten categories for characterizing the teachers candidates' expressions about classroom actors and events. The categories, along with examples from the data, are shown in Table 1. Nine of the coding categories move generally from inflexible mono-causal (learner-caused or teacher-caused) explanations at the lower end to dynamic multicausal

interactive explanations at the higher end. We coded statements that did not reference students, teachers or classroom interactions as 0.

This coding scheme reflects a sequence of understanding consonant with the developmental goals of the program, and statements with a higher score generally

Table 1. Coding categories of thought expression with examples from teacher candidate data

1. **Fixed Characteristics**
    These statements about teachers, the school system, or students assume that that the classroom and its participants are unchangeable and non-reactive.
    "[I hoped] he would be encouraged to make mistakes, but this seems to be an unlikely outcome in light of his insecurity."

2. **Prior Characteristics Shape Current Learning**
    These statements assume a student or teacher's behavior/actions/thoughts are a result of unchangeable prior characteristics, such as language, class, disability, personality, or moral characteristics.
    "…his friends are very literate, so his friends are nerdy, he seems to have a really solid little group, so I would have never identified him as hiding out…"

3. **Educational Moral Imperatives**
    These statements assume that all students should respond in similar ways to instruction or assignments.
    "I was disappointed with his apathetic response to reading…I feel like I might be a positive force here in the class with him, but I'm leaving, so what's he have left?"

4. **Influences on Students**
    These statements assume that students will be affected by assignments or instruction, without elaboration on why the assignment or instructional action was chosen or how it fits into a larger learning context.
    "What do you think about putting specific directions on a worksheet like saying that you have to have at least ten words?"

5. **Reactiveness of Educational Setting**
    These statements depict the teacher's or students' reactions to events in the classroom and the actions of othersbut without elaboration about the reasons for a behavior or action.
    "Students seemed to love the brainstorming part of writing as they kept generating many, many ideas of what to work with."

6. **Complexities in Situation**
    These statements consider a student's life outside the classroom including student's family or language background, in relation to classroom choices and actions.
    "I learned about another side to Ruben's story by reading his cumulative file, though. Ruben has been in special education since he was in second grade, and severely struggles with words- in both spelling and comprehension. His mother left when he was quite young. Seeing that Ruben had so much to struggle with behind his subtle smiles and calm temperament was really helpful and eye-opening. I watched how I phrased things with Ruben, and understood better the struggle he has been facing his whole life."

Table 1. Coding categories of thought expression with examples from teacher candidate data (*continued*)

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7. Dynamic Complexities of Responsiveness
    These statements consider and elaborate learning differences in the classroom. These statements consider individual differences of thinking and learning differences and teacher responses to those differences.
    "Today the kids were saying something very different and 'I can't do this because nobody has been helping me do this,' and I said, 'is that what you mean by boring?'"

8. Learning in Dynamic Systems
    These descriptive statements about classrooms recognize the teacher's power to create different kind of learning situations and to support different types of learning.
    "So the students began by writing directions for how to make a peanut butter and jelly sandwich. I modeled exactly what their steps said, teaching them that technical writing is actually a lot more detailed than the how-to articles they were familiar with. We started then, by reading an actual technical document and highlighting its key components. Students were also given a template for creating a technical document, so they could refer to either the rest of the week…this is where I realized we'd need the most scaffolding: during the drafting process…"

9. Reflective Command over Environment
    These statements recognize learning and teaching as situated in a large and reactive system. The 9's do not have to be grounded in observation about specific classroom practices, but they sometimes are.
    "This I plan for my next step as a conscientious teacher. This is an idea put forth by Tomlinson in 2002 in *The Parallel Curriculum* which focuses on enabling students to see themselves in relation to the discipline both now and with possibilities for the future; understand the discipline more fully by connecting it to their lives and experiences; increase awareness of their preferences, strengths, and interests, and need for growth…" (p. 52). I want to look at how I can achieve this so that students see a relation to the content in the future, not just their past experiences. I feel that teaching students how to connect their personal experiences with the content as well as how to apply the content to future life experiences will allow students to learn and grow comprehensively, preparing them for the world outside of the classroom."

0. No characterization of students', teachers', or classroom interactions.

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would be considered more sophisticated within the program. The higher levels, 4 through 9, indicate an understanding of the educational situation as a complex interaction between external influences and internal dynamics and ultimately guided by the reflective participation of teachers and students. Levels 1 through 3 attribute educational events to fixed characteristics of individuals (such as personality or intelligence attributes), prior conditioning that controls current behavior, or fixed moral responsibilities that individuals either live up to or violate.

