

# Making the Invisible of Learning Visible: Pre-service Teachers Identify Connections between the Use of Literacy Strategies and their Content Area Assessment Practices

Jennifer Mitton-Kukner, Anne Murray Orr

St. Francis Xavier University

*In this paper we discuss secondary pre-service teachers' developing assessment practices during field experience, after taking a content area literacy course. This paper arises from a longitudinal study exploring pre-service and beginning content area teachers' use of literacy strategies in teaching mathematics, science, and other content areas. Pre-service teachers' descriptions of their teaching revealed how they understood assessment and literacy practices during field experience as intertwined and symbiotic. Pre-service teachers discussed the use of literacy strategies as multi-faceted and serving multiple assessment purposes in their classrooms, enabling them to better understand student learning by making the invisible processes of thinking visible.*

*Dans cet article, nous décrivons quatre façons dont les enseignants en formation semblaient développer des pratiques d'évaluation pendant une expérience sur le terrain et après avoir suivi un cours en alphabétisation aux contenus adaptés. Les résultats découlent d'une étude pluriannuelle portant sur l'emploi de stratégies en alphabétisation par des enseignants en formation et des enseignants débutants offrant des cours de maths, de sciences et d'autres disciplines. Les descriptions par les enseignants en formation de leur enseignement ont révélé que pendant l'expérience sur le terrain, ils ont compris le lien serré et symbiotique entre l'évaluation et les pratiques en alphabétisation. Les enseignants en formation ont également décrit leurs stratégies en matière d'alphabétisation comme étant multidimensionnelles et aptes à satisfaire à plusieurs objectifs d'évaluation dans leurs classes, ce qui rendait visibles les processus invisibles de réflexion et leur permettait ainsi de mieux comprendre l'apprentissage par leurs élèves.*

I found [literacy strategies] gave me the ability to gauge where the students are, especially with the entrance and exit slips and the reflections, cause then, based on what they say or if they are able to answer a particular question, I can see if they're confused, or if they're getting it, or if they choose to ask me a question. . . . And if it's just one student in particular then I can talk to them independently, but if I see a pattern then I can address the problem as a class...If I did find that they were having difficulty, I may not be able to proceed with the next lesson as I had planned, I might have to backtrack and address certain issues. So, I found on a day-to-day basis I could be influenced . . . depending on what they had said. Just from circulating and seeing, observing what they were doing, kind of gave me an idea of what I need to spend more time on. (Pre-service science and physical education teacher Mary<sup>1</sup>, May 1, 2013).

In the transcript excerpt above, a pre-service teacher, Mary, described the connections she saw between her knowledge of literacy practices and how these informed her daily and long term planning of a grade 9 science class. Mary's response reflected how she viewed her capacity to infuse her content area teaching practices with literacy strategies and, in turn, how the use of these strategies allowed her to gauge student learning of content, to modify her instructional practices, and to provide purposeful feedback. Mary's description shows her understanding of the multi-faceted nature of classroom assessment (Earl, 2013; Chappuis, 2009) and how she uses it to inform her knowledge of student learning. In this paper we discuss the emergence of pre-service teachers' (PSTs') developing assessment practices through the lens of a content area literacy course, as part of our longitudinal study exploring pre-service and beginning content area teachers' literacy practices.

### **Classroom Assessment: Multiple Purposes, Formats and Audiences**

Classroom assessment practices across Canada, and the world, are changing and reflect a fundamental shift in thinking about assessment "from a culture of testing to a culture of learning" (Poht, 2013, p. 634). Several reasons contribute to thinking about assessment as a pedagogical tool for improving student learning. Research has demonstrated the connections amongst ongoing assessment, instructional practices, and student learning (Black & Wiliam, 1998; Wiliam, Lee, Harrison, & Black, 2004) and changes in technology and its influence upon careers and society have informed the revisions of knowledge, skills, and assessment of K-12 curriculum (Moje, 2000; Prensky, 2010; Roscoe, 2013). Assessment policies across Canada, as well, reflect these new understandings about assessment and are placing a growing emphasis on ongoing assessment as a tool to promote student learning through how it may inform teachers' instructional practices and students' learning awareness (Alberta Assessment Consortium, 2012; Kids & Learning First, 2012; Manitoba Education, Citizenship & Youth, 2006). Changes in understanding about classroom assessment have also occurred in an era of increasing large-scale assessment in Canada (Duncan & Noonan, 2007; Volante & Fazio, 2007), and while such methods are potentially problematic for vulnerable groups of students (i.e. English language learners; Cheng, Klinger, & Zheng, 2009), they have become an established method to evaluate student achievement of learning outcomes in Canadian public education (Erickcan & Barclay-McKeown, 2007; Klinger, Deluca, & Miller, 2008).

Situated within the multiple demands described above, classroom assessment is a complex undertaking for teachers as it is informed by multiple purposes and needs to be communicated to different audiences. Earl (2013) explains that no one activity may be used to characterize classroom assessment, as it incorporates "a constellation of purposes, formats, and audiences", and which includes "providing feedback to students, offering diagnostic information for the teacher to use, providing summary information for recordkeeping, proffering evidence for reports, and directing efforts at curriculum and instructional adaptations" (p. 2-3). Earl, and others (Volante & Beckett, 2011; Volante, 2010), emphasize that because of its multi-purpose nature, classroom assessment has inherent tensions as its purposes may support, compete, and conflict with one another.

To clearly differentiate the purposes of assessment scholars acknowledge formative assessment (also known as assessment *for* learning), as ongoing assessment during a unit of study in which monitoring of student learning is used by teachers to modify instruction or by students to adjust learning methods (Popham, 2011), and summative assessment (also known as

assessment of learning), as evaluative assessment at the end of a unit of study to document student learning, usually taking the form of final tests, papers, and projects, which are used to formally communicate student progress to parents, students, and others (Chappuis, 2009). It is not the task type that categorizes an assessment as summative or formative, it is the purpose informing the use of the task that makes this specification (Manitoba Education, Citizenship & Youth, 2006). Although the research shows the strong connection between the use of formative assessment practices and student learning and that teachers are becoming more familiar with a wide range of assessment practices (Volante & Beckett, 2011) while involved in targeted professional development (Wilson, 2008, Gunn & Hollingsworth, 2013), scholars also acknowledge the tendency of teachers to rely upon summative assessment practices (Duncan & Noonan, 2007; Remasal, 2011; Smith, 2011; Stiggins, 2002; Volante, 2010). This brings sharply into focus the importance of teacher education in terms of what it may do in developing and preparing pre-service teachers (PSTs) for assessment roles and responsibilities (Mertler, 2009; Poth, 2013).

