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Thinking about Professional Literacies with Mathematics, English Language Arts, and Science Preservice Teachers

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Abstract

The intent of this article is to present our initial conceptualizations and thinking about the literacies preservice teachers acquire and learn during their teacher preparation program. Beginning with some general and global definitions of literacy, we then present our thinking about these literacies in a school context, a teacher practice context, and then in a teacher preparation context. The article closes with a design for an upcoming study of preservice teachers' acquisition of these literacies. The proposed study explores 'professional literacies' with primary/junior and intermediate/senior preservice teachers of Mathematics, English Language Arts, and Science during teacher preparation curriculum courses.

Le but de cet article est de présenter nos conceptualisations initiales et la réflexion sur l'alphabétisation preservice enseignants à acquérir et apprennent au cours de leur programme de préparation des enseignants. À commencer par quelques définitions générales et globales d'alphabétisation, nous présentons ensuite notre réflexion sur ces alphabétisations dans un contexte scolaire, un contexte de pratique de l'enseignant, puis dans un contexte de préparation des enseignants. L'article se termine avec un design pour une prochaine étude de l'acquisition de ces alphabétisations de. L'étude proposée explore alphabétisations professionnelles avec les futurs enseignants primaires / junior et intermédiaire / supérieurs de mathématiques, l'anglais, et de la science au cours des cours du programme d'études de préparation des enseignants.

Key words: *professional literacies, preservice teacher, teacher preparation, elementary and secondary school, mathematics, English language arts, science*

"... in the world of the future, the new illiterate will be the person who has not learned how to learn." Alvin Toffler, US writer.

Background

In 1958, UNESCO defined literacy as the ability to read and write short simple statements, and they contextualized (or reduced) it to one's everyday life. Over the years, UNESCO has modified its definition, identifying the earlier version as 'basic literacy', and developing a more comprehensive definition called 'functional literacy'. In 1978,

> "A person is functionally literate who can engage in all those activities in which literacy is required for effective functioning of his or her group and community and also for enabling him or her to continue to use reading, writing, and calculation for his or her own and the community's development" (UNESCO, 2005b, p. 154).

And in 2005,

> "Literacy is the ability to identify, understand, interpret, create, communicate and compute using printed and written materials associated with varying contexts. Literacy involves a continuum of learning in enabling individuals to achieve his or her goals, develop his or her knowledge and potential, and participate fully in community and wider society"

Many other organizations echoed this point of view, for example the Organisation for Economic Co-operation and Development (OECD) in 1997 and the International Council for Adult Education (ICAE) in 2003 noted basic literacy was generally understood as "learning to read and write (text and numbers), reading and writing to learn, and developing these skills and using them effectively for meeting basic needs" (ICAE, 2003). The American Library Association (ALA) made a similar statement in 2005 stating literacy as "the ability to use printed

and written information to function in society, to achieve one's goals, and to develop one's knowledge and potential" (ALA, 2015). The Canadian Council on Learning (2007) defined functional literacy as including "the ability to analyse things, understand general ideas or terms, use symbols in complex ways, apply theories, and perform other necessary life skills — including the ability to engage in the social and economic life of the community." Of value to note, from all these definitions is the increasing sense of literacy for a bigger purpose than just to be able to read and write.

Literacy is being acknowledged and accepted as a necessary aspect to one's learning, to one's ability to gather and develop knowledge, and realizing one's intellectual as well as social, economic, and political potential. From literacy to language, and back to literacy, one then needs language to convey one's learning to another, and to capitalize on one's social, economic, political, and intellectual potential. Language, being the use of signs, gestures, words, sounds, and patterns to convey meaning within particular contexts such as cultural, social, and political (Lankshear, 1997), requires a much more sophisticated sense of reading and writing. Language then, using symbols in complex ways and applying theories through speaking, writing, and thinking implies a level of literacy greater than the strict ability to read and write.

The intent of this article is to present our initial conceptualizations and thinking about the literacies preservice teachers acquire and learn during their teacher preparation program. Beginning with some general and global definitions of literacy, above, we then present our thinking about these literacies in a school context, a teacher practice context, and then in a teacher preparation context. The article closes with a design for an upcoming study of preservice teachers' acquisition of these literacies.

Literacy in the school context

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Bruce (1997) stated that any definition of literacy is subject to change based on societal needs at any given time. There is little debate that the literacies students need to learn in school today are evolving, for example often due to the influence of Information and Communication Technology (ICT). It can be argued, therefore, that the literacies that teachers need must also necessarily change. While any major change can be seen as daunting, situated within an appropriate context these new challenges can also been seen as exciting and natural. Generally, we find that technology and ICT is often a driving force behind societal change, and thus change in teaching and learning. Hence, we use a technology and ICT lens initially to explore the changing nature of literacy in the school context.

In 1996, The New London Group, a group of English language arts researchers, wrote a manifesto on multiliteracies that called for the teaching of new literacy skills related to technology and to the corresponding societal changes. This group argued that multiliteracies will dramatically impact forms and functions of writing by focusing on the importance of being literate in a variety of modes. The group recognized that as a global economy and, therefore community, we are increasingly expected to interact with people from a vast array of cultures on a daily basis. New literacy skills are required to understand accents, to read body language, and to communicate effectively with people from various cultures and with varying dialects. In addition, the manifesto acknowledged the monumental change taking place in society due to the increased use of ICT. The group argued for the need for new literacy skills related to the use of new technology.

Kress (2003) argued for the teaching of new literacy skills such as design. In contrast to simply word processing a final draft of their narratives, Kress believed that students should be taught to design multimodal narratives that reflect the increased use of image and sound that they

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are seeing on the Internet. Today's students are visually inundated when they read online. Hence, these types of multimodal texts involve new modes of literacy that complement the conventional skills students are currently learning in schools. Kress also stated that unless students begin to learn these new skills, they are heading toward illiteracy.