For each assignment of the six focal teacher candidates we examined the profile of statements of different codes, translated into percentages, and compared the

profiles across assignments and sections. The six focal subjects were purposefully chosen to include the two teacher candidates who expressed higher level thoughts from the beginning, and the remainder randomly chosen from the class and reflective of the general level.

We coded the full text of the six hiding-out papers (each of which was approximately 1500 words in length, for a total of approximately 9,000 words comprising 369 coded sentences) and all sections of the PACTs for the six teacher candidates, except for the context commentary that contained few relevant comments on classroom behaviors (totaling 2903 coded sentences and approximately 70,000 words). For the six M.Ed. papers we coded the presentations and analyses of the first and last data presentations, the review of literature and the concluding discussion. We did not include the introductory section as that was a personal narrative of development and contained few comments about classroom interactions. As the theses were lengthy documents, we were selective in our coding of the student presentation of their classroom data, which comprised the bulk of the documents; we focused on the initial and final data collections (or artifacts, as they were called in the assignment) to observe contrasts over time. We coded from the M.ED. papers a total of 1657 sentences, comprising approximately 40,000 words. Additionally we coded the full text of the class discussion (comprising 101 pages of transcript and 321 coded turns from the focal teacher candidates) and forum comments for the English Education course over the full fall term (comprising 54 contributions, and 313 coded sentences).

3. Findings

3.1 Thoughts expressed corresponded to the expectations of the assignment

First, as shown in Table 2, we found that there was a direct correspondence between the genre of the three tasks assigned and the character of the thought expressed. Each of the three major assignments elicited an overrepresentation of a particular kind of statement compared to the other assignments and the forum and class discussion. Two-sample Kolmogorov-Smirnov (KS) tests were conducted to test the equality of the distribution of cognitive codes between all genre pairs.[1] All distributional comparisons between genres were significantly different (all $ps \leq .002$).

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1. The nature of our data did not allow us to use parametric statistical analyses. In our consideration of nonparametric methods of data analysis, we struggled to find an appropriate analysis that would apply to our study. However, we did find that one test would work if we suspended

Table 2. Percentage of statement types for assigned genres (aggregate of all six teacher candidates)

Code	Hiding Out	PACT	M.Ed. Thesis	Engl. Ed Talk	Engl. Ed Forum
1	0%	0%	0%	0%	0%
2	0%	0%	0%	1%	0%
3	6%	0%	0%	2%	4%
4	8%	10%	2%	31%	19%
5	26%	49%	20%	32%	24%
6	20%	2%	9%	3%	6%
7	29%	27%	29%	8%	18%
8	1%	5%	6%	0%	1%
9	4%	3%	28%	3%	4%
0	6%	4%	6%	10%	24%
	n=423	n=2656	n=1563	n=317	n=411

For the Hiding-out paper, statements coded as level 7 represented 29% of all the statements, with level 5 following at 26% and 6 at 20%. Together levels 5, 6 and 7 accounted for 75% of the statements. During the same term, but in the other class, in discussions (Engl. Ed. Talk) level 4 and 5 statements predominated overwhelmingly at 31% and 32% respectively, as they did in the weekly forum comments (Engl. Ed. Forum) with 19% at level 4 and 26% at level 5. The students' PACT assignments the following term showed a great predominance of level 5 statements at 49%. The M.Ed. theses showed higher percentages of level 7, 8, and 9 statements than any other assignment or activity at 29%, 6%, and 28% respectively. Together levels 7, 8 and 9 comprised 63% of the statements in the coded segments of the M. Ed. papers

These differences follow directly the expectations of the genres associated with the major tasks. The hiding-out paper asked teacher candidates to gather specific evidence about students with difficulties and to interpret behavior. The PACT assignment specifically focused on the planning of classroom events and

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one conventional assumption (i.e., the assumption of independence). Two-sample Kolmogorov-Smirnov (KS) tests were conducted to test the equality of the distribution of cognitive codes between different pairs of assignments here, and between PACT and M.Ed. thesis components under findings 2 and 4. Due to the small sample size, we used individual statements in the writing samples as our unit of analysis. The statement codes were aggregated across students within each assignment. We were looking to see if the aggregated statements of a small number of subjects varied significantly across differing genres. Despite our violation of the assumption of independence, the KS test offered the most efficient way for us to determine if the distributions of student responses from one genre to another were non-random.

the reflective analysis of what actually happened, which elicited comments about how students and teachers were expected to act and actually reacted to the unfolding events of the lesson. The M.Ed. thesis, as a high level inquiry asking teacher candidates to understand their teaching experiences, called for statements making observations about reflective command of the environment.