### **Pre-service Teacher Education and Classroom Assessment: Gaps and Emphases**

Popham (2009) suggests that the wide knowledge gap for many experienced teachers regarding assessment is due to the lack of education they received about educational assessment during their teacher education programs. Popham advocates for ongoing professional development assessment activities that target teachers. He emphasizes that this is a need for teachers in schools “until pre-service teacher educators routinely provide meaningful assessment literacy for prospective teachers” (p. 11). Studies have found that assessment courses offered to PSTs made little impact upon their knowledge and practices (Darling-Hammond & Bransford, 2005; Mertler, 2009) with PSTs depicted as mainly unaware of assessment principles that align with sound instructional and assessment practices (Campbell & Evans, 2000; Graham, 2005, Volante & Fazio, 2007; Wang, Kao, & Lin, 2010).

In Canada there is growing emphasis on the offering of assessment courses to PSTs. Poth (2013), in the examination of 57 course syllabi of assessment-related courses from teacher education programs in western Canada, found that while assessment was described as a purpose for supporting student learning there was little recognition that assessment could be used to enhance instruction and emphasis was placed upon the development of summative assessments. Poth’s work brings into focus possible reasons as to why PSTs feel unprepared to assess student learning (Mertler, 2009; Volante & Fazio, 2007) in relation to their multiple concerns about assessment (Simon, Chitpin, & Yahya, 2010). For example, an earlier study, Volante and Fazio (2007), found little evidence to support the idea that PSTs understood formative and metacognitive purposes of assessment despite having taken an assessment course. They seemed “predisposed to rely on traditional approaches they had likely been exposed to as students themselves” (Volante & Fazio, 2007, p. 761). While there is growing emphasis on the importance of teacher educators modeling effective assessment practices (formative and summative) as part of pre-service teacher education (Goos & Moni, 2011; Frank & Barzilai, 2004; Roscoe, 2013), few studies demonstrate the impact of these practices upon PSTs’ assessment knowledge and practices during teaching practicums and their early years of teaching.

**Pre-service teachers, content area literacy and classroom assessment.** Literacy for many today refers not only to the ability to read and write, but also to a combination of values and abilities to understand, think critically about, engage with, and improve society

(Kane, 2011; Lind, 2008; Government of Alberta, 2009). This expanded understanding of literacy requires teachers to rethink their approach to literacy instruction in schools (Au, 1998; Barr, Watts-Taffe, & Yokota, 2000; Beers, 2003; Gee, 2008; Lankshear & Knobel, 2003; New London Group, 1996; Robertson & Hughes, 2011), and requires teacher education programs to reconsider their approach to literacy instruction in the content areas. Teacher education programs are often thought to prepare new teachers poorly to integrate literacy into content areas (Cantrell & Callaway, 2008). A number of studies have explored PSTs' learning after taking a course in content area literacy as part of their program (See Daisey, 2012; Moore, 2003; Sheridan-Thomas, 2006; Bruinsma, 2006). This body of research has demonstrated how content area literacy courses are critical in expanding PSTs' understanding of literacy (Alvermann, Rezak, Mallozzi, Boatright, & Jackson, 2011; Begoray, 2002; Estrada & Grady, 2011; Freedman & Carver, 2007). Yet, no research could be found that inquired specifically into PSTs' understandings of assessment after taking such a course. As we analyzed data from the second year of our study, it seemed a number of the PSTs we interviewed and observed in their field experiences saw connections between assessment and the literacy practices that they had begun to integrate into their content area courses in secondary schools.

### **Theoretical Framework: Connecting Assessment and Literacy Practices through the Concept of Pedagogical Content Knowledge**

Common to both formative and summative assessment terminology are the terms assessment *for* learning, assessment *as* learning, and assessment *of* learning (Earl, 2013). In these instances, the prepositions *for* and *as* indicate assessment for formative purposes whereas the preposition *of* is used to indicate assessment for summative purposes. While assessments *for* and *as* learning are understood as formative approaches to assessment, according to Earl (2013) they also indicate the different roles of teachers and students. Earl explains that:

[In] Assessment *for* Learning . . . [teachers] use their personal knowledge of the students and their understanding of the context of the assessment and the curriculum targets to identify particular learning needs. Assessment *for* learning happens in the middle of learning, often more than once, not at the end. It is interactive, with teachers providing assistance as part of the assessment. It helps teachers provide the feedback to scaffold next steps. And it depends on teachers' diagnostic skills to make it work. (p. 27). Assessment *as* Learning focuses on the role of the student as the critical connector between assessment and their learning. Students, acting as critical thinkers, make sense of information, relate it to prior knowledge, and use it to construct new learning. This is the regulatory process in metacognition. It occurs when students personally monitor what they are learning and use the feedback from this monitoring to make adjustments, adaptations, and even major changes in what they understand. (p. 28).

Earl's conceptualization of classroom assessment as composed of three distinct purposes enabled us to understand how the PSTs in our study were making use of literacy strategies to create opportunities for students to interact with content and to inform their understanding of student learning with particular emphasis on formative assessment (assessment *for* and *as* learning) practices. As well, participants' abilities to describe how the use of literacy strategies helped their students become more adept at thinking and practicing the skills that were particular to a content area provided us with evidence of their evolving pedagogical content knowledge (Shulman, 1986).