The multimodal texts as text, images, video, and other media forms add the potential for authors and readers to shape their interpretation by exploring various stated and unstated social, cultural, and historical contexts. The internet is providing a reading and writing space where multimodal texts are the expected and normal experience. This is the hypertextuality of expression through the internet. Hypertextuality is "an open-ended and ever developing" (Riffaterre, 1994, p. 786) literacy experience where, possibly at its simplest, "writing and reading become pictorial operations" (Sandbothe, 2000, p. 90), and at its most complex, a non-linear sense of text. For example, to use a connect-the-dot metaphor, a framework of dots intended to create one particular image by the author(s) that may become a different image by the reader(s) as they connects the dots to suggest a different perspective and interpretation. Hypertextuality (Riffaterre, 1994; Sandbothe, 2000) is requiring that students blend knowledge and ideas from a variety of types of information to produce highly literate, multimodal pieces of information.

In this way, new student-generated texts are always evolving as students become more efficient with the process of design. Burnett and Myers (2006) noted that screen-based texts can be easily altered and manipulated and this ease of revision may prompt writers to experiment with text more extensively. Students can begin to make critical decisions about the interplay between text and image and they can continue to enhance their texts as their own digital and visual literacy skills become increasingly sophisticated. Jewitt (2003) and Fuchs (2006) argued that new literacy practices and the use of new Information and Communication Technology

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(ICT) within the classroom are producing new types of texts. These new texts signal the need to re-think conceptions of literacy, learning, and assessment.

Digital literacy is a term that is emerging in policy documents as an attempt to bring the societal trend of increased use of ICT and the development of new literacies into the classroom. Knobel and Lankshear (2009) talked about digital literacy as being a response to the fears of a growing digital divide between those that can participate in learning and those that cannot. Lanham (1993) claimed that digital literacy expands the definition of literacy from its original definition of "to read and write" to now meaning "the ability to understand information however presented". He argued that the multimediated nature of digital information means that deciphering information involves "being skilled at deciphering complex images and sounds as well as the syntactical subtleties of words" (p. 200). Following this argument, asking students to create digital texts using text, hyperlinks, and images is a logical step in their learning of these important literacy skills. A digitally literate person is "quick on their feet in moving from one kind of medium to another…know[s] what kinds of expression fit what kinds of knowledge and become skilled at presenting [their] information in the medium that [their] audience will find easiest to understand" (p. 200).

While digital literacy is beginning to make an appearance within policy documents, Leu and Kinzer (2000) refer to this time as "literacy as technological deixis" (p. 117). The term deixis, they explain, is used by linguists like Murphy (1986) for words such as *now, today, here,* and *there.* These are all words that change quickly depending on the time and space in which they are being said. This can be said for literacy as it relates to technology as the forms and functions of literacy rapidly change and adapt to the evolution and creation of new technologies. Looking more broadly, the same can also be said for the evolving role of the classroom teacher

in response to these significant changes in the literacy practices actually being used in today's society and economy.

Literacy in the context of teacher practice

Pilgrim and Bledsoe (2011) argued that there has never been greater access to information for teachers than there is today. Because there is so much information available for practicing teachers, the forms and functions of Professional Development (PD) have changed. Teachers may now engage in meaningful, timely PD that is relevant and useful to them in their particular classrooms at any time. As a result, learning to teach is less about absorbing particular bits of information and more about acquiring specific literacies (such as understanding where and how to access all of this useful information, and being able to self-determine the kinds of PD one might need at any given time) that will endure this evolution in teaching and learning.

Literacy behaviours impact on one's identity (Gee, 1997). Rather than simply being involved in the practice of reading or writing text, participants are shaping their identities in relation to the discourses within which they are participating. Socially constructed hypertexts, for example, require a certain amount of specific knowledge about terminology and spatial organization. Hypertext "is actually understood as a technology of connection and as a transformative aesthetic form of expression" (Burnett & Marshall, 2003, p. 81). Hypertext is the text of the internet that allows for immediate interconnectivity with any and all other texts, images, and media forms. Often, hypertext is created by more than one writer, and read by more than one reader—a distinctly social and collaborative literacy experience. Someone who is a novice to this type of writing will be identified by his/her lack of specific knowledge about the language and organization of the text. Therefore, veteran teachers who are accustomed to being authorities within the classroom will identify themselves as novices when it comes to the

teaching of new literacies. While this flattening of the teacher-as-expert hierarchy is a characteristic of new literacies, it is certainly not a characteristic of most traditional and current classroom settings. When teachers begin to learn, and, ultimately teach, these new literacies, they are not only being asked to learn new skills, for example, related to ICT, but more importantly they are also being asked to change their roles within the classroom and their thinking.

Jewitt (2003) stated that the nature of the product that students create changes due to the increased use of modes (i.e., sound, image, text, links, etc.), and that teachers need to re-conceptualize three critical components of their classroom: literacy, learning, and assessment. Assessment practices must change in order to adequately capture students' multimodal competence. Failure to change assessment practices, Jewitt believed, is to ignore the meaning of the process and the final product.

Teachers' professional literacies are intertwined, for example, assessment literacy is integrally linked to subject area literacy. Adams and Hamm (2000) discuss practical methods for making such literacies relevant to the mathematics classroom. Kalantzis, Cope, and Harvey (2003) argued that four types of assessment practices will become increasingly relevant to multimodal English language arts classrooms -- project assessment, performance assessment, group assessment, and portfolio assessment. Project assessment, which is designed to measure broad knowledgeability and flexible solutions orientation to knowledge, requires students to complete in-depth tasks (e.g., task plan, retrieval of information, and presentation). Performance assessment would assess organization and problem solving skills that