There was no increase in higher level coded expressions over time as the initial paper due in November predominantly exhibited levels 5, 6, and 7, while the PACT due the following March overrepresented level 5, and the final M.Ed. project from July overrepresented levels 7, 8, and 9, leaving no simple time-related or developmental pattern (though we will discuss later more subtle indicators of development over the year.)

3.2 Structured sections correlated with thoughts expressed

Our second major finding further substantiates the linkage between genre and elicited thought, even within a single genre. Different sections within the PACT document have distinctive profiles, particularly visible on statements coded 5, 8, and 9. These results are shown in the shaded cells in Table 3. All distributional comparisons between components were significantly different ($ps \leq .008$) except for the comparison between Instruction and Assessment which only reached a marginal level of significance ($p = .10$).[2]

Table 3. Percentage of statement types by PACT section (aggregate of all six teacher candidates)

Code	Planning	Instruction	Assessment	Daily Reflection	Overall Reflection
1	0%	0%	0%	0%	0%
2	0%	0%	0%	0%	0%
3	1%	1%	0%	0%	0%
4	11%	13%	8%	10%	11%
5	40%	56%	71%	49%	22%
6	4%	1%	0%	1%	0%
7	26%	21%	17%	28%	29%
8	9%	3%	0%	4%	13%
9	3%	1%	0%	3%	23%
0	6%	4%	4%	5%	2%
	n=905	n=623	n=474	n=478	n=176

2. See footnote 1 above.

Similarly in the M.Ed. theses each section has its characteristic profile of statements, with a predominance of particular kinds of statement. The presentation and discussion of the artifacts have a stronger representation of level 5 statements, while reviews of the literature and the conclusions contain predominantly level 7 and 9 statements. These results are shown in shaded cells in Table 4. Two-sample Kolmogorov-Smirnov (KS) tests were conducted to test the equality of the distribution of cognitive codes between all M.Ed. component pairs.[3] All distributional comparisons between components were significantly different ($ps < .001$), except for the comparison between the Literature Review and the Conclusion which was marginally significant ($p = .05$).

Table 4. Percentage of statement types by M.Ed. Thesis section (aggregate of all six teacher candidates)

Code	First Artifact	Final Artifact	Review of Lit	Conclusion
1	0%	0%	0%	0%
2	0%	0%	0%	0%
3	1%	0%	0%	0%
4	6%	1%	3%	1%
5	46%	31%	6%	1%
6	2%	4%	4%	3%
7	17%	31%	32%	45%
8	2%	6%	6%	11%
9	16%	22%	44%	37%
0	10%	5%	5%	2%
	n=186	n=734	n=471	n=172

This finding of differentiation of cognitive profiles within structured parts of the assigned genre echoes the findings in Kelly and Bazerman (2003) and Kelly et al. (2010).

3.3 There was no statistically significant evidence of transfer across settings

No statistically significant quantitative patterns could be found indicating transfer from the hiding-out assignment to the activities in the separate English Education class although some qualitative examples of continuity of thinking between courses

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3. See footnote 1 above.

suggest the possibility of transfer. Establishing that possible transfer, however, would require a more focused and extensive study.

3.4 There were indications of cognitive development over time

The M.Ed. papers clearly show a higher proportion of code 9 statements along with codes 5 and 7, than the earlier major assignments. Because of the differing expectations of the different genres over the year, however, results indicating change over time must be viewed with caution. It is difficult to disentangle assignment effects from time effects. Further the intertextuality demanded within the final M.Ed. paper, where reference and citation is mingled with the writer's own thoughts seemed to elevate the thought expressed in the vicinity, as though the other texts were providing higher level ideas for the teacher candidates to discuss and apply to their materials.