Shulman (1986) describes pedagogical content knowledge (PCK) as one of three kinds of knowledge teachers possess, alongside content knowledge and curriculum knowledge. PCK is explained by Shulman as an awareness of which forms of representation are most relevant for the teaching and learning of topics in a subject area, something we see as associated with literacy in a content area. Although Shulman does not discuss assessment directly, he asks, “How do teachers decide...how to question students about [the topics being taught] and how . . . [do they] deal with problems of misunderstanding?” (p. 8). The PSTs we interviewed provided evidence of the relatively high-level thinking they were doing about how best to “question students” about their learning, using a variety of literacy practices and moving away from an over-reliance on tests at the end of a unit of study. They also described being able to address “problems of misunderstanding” that became apparent to them through the formative assessment data they collected through literacy strategies such as mapping, drawing, or double entry journals. These practices suggest that these PSTs’ comments reflect a growing PCK as they integrate literacy practices into their teaching and, importantly, into their assessment practices. After Year 1 of our longitudinal study we noted:

. . . participants’ awareness of how literacy can contribute to authentic assessment in mathematics and science. This was perhaps one of the most surprising findings. We did not expect these new teachers to have such relatively sophisticated conceptions of assessment, as some of them demonstrated their understanding of the need for students to be able to represent their learning in a variety of ways and to be self-assessors at the same time, metacognitively considering their own learning practices. (Murray Orr, Mitton-Kukner & Timmons, 2014).

In our current analysis of the Year 2 data, we develop this finding more fully, showing in detail how PSTs understood assessment and literacy practices in their classrooms during field experience as intertwined and symbiotic. This paper describes our further learning about this topic.

## **Methods**

As instructors of a course called *Literacy in the Content Areas* in a teacher education program at a small Canadian university, we observed how this course, positioned in the final term of a two-year B Ed program, seemed to invite PSTs in math, science, social studies, and other secondary teaching areas to infuse literacy practices learned in the course into their final field experience. Goals of this course include developing PSTs’ capacity to construct an instructional environment that enhances understanding of content learning through explicit use of comprehension, vocabulary, fluency, writing, and other strategies that enable students to engage with and understand different kinds of texts connected to course content; deeper understanding of the reading process to boost learning, and knowledge of the interaction between reading, writing, listening, speaking, viewing, and other ways of representing particular to content areas. Students are introduced to and engage with writing to learn and public writing<sup>2</sup> (Daniels, Zemelman, & Steineke, 2007) strategies. As part of working towards these outcomes PSTs are asked to demonstrate active engagement and commitment to professionalism through participation in in-class activities, making ongoing connections between course texts as well as relevant teaching practices and school context.

Anecdotal comments from PSTs led us to begin an inquiry in 2012 into how PSTs were

taking up the ideas of this course and applying them to their teaching. 2014 is the third year of our longitudinal study into the evolving PCK of secondary PSTs as they begin to infuse their content area teaching with literacy strategies. We are currently interviewing and observing PSTs during their field experience for the 2014 data set. This paper draws on data from the second year of the study, 2013.

In March and April 2013, we interviewed 16 PSTs whom we had taught in the *Literacy in the Content Areas* course in the winter of 2013, and observed nine of them for one lesson each during their final spring field experience. The participants were all secondary PSTs, who were certified by the province to teach mathematics, science, social studies, or other content area subjects, after their completion of a final field experience in May 2013. The students had completed the course and grades were submitted before conducting any interviews or observations. Some interviews were face-to-face and others were by phone or Skype. The interviews were semi-structured, approximately 30 minutes in length, and were transcribed by a research assistant. We also asked participants if we could observe one of the lessons they taught during their field experience in April 2013, to observe how they incorporated literacy into their teaching. The first author visited five PSTs' classrooms while the second author visited four, and each of us took field notes as we observed.

In our analysis of the interview transcripts and field notes from the interviews and the observations, we read and re-read the data (Creswell, 2007; Merriam, 2009), noting themes we saw emerging. After identifying approximately ten potential themes individually, we met to discuss these themes, narrowing them down to six themes for which evidence recurred repeatedly. We have written elsewhere (Mitton-Kukner & Murray Orr, in press) about these themes or findings, which enabled us to begin to tease out tangible indicators of PSTs' growth in PCK alongside their increasing facility in infusing their teaching with literacy strategies. One of the findings identified PSTs who were able to make explicit connections between curriculum outcomes, assessment, and literacy strategies. These PSTs appeared to be more likely to integrate literacy strategies into their teaching. In delving further into this finding, we realized PSTs were voicing compelling ideas around assessment. This paper focuses on those ideas in the following section.

**Findings: Literacy as assessment; Making the invisible of thinking and learning visible.** PSTs who spoke of literacy as an ongoing part of their teaching practices were able to discuss how they understood the use of literacy strategies as multi-faceted, serving multiple assessment purposes in their classrooms. Participants discussed assessment connections with detail and clarity and suggested that the use of literacy strategies, particularly writing to learn activities (Daniels et al., 2007), enabled them to better understand student learning by making the invisible processes of student thinking visible. For example, Andrea, a math and science pre-service teacher, described literacy strategies as catalysts for student conversations and informative for her own understanding of student progress:

I found that these literacy tools helped me get those conversations going or get an activity going so I could observe something, like if they're just sitting there on their own doing their own work it's hard, it's hard to observe and listen because there's not much going on externally, it's all pretty internal at that point. (Pre-service math and science teacher Andrea May 2, 2013).

This emphasis on how a literacy-based activity in math enabled Andrea to better understand student thinking was mentioned by several participants who identified deep connections

between literacy strategies and observing ongoing student learning. Participants also spoke of how they used literacy strategies for diagnostic purposes at the outset of a new unit. For example, Elizabeth, a science and physical education PST spoke of how using an exit slip provided a two-fold assessment opportunity: to establish what students already knew and to target outcomes that are unique to the province's physical education curriculum and its overall emphasis on knowing, doing, and valuing:

In phys. ed. I noticed that these strategies were kind of helpful in terms of assessment, and getting baseline ideas of...what students' understandings are of the physical skills that we're going to be doing or the sports that we might be playing. And then I also found that it was really helpful in terms of getting information on the curriculum outcomes...I did a unit on cooperation and I . . . had students complete an exit slip on...how they felt they added to group work or how they felt they were a team player and what not. And I think, from an assessment standpoint that allowed me to target curriculum outcomes and feelings. (Pre-service science and physical education teacher Elizabeth, Interview April 29, 2013).

Elizabeth's ability to talk fluidly about the many purposes that literacy strategies served in her teaching suggests her knowledge of how to infuse literacy supported the pedagogical decisions she made, helping her to plan and target aspects that were specific and relevant to the content area she was teaching.

**Literacy as creating opportunities for metacognition: Processing information and making connections.** The ability to think of literacy infusion as supporting the teaching and assessment of curriculum outcomes was noted as a commonality amongst the participants who saw literacy strategies as creating opportunities for students to better process information and make connections. This group of PSTs seemed to understand that literacy was not only about thinking, but was also about thinking that was particular to specific content areas and the ways literacy strategies helped them to better assess student learning. For example, a pre-service science and physical education teacher, Mary, described using a mapping strategy as part of a grade 9 science unit to help students make connections over time:

We were doing sexual reproduction and we had covered various topics under that scope so I wanted them to be able to see how everything was linked [using a mind map] because we looked at it at the cellular level and then with animals and plants. So, I wanted them to see that although there are separate things about each, they're all interconnected, so I wanted to see . . . how they would make those connections and there was a couple of different ways that they approached it, but all of them were correct, so it was neat to see, how they made those connections and what they related...and how they worded things and the little drawings they found helpful to connect with the material. (Pre-service science and physical education teacher Mary, Interview May 1, 2013).

In this excerpt Mary emphasizes the creative ways students showed their understanding of the content as they developed mind maps that were unique and perhaps representative of how they processed information. As part of this unit, Mary also spoke of how the use of literacy strategies helped her better understand where students were experiencing misconceptions, which directly impacted her daily planning:

I found on a day-to-day basis I could be influenced by my [students'] exit or entrance slips depending on what they had said. And even the mind map, I would kind of circulate as they were doing it...there

were certain topics that...jumped out...but then there were things that I noticed were missing, so, in the next class I...went over that and reminded them of certain things we had covered, ask[ed] them questions to see if they didn't understand or had they just forgotten because it seemed unimportant to them. So, just from circulating and seeing, observing what they were doing, kind of gave me an idea of what I need to spend more time on...even if it is just a little writing break, you get them to sit, think and see "what do I really think about this?" and elaborate on it and then we can go from there to kind of prepare them for assessment pieces. Cause if they're able to dig deeper and think critically, then chances are they're going to do better when it comes to the summative assessments. (Pre-service science and physical education teacher Mary, Interview May 1, 2013).

Mary's ability to speak with clarity about assessment as part of her ongoing planning is a sound example of how she used literacy strategies for assessment for learning purposes. Mary indicated that the better she understood student learning as it was happening, the more likely they would be successful on later summative assessments. This emphasis on the connections between the use of literacy strategies and planning were also evident in other participants' accounts of their teaching.

Brenda, a science and English language arts teacher PST, described the development of her own thinking about planning and assessment in response to the *Literacy in the Content Areas* course:

I would say it's definitely changed a bit from last year because now I'm taking the time to insert those assessment for learning strategies...for example...I'm doing kind of a lecture style, say we're learning a new topic in science and it's a lecture style, I will make sure that I take time to stop and get them to do a quick write or do a reflective write or a write around...just to make sure...that they can absorb what we've just talked about...In terms of long term planning I recognize how to differentiate assessment more so, like, using the brochures instead of a test. Using a newspaper front page instead of a test...I...use them more now than...before content lit [the course] because now I know how to actually create differentiated assessment, like brochures and whatnot and make it useful. So, I know how to create a rubric and give it to them so that I know they'll actually be showing their learning. (Pre-service science and English language arts teacher Brenda May 7, 2013).

We note with interest how Brenda uses the concept assessment *for* learning (Earl, 2013) interchangeably with her understanding of how to infuse literacy strategies as well as the emphasis that she placed upon literacy strategies as possible ways to differentiate summative assessments. This depth of understanding was not singular to Brenda and was also evident in other participants' descriptions of the connections they made between infusing literacy and informally assessing student learning, causing us to consider that perhaps these PSTs' knowledge of literacy strategies was providing them with a different language through which to conceptualize learning.

**Literacy as creating opportunities for student preparation for summative assessments.** Many participants used literacy strategies as part of their practices to prepare students for summative assessments. They credited the use of such approaches as better preparing students for end of unit tests. For example, Andrea, a math and science PST described her use of a concept map as an ongoing part of a grade nine math unit:

After we would finish, [we would] try to add that piece into our concept map and talk about the connections that we've already talked about...that sort of thing helped them [students]...organize their



ideas and they could also use it as a tool to study for the quizzes, their tests, or their exam at the end of the year...they all had the information in one spot. (Pre-service math and science pre-service teacher Andrea, May 2, 2013).

In Andrea's description of how she used a concept map as part of her grade nine math curriculum, we noted how she made pragmatic sense of how a literacy tool like a concept map could have a dual assessment purpose: Providing regular opportunities for students to make connections while also preparing them for upcoming summative assessments like quizzes or major unit tests. In addition to this, we also found that some participants saw the success of their students on end of unit tests as evidence that the literacy strategies they used were helpful:

I feel [in] my grade 11 History class, they really came a long way in the short amount of time that I had with them and I do credit a lot of their development with me to the writing activities that we did. And I do think that everything that we did throughout the whole semester really helped for the final test . . . [it had] quite a lot of short and medium length essay questions. (Pre-service social studies and math pre-service teacher Don, April 29, 2013).

While participants placed positive emphasis on the use of literacy strategies with regards to summative assessment, a few participants also demonstrated their growing understanding of how a student's lack of literacy skills may also interfere with their ability to perform in a testing situation. Linda, a science and art PST, described her growing awareness of this in relation to a recent experience she had during her practicum:

It upsets me when I see students not performing well, when I know that they're trying hard, and it's a language thing, like writing for example. Today I forgot, actually, to make an [adapted] version of a test, so today I was frantically trying to cut down on the words and make questions more direct with less choices, but, I mean . . . it's language. My cooperating teacher said that this student . . . asked him what the word "absorb," meant . . . four questions relied on that word! So if you didn't understand it, you got all four wrong and he did get all four wrong . . . I feel like, he had the concept . . . but it was a terminology thing . . . (Pre-service science and art pre-service teacher Linda, April 24, 2013).