Nonetheless we can make a few comments on development over time by examining two aspects of the data. First, while there are only a few comments coded as 1 or 2 (so few that in most assignments they show up as zero percent) — all clustered within the fall term. Code 3 statements decrease to only occasional appearance by the end of the fall term. In the hiding out papers a total of only 6% of comments were code 3 and 0% were 1 or 2. In the PACT assignments, no code 1 or 2 statements appeared and only a scattering of code 3 statements appeared that comprised less than 0.5 % of the total. The few statements coded 1, 2, or 3 appearing in the M.Ed. theses (totaling less than 0.5%) concerned other teachers' stances and about the issue of responsibility (see qualitative discussion in finding 3.5). So all three of these more static views of students and classrooms extinguish as students move through the winter and spring.
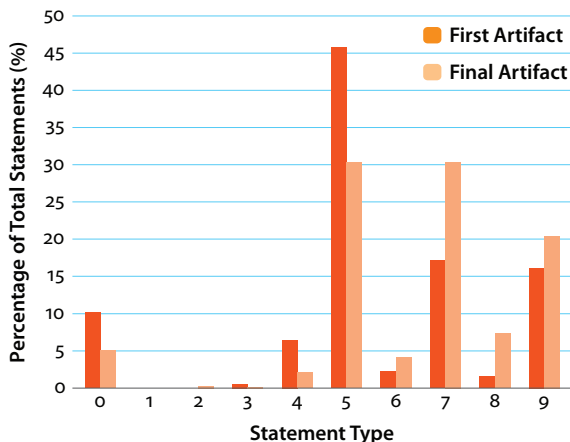

Figure 2. Statement types in first and final artifacts in M.Ed. thesis

Second, within the M.Ed thesis-writing process we can tentatively track development over time, as the artifacts were initially written up at different times. As shown in Table 4 and Figure 2, when we compare the first artifact presentation (first drafted in January) and the last (first drafted in May), we see striking differences in the profile with substantial increases of higher level code 7, 8, and 9 statements. The result of a two-sample KS test indicated that the distribution of cognitive codes between the first and final artifact was significantly different ($D = .19$, $p < .001$).[4]

3.5 Patterns of development varied with individuals, but all teacher candidates showed change over time

When we examine individual cases, interesting patterns emerge that suggest some of the complexities and individuality of development. While three candidates seem to present clear cases of our developmental model, three others follow more individualized paths that reflect the particulars of their situations, but which nonetheless fit the model we present. We provide below both quantitative and qualitative analyses of their individual progress.

Three teacher candidates demonstrated an increasing ability to add higher coded comments to their discussions beginning in the fall term and continuing through the year. Amanda (psuedonyms used), for example, four weeks into the fall term in class discussion addresses a student's general lack of responsibility in the categorical terms of an educational imperative (code 3):

> …here in college even if students aren't reading they know that they should be. I feel like in high school to have those conversations where they didn't have to read in order to contribute in class, well they would [still] have excuses for [not contributing]…

But in the hiding-out paper later that term, Amanda's statements about a student's limited participation indicated she was looking more deeply into what was behind the behavior:

> Ruben didn't complain when I asked more questions than were written on the double-sided prompt, and he showed me in a new setting how sweet a boy he is. I learned about another side to Ruben's story by reading his cumulative file, though. Ruben has been in special education since he was in second grade, and severely struggles with words — in both spelling and comprehension. His mother left when he was quite young. Seeing that Ruben had so much to struggle with behind his subtle smiles and calm temperament was really helpful and eye-opening. I watched how I phrased things with Ruben, and understood better the struggle he has been facing his whole life.

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4. See footnote 1 above.

By the time of her M.Ed. thesis Amanda regularly comments on how students are making sense of school tasks and relating that to their total learning, as in this level 8 comment:

> I believe that the student who felt this assignment was going to be difficult thought that it would be difficult because finding school out in the world is something foreign to him. I think being able to see school out in the everyday is a skill that needs to be honed in high school as it is not always as explicitly relevant as learning in elementary school.

After an extended discussion of how students are able to address assignments, she comes to reflective conclusions about her own choices and how she might change her actions, thereby taking more command over the learning situation, in a code 9 statement:

> While analyzing Mike's responses to the project, I realized I had to confront my own motivations. *Is one of my goals to turn around views like this — that say school is unimportant? …* In the future I would like to explore the claim that if students are able to see that school is used out in the world more often and in more ways than they are used to accepting, that the value of school will increase in their eyes.

Another teacher candidate, Celia, however showed a more complex and problematic growth in thinking. She rarely spoke in class and her few comments tended to be about students' responsibility independent of any circumstances affecting student participation (code 3); for example, "My class was supposed to turn in an essay today and four of the twenty-four students turned it in." Nonetheless, her forum comments began to start moving from predominantly code 5 to a few at code 6 and 7 at the time of the hiding out paper submission and her hiding-out paper did have an almost equal mix of statements coded 5, 6, or 7. For example, she showed awareness of her student's shyness and fear of public speaking, qualities that she discovered through an interview with her student (code 7):

> …I knew that I had to adapt my own teaching to let her earn some participation points. Yet this had to be done in a sensitive manner that still allowed room for [student]'s affective filter to not become endangered.