In this example, it seems that Linda was very aware of her role in the creation of a testing situation in which the student was unable to demonstrate his understanding of content. Linda in this instance seems to recognize the importance of vocabulary teaching as a needed element in her pedagogical practices. Many of the participants, particularly those who demonstrated understanding of how to infuse literacy into the teaching of their content areas, were able to describe the pragmatic connections between the use of literacy strategies as better preparing students for summative assessments. Their ability to do so and the success they experienced in response to their use of such strategies bodes well for the potential that they might continue to infuse literacy into the teaching of their content areas. We also noted the growth of some participants' understanding of how a lack of literacy may interfere with a student's ability to demonstrate learning and see this as possible motivation for their continued use of literacy strategies in their teaching.

**Literacy as creating alternative assessment opportunities.** Many participants used literacy strategies as part of their practices to prepare students for traditional summative assessments such as end of unit tests. In addition to these approaches, we also noted the different assessment opportunities that participants described in relation to literacy strategies.

For example, Byron, a math and science PST, talked about the inclusion of a written component on a math test, which allowed him to have better insight into what students knew about the process rather than relying solely on the answer:

It was just a very simple question, like, to start off the test, and just explain why that's your answer...two or three words explaining why. A lot of them . . . just sketch[ed] the rule down . . . but then I knew that they knew they understood what they were doing . . . So that was really useful marking because, sure they got the right answer, but then I could go into if they didn't get it, but had the right idea, then I could give them some points. (Pre-service math and science teacher Byron, April 24, 2013).

Adding a question that allowed students to show their understanding of the problem in a different way not only provided Byron with new insights into student learning but also enabled him to acknowledge their understanding as part of points awarded for this question. Sandra, a social studies and physical education PST, described differentiating test questions using literacy strategies. In the following, Sandra discusses the use of drawing as a response on a social studies test and the ways that students responded to her request:

[On] one of my tests this year, like the last question, there was...five short answer questions...that was out of ten . . . the [very] last question was out of five and I asked them to draw for me and . . . they had a choice. It was either the Aztec hierarchy or the school system in Spain . . . and some of them put up their hands during the test and [they] were like, "You want me to draw?" and I was like, "Yeah, draw it out for me." And then they had to just put five bullet points about what they drew. Some of [the students] were so confused. They were like, "I'm drawing on a test." I was like, " Yeah, try it out. See what you can do." And the picture wasn't really worth all that much. It was obviously the bullet points that were, but it was just neat to see the ways some of them portrayed what they thought. (Pre-service social studies and physical education teacher Sandra, July 31, 2013).

In this example, we note Sandra's awareness that the drawings composed by the students were not the key piece that she was assessing; the way that students explained their drawings was her assessment focus. Sandra also drew our attention to how students responded to this kind of question and suggests that for many of them drawing on a test was not the kind of test item to which they were accustomed. In addition to PST developing creative test questions and end of unit assessment tasks such as the brochure or newspaper front page depicted earlier by Brenda, Lana, a science and family studies PST, also spoke of her use of a rubric as serving as a metacognitive self-assessment tool. Lana described the rubric as allowing her to better understand how students "were feeling about the material" and if they "needed a bit of help...and more practice with these strategies or...this section of our unit." Lana suggested that the rubric served as "a type of literacy strategy . . . as they're looking at it, they're thinking about it and then expressing how they feel" (Pre-service science and family studies teacher Lana, May 3, 2013). Participants' ability to creatively use literacy strategies in their teaching in ways that targeted the assessment of outcomes suggested for us a deeper understanding on their part about assessment and how to create better opportunities for students to demonstrate what and how they are learning.

**Challenges using literacy strategies for assessment purposes.** Although participants acknowledged that literacy strategies played an important assessment role in their classrooms, they also experienced tensions, particularly in the ways literacy strategies

intersected with principles of sound assessment. For example, thinking of writing to learn strategies (Daniels et al., 2007) in an assessment for learning way placed emphasis on the importance of PSTs providing descriptive feedback to students. The challenge for some participants was providing support for individual student needs in addition to the amount of written descriptive feedback that they felt required to provide. Andrea, a math and science PST noted this challenge in her practicum:

To get everybody sort of doing these strategies and getting the support that they need to do these strategies was a bit of a challenge and then I found trying to give them feedback, like if they did hand something in for me to read, to give feedback on that many...like 130 students' worth of work, I found that a challenge. Like there [were] a lot of nights I had a lot of stuff to go through... (Pre-service math and science teacher, Andrea, May 2, 2013).

Andrea's emphasis on the amount of student work that was handed in and her worries about how to adequately respond in ways that were helpful to each student indicates a valid point, but perhaps also addresses some of her inexperience at this stage of her teaching in how she might have better paced the amount of work to be handed in from each class. That being said, we acknowledge the importance of her concern, as potentially it may become a deterrent to her use of literacy strategies, especially if she continues to see the need for all informal class work to be assessed and responded to.

Some participants, such as Linda, told of how they noticed vocabulary issues could interfere with students' achievement on summative assessments. They recognized that not knowing the meaning of a word could cause students' results to be an inaccurate reflection of their learning. This challenge illustrated an awareness of the limitations of using just one snapshot of student learning, like an end-of-unit test. Linda described this moment as "upset[ing] . . . when I see students not performing well when I know that they're trying hard and it's a language thing (Pre-service science and art teacher, Linda, April 24, 2013). Linda described feeling "upset" when she observed language as an obstacle in the path of a student's success in writing a test. She believed the student "had the concept" but that because he did not understand what the word "absorb," he was not able to demonstrate his knowledge on the test. Although Linda did not explain what she might do differently next time, her ability to articulate this issue suggests she may take action to try to avoid such an experience for her students in future.

Also creating assessment challenges for participants in their use of literacy strategies were their perceptions of students' literacy skills. Don, a social studies and music PST noted that he wanted students "to be really strong writers" and attempted to not "penalize them for grammatical errors" (Pre-service social studies and music pre-service teacher Don, April 29, 2013) in their attempts to express understanding of content. Don seemed particularly mindful of his own bias as he acknowledged that he attempted to not give a lower grade to their efforts because of mechanical errors. However, not all of the PSTs seemed to be as reflective upon their own biases. Cassie, a social studies PST, described her surprise at "the lack of literacy in students these days" and claimed that she "d[idn't] want to say [that] the standards have changed, but in some ways they have [become lower]" (Pre-service social studies and Gaelic studies pre-service teacher Cassie, April 24, 2013).

Some PSTs noted that although they were not able to integrate some of the assessment strategies they wished to try during their field experience, they had definite plans for incorporating these when they had their own classrooms in the next year:

. . . Maybe not with this classroom I'm currently teaching, but in the future when I, if I have my own classroom, to, in order for them to see more value in it [I would] like to include those pieces as part of a portfolio or something like that. (Pre-service math and science teacher, Andrea, May 2, 2013).

This transcript excerpt shows that Andrea wanted to engage her students in self-assessment of their learning through the use of portfolios, which would include the opportunity for students to write reflectively as they perused their collected work over the course of a semester, a relevant literacy practice that would deepen student learning in this math class. However, taking on such a large project during a six-week field experience is challenging; a longer time frame is needed. Despite this reality, we found it hopeful the Andrea envisions herself using such a practice in her future as a secondary math teacher.

### **Discussion: PSTs' Purposeful Assessment Practices through the Infusion of Literacy**

All of the participants in our study described examples of how they used literacy strategies as part of their instructional practices. A majority of this group were also able to discuss the connections they saw between literacy and assessment, in how the inclusion of literacy strategies served multiple assessment purposes. Comments from PSTs indicated that their use of literacy strategies enabled them to create opportunities in which students made their thinking and learning visible. In doing so, they felt they were better able to see how students were processing information and making connections over time allowing PSTs to adjust their instruction and differentiate feedback. For example, Andrea described her use of literacy strategies to create opportunities for her grade nine math students to discuss and to make visible the internal processes of their thinking.

We also noted with some interest the instances in which PSTs were able to clearly articulate the multiple assessment purposes that literacy strategies served in their teaching. For example, Brenda described how her daily and long term assessment planning was informed by her knowledge of literacy. Brenda identified examples of how she used literacy strategies for formative purposes to allow students to make meaning of new content and for summative purposes to create alternative assessment opportunities. Other PSTs also identified the ways different literacy strategies, such as drawing, enabled them to create test questions that targeted student knowledge of content and application of ideas. As part of this, PSTs felt that the inclusion of literacy strategies in which students were encouraged to regularly make meaning of content better prepared them for summative assessments. For example, Don, a social studies and music PST, credited the consistent use of writing to learn activities for the solid performance of his students on a history test.

Given the growing emphasis on metacognition as an integral part of student learning and the role that assessment may play to foster it (Black & Wiliam, 1998; Wiliam et al. 2004; Chappuis, 2009; Earl, 2013), we were drawn to PSTs' descriptions of how the inclusion of literacy strategies created opportunities for student awareness of their own learning. For example, Mary, who had students draw a mind map over the course of a biology unit on sexual reproduction, emphasized how this enabled students to see the interconnectedness of new content while also providing her with information on how to adapt her instruction.

Participants described the challenges that occurred when the use of literacy strategies intersected with their understanding of sound assessment principles. PSTs named the pace and

quantity of descriptive feedback as well as a lack of time to try new things like larger public writing projects as some of the tensions they experienced. Some PSTs also named the challenge of developing test questions that allowed students to demonstrate their knowledge. A number of participants were aware of their own biases regarding student literacy skills, and how these influenced their perceptions of student learning. We have written about the challenges that field experience constraints can create for content area PSTs in their attempts to include literacy as part of their instructional practices (Murray Orr, Mitton-Kukner, & Timmons, 2014; Mitton-Kukner & Murray Orr, in press). We note that the constraints of time, established classroom routines, and classroom management concerns also influenced PSTs' understanding of their assessment practices. Despite these challenges, we saw these PSTs as having sophisticated understandings of the multiple purposes of assessment, particularly in their use of literacy strategies as a way to monitor student learning, adapt instruction, provide feedback, and create metacognitive opportunities for students to describe their learning and struggles. Scholars have found that assessment courses tend to make little impact on PSTs' assessment practices (Darling-Hammond & Bransford, 2005; Mertler, 2009) and PSTs are generally unaware of sound assessment principles (Campbell & Evans, 2000; Graham, 2005; Volante & Fazio, 2007; Wang et al., 2010). As we situate these findings in relation to what is known about teacher education and assessment we note with interest participants' responses to the *Literacy in the Content Areas* course that they took as part of their program of studies. One of the underlying principles of the interdisciplinary course we teach secondary PSTs is that the inclusion of literacy strategies is about creating better opportunities for students to learn content. This principle is pulled across course outcomes, activities, and assignments so that PSTs are not only learning theoretically about this connection but are also experiencing it. As part of this guiding principle, we model the use of literacy strategies in the teaching of content, and make explicit use of formative assessment practices such as ongoing descriptive and peer feedback. We propose PSTs' pedagogical understanding of assessment has been informed and deepened by the combination of their experiences in the course, *Literacy in the Content Areas*, its activities, assignments and our assessment practices, along with their experiences in their six-week field experience following the course.

### **Conclusion: The Promising Possibilities of Literacy Instruction in the Content Areas**

Teachers across North America, and in many places around the world, are being asked to effectively use assessment to foster student learning and metacognitive awareness. The purpose of assessment has moved beyond the singularity of summative assessment (Poth, 2013) bringing sharply into focus the ability of teachers to know and use assessment as a set of diagnostic and ongoing learning tools that inform instruction, feedback, and student growth. Considering the development of this group of PSTs' assessment practices in relation to their understanding of literacy strategies provides thought-provoking possibilities. Pre-service teacher education programs might consider structuring literacy in the content areas courses to engage students in experiencing multiple ways literacy strategies can be integral to their assessment plans in their teaching practices.