But by midyear her personal journals revealed that she was feeling overwhelmed in the classroom and was happy just in maintaining control, for example:

> Today's class felt very rushed; I tried to do too many things in one period, especially since classes were shorter (only 43 minutes long). The partners list that I printed out for students to use when I asked them to "talk to someone next to them" worked very well since it gave them no excuse to talk with someone besides their partners.

She stopped posting to the classroom forum and the comments on her PACT assignment showed little growth. She also had difficulty in completing her M.Ed. thesis, requiring three rounds of revision. Only with some difficulty and some delay after the regular end of the program was she able to produce a thesis that met the analytical expectations of the program. Celia's difficulties in coming to a more analytical perspective may be related to her being overwhelmed by classroom events, hindering her from developing sufficent perspective on events to do more than report them.

Celia's case provides some evidence that while genre provides an opportunity space for thought, until the writer brings appropriate perspectives to the space, the text does not fulfill the genre. Only with the scaffolding provided by the reviewers' revision comments could Celia come to articulate the kinds of thoughts expected in the genre. For her the expected cognitive developments did not come easily or fully, but yet the genre and associated expectations kept the task in front of her to lead her development.

The two students who began with higher-order coded statements also showed interesting patterns of growth. Deanna in particular showed ability to produce statements of the highest code from early in the program, and that continued throughout. From the beginning of the class her discussion and forum comments included a mixture of code 6, 7 and 9 statements along with code 4 and 5 statements. In the hiding-out paper, while code 6 and 7 statements predominated her highest level comments were brief and tended to be quoted. Thus she connected her code 5 observation in one sentence to a code 9 characterization based on a reading in the next.

For each slide she had done in great detail the first several steps, which asked her to display knowledge, but had not proceeded to the referential questions. This combined with her reluctance to speak in class, suggested that she might be self conscious about her own lack of literacy skills, and might avoid ridicule by not participating in the classroom, a defensive practice described in Brozo's article (Brozo 1990: 324).

In the M.Ed. paper, however, Deanna sustained long statements at levels 7, 8, and 9, without returning to levels 4 and 5 as she did in earlier papers. She interacted with her citations relying on them to raise the level of her thought, as in the following passage:

> In Torrance and Pryor's (2001) action research of such formative assessments, they found that before teachers received instruction in using these assessments to assess learning, they tended to focus on assessing behavioral and management objectives. During the lesson I videotaped for my chapter three, I was aware of the possibility that I would focus primarily on such objectives, but was pre-planning other kinds of formative assessments to try to prevent this. I was hoping to use

my assessments to make my expectations about student work visible, in particular with reference to correcting task and quality criteria.

4.   Conclusions

An underlying methodological contention of this study is that the prior limitation on findings concerning writing to learn, discussed at the beginning of this article, have been due to the inability to capture the kinds of advanced cognitive growth associated with writing; further, such advanced cognitive growth is best captured through situated studies that measure activity-specific forms of cognition. This study and its companion Bazerman, Simon and Pieng (2014) demonstrate the possibility of developing task-specific measures of cognitive growth within ethnographically grounded research. This has allowed us to confirm with quantitative evidence longstanding beliefs about the value of writing.

Findings 1 and 2 provide strong evidence that genres and structured parts of genres can direct the kind of thoughts expressed by students. The assignment of particular genres, in the appropriate motivating and supportive situation, can lead students to produce particular kinds of expressed thoughts in addressing the intellectual challenges of the genre. In this case, genres provided opportunities for the teacher candidates to learn to think of classroom interactions and children's learning in interactive rather than monocausal terms. Finding 3 leaves open the question of transfer of these modes of thoughts to other related settings. Finding 4 provides some evidence of development of cognition over time for the writers, though the differences in demands of the assignments and situations make disambiguation of effects more difficult. Finding 5 provides an indication in individual cases of development over time, but with time lags and punctuated moments of reorganization. Teacher candidates' learning and development had potentially multiple interlocking sources. Writing in the assigned genres became meaningful and effective tools of cognitive growth because they matched motives, activities, social organization of the program, the many hours of challenging experience in the classroom, as well as the career trajectory of the students. Nonetheless, in the context of these other variables, this study provides strong evidence that the genres did provide occasions for the teacher candidates to crystallize their thinking about classroom interactions and student learning.

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