## Acknowledgements

Thank you to the participants of this study for their willingness to talk about their teaching practices and for the opportunity to observe their teaching during field experience. We would also like to express our thanks to the anonymous reviewers of this paper; their insights and suggestions were much appreciated.

## References

- Alberta Assessment Consortium. (2012). *Key Visual: Assessing learning in the classroom*. Retrieved from <http://www.aac.ab.ca/>
- Alvermann, D. E., Rezak, A. T., Mallozzi, C. A., Boatright, M. D., & Jackson, D. F. (2011). Reflective practice in an online literacy course: Lessons learned from attempts to fuse reading and science instruction. *Teachers College Record, 113* (1), 27–56.
- Au, K. H. (1998). Social constructivism and the school literacy learning of students of diverse backgrounds. *Journal of Literacy Research, 30*(20), 297-319.
- Barr, R., Watts-Taffe, S., & Yokota, J. (2000). Preparing teachers to teach literacy: Rethinking preservice literacy education. *Journal of Literacy Research, 32*(4), 463-470.
- Beers, K. (2003). *When kids can't read: What teachers can do*. Portsmouth, NH: Heinmann
- Begoray, D. (2002). Not just reading anymore: Literacy, community and the pre-service teacher. *English Quarterly, 34*(3-4), 39-45.
- Black, P. & Wiliam, D. (1998). Inside the black box: Raising standards through classroom assessment. *Phi Delta Kappan, 80*(2), 1–20.
- Bruinsma, R. W. (2006). Are they ready to teach reading and writing? The preparation of preservice elementary language arts teachers in Canadian universities. *The Alberta Journal of Educational Research, 52*(1), 99-102.
- Campbell, C. & Evans, J.A. (2000) Investigation of preservice teachers' classroom assessment practices during student teaching. *The Journal of Educational Research, 93*(6), 350-355.
- Cantrell, S. C. & Callaway, P. (2008). High and low implementers of content literacy instruction: Portraits of teacher efficacy. *Teaching and Teacher Education, 24*, 1739-1750.
- Chappius, J. (2009). *Seven Strategies of Assessment for Learning* (1<sup>st</sup> edition). Toronto, ONT: Pearson.
- Cheng, C. Klinger, D.A., & Zheng, Y. (2009). Examining students' after-school literacy, activities and their literacy performance on the Ontario secondary school literacy test. *Canadian Journal of Education, 32*(1), 118-148.
- Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2<sup>nd</sup> ed.). Los Angeles: Sage Publications Ltd.
- Daisey, P. (2012). The promise of secondary content area literacy field experiences, *Literacy Research and Instruction, 51*(3), 214-232.
- Daniels, H., Zemelman, S., & Steineke, N. (2007) Content-area writing: Every teacher's guide. Portsmouth, NH: Heinemann.
- Darling-Hammond, L., & Bransford, J. (Eds.). (2005). *Preparing Teachers for a Changing World: What teachers should learn and be able to do*. San Francisco, CA: Jossey-Bass.
- Duncan, R.C. & Noonan, B. (2007). Factors affecting teachers' grading and assessment practices. *The Alberta Journal of Educational Research, 53*(1), 1-21.
- Earl, L. (2013). *Assessment as Learning: Using Classroom Assessment to Maximize Student Learning* (2<sup>nd</sup> ed.). Thousand Oaks, CA: Corwin.
- Erickcan, K. & Barclay-McKeown, S. (2007). Design and development issues in provincial large-scale assessments: Designing assessments to inform policy and practice. *The Canadian Journal of Program Evaluation, 22*(3), 53-71.

- Estrada, K. & Grady, K. (2011). Reflective inquiry and pre-service teachers' conceptions of content area literacies. *Reflective practice: International and Multidisciplinary Perspectives*, 12(6), 749-762.
- Frank, M. & Barzilai, A. (2004). Integrating alternative assessment in a project-based learning course for pre-service science and technology teachers. *Assessment & Evaluation in Higher Education*, 29(1), 41-61.
- Freedman, L., & Carver, C. (2007). Preservice teacher understanding of adolescent literacy development: Naïve wonder to dawning realization to intellectual rigor. *Journal of Adolescent & Adult Literacy*, 50(8), 654-665.
- Gee, J. P. (2008). Being a lion and being a soldier: Learning and games. In Coiro, J., Knobel, M., Lankshear, C., Leu, D. J. (Eds.), *Handbook of Research on New Literacies* (pp. 1023-1036). New York: Taylor and Francis.
- Goos, M. & Moni, K. (2001). Modelling professional practice: A collaborative approach to developing criteria and standards-based assessment in pre-service teacher education courses. *Assessment & Evaluation in High Education*, 26, 76-88.
- Government of Alberta. (2009). *Living literacy: A literacy framework for Alberta's next generation economy*. Alberta Advanced Education and Technology. Retrieved from <http://act.alberta.ca/community.aspx>
- Graham, P. (2005). Classroom-based assessment: Changing knowledge and practice through preservice teacher education. *Teaching and Teacher Education* 21, 607-621.
- Gunn, T.M. & Hollingsworth, M. (2013). The implementation and assessment of a shared 21st century learning vision: A district-based approach. *Journal of Research on Technology in Education*, 45(3), 201-228.
- Kids and Learning First: A Plan to Help Every Student Succeed*. (2012). Nova Scotia Department of Education. Halifax, NS: Province of Nova Scotia.
- Kane, S. (2011). *Literacy & Learning in the Content Areas* (3<sup>rd</sup> edition). Scottsdale, Arizona: Holcomb Hathaway, Publishers.
- Klinger, D., Deluca, C., Miller, T. (2008). The evolving culture of large-scale assessments in Canadian education. *Canadian Journal of Educational Administration and Policy*, (76), 1-34. Retrieved from <http://umanitoba.ca/publications/cjeap/articles/klinger.html>
- Lankshear, C, & Knobel, M. (2003). *New literacies: Changing knowledge and classroom learning*. Philadelphia: Open University Press.
- Lind, A. (2008). *Literacy for all: Making a difference*. Paris: United Nations Educational, Scientific and Cultural Organization International Institute for Educational Planning. Retrieved on July 25, 2012 from <http://www.unesco.org/new/en/education/themes/education-building-blocks/literacy/resources/key-publications/>
- Manitoba Education, Citizenship & Youth. (2006). Rethinking classroom assessment with purpose in mind: Assessment for learning, assessment as learning, and assessment of learning. Retrieved from <http://www.edu.gov.mb.ca/k12/assess/wncp/>
- Mertler, C.A. (2009). Teachers' assessment knowledge and their perceptions of the impact of classroom assessment on professional development. *Improving Schools*, 12(2), 101-113. doi: 10.1177/1365480209105575
- Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation*. San Francisco, CA: Jossey-Bass.
- Mitton-Kukner, J. & Murray Orr, A. (in press). Inquiring into pre-service content area teachers' development of literacy practices and pedagogical content knowledge. *Australian Journal of Teacher Education*.
- Moje, E.B. (2000). What will classrooms and school look like in the new millennium? *Reading Research Quarterly*, 35(1), 128-129.
- Moore, R. (2003). Reexamining the field experiences of preservice teachers. *Journal of Teacher*

- Education*, 54(1), 31-42.
- Murray Orr, A., Mitton-Kukner, J., & Timmons, D.J. (2014). Fostering literacy practices in secondary science and mathematics courses: Pre-service teachers' pedagogical content knowledge. *Language and Literacy*, 16(1), 91-110.
- New London Group (Cazden, C., Cope, B., Fairclough, N., Gee, J., Kalantzis, M., Kress, G. & Nakata, M.). (1996). A pedagogy of multiliteracies: Designing social futures. *Harvard Educational Review*, 66(1), 60-92.
- Popham, W. J. (2011). *Transformative Assessment in Action: An Inside Look at Applying the Process*. Alexandria, VA: ASCD.
- Popham, W. J. (2009). Assessment literacy for teachers: faddish or fundamental? *Theory Into Practice*, 48(1), 4-11.
- Prensky, M. (2012). *Teaching Digital Natives: Partnering for Real Learning*. Thousand Oaks, CA: Corwin.
- Poth, C. (2013). What assessment knowledge and skills do initial teacher education programs address? A Western Canadian perspective. *Alberta Journal of Educational Research*, 58 (4), 634-656.
- Remesal, A. (2011). Primary and secondary teachers' conceptions of assessment: A qualitative study. *Teaching and Teacher Education*, 27(2), 472-482. doi:10.1016/j.tate.2010.09.017
- Robertson, L. & Hughes, J.M. (2011). Investigating Pre-Service Teachers' Understandings of Critical Media Literacy. *Language and Literacy*, 13(2), 37-53.
- Roscoe, K. (2013). Enhancing assessment in teacher education courses. *The Canadian Journal for the Scholarship of Teaching and Learning*, 4(1), 1-15. DOI: <http://dx.doi.org/10.5206/cjsotl-rcacea.2013.1.5>
- Sheridan-Thomas, H. (2006). Making sense of multiple literacies: Exploring pre-service content area teachers' understandings and applications. *Literacy Research and Instruction*, 46(2), 121-150.
- Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4-14.
- Simon, M., Chitpin, S., & Yahya, R. (2010). Pre-service teachers thinking about student assessment issues. *International Journal of Education*, 2(2), 1-20.
- Smith, K. (2011). Professional development of teachers—A prerequisite for AFL to be successfully implemented in the classroom. *Studies in Educational Evaluation*, 37(1), 55-61. doi:10.1016/j.stueduc.2011.03.005
- Stiggins, R. (2002). Assessment crisis: The absence of assessment for learning. *Phi Delta Kappan*, 83(10), 758-765.
- Volante, L. (2010). Assessment of, for, and as learning within schools: Implications for transforming classroom practice. *Action in Teacher Education*, 31(4), 66-75.
- Volante, L. & Beckett, D. (2011). Formative assessment and the contemporary classroom: Synergies and tensions between research and practice. *Canadian Journal of Education*, 34(2), 239-255.
- Volante, L. & Fazio, X. (2007). Exploring teacher candidates' assessment literacy: Implications for teacher education reform and professional development. *Canadian Journal of Education* 30 (3), 749-770.
- Wang, J., Kao, H. & Lin, S. (2010). Preservice teachers' initial conceptions about assessment of science learning: The coherence with their views of learning science. *Teaching and Teacher Education*, 26, 522-529.
- William, D. Lee, C. Harrison, C., & Black, P. (2004). Teachers developing assessment for learning: Impact on student achievement. *Assessment in Education: Principles, Policy, and Practice*, 11(1), 49-65.
- Wilson, N. S. (2008). Teachers expanding pedagogical content knowledge: Learning about formative assessment together. *Journal of In-Service Education*, 34(3), 283- 298. doi:10.1080/13674580802003540



## **Notes**

<sup>1</sup> Pseudonyms are used for all participants' names in this study.

<sup>2</sup> Daniels et al. (2007) define writing to learn strategies as informal writing activities that help learners to act upon their understanding of content. Public writing refers to more polished and formal pieces of writing intended for an audience. Daniels et al. provide a wide variety of both of these kinds of activities situated in different content areas.

---

*Jennifer Mitton-Kukner* is an Assistant Professor of Assessment, Literacy, and Qualitative Research Methods in the Faculty of Education at St. Francis Xavier University in Nova Scotia. Her research areas include content area literacy, pre- and in- service teacher education, and teachers as researchers.

*Anne Murray Orr* is an Associate Professor in the Faculty of Education at St. Francis Xavier University in Nova Scotia. Her current research is in the areas of early literacy, content area literacy, Indigenous language immersion programs, and pre- and in-service teacher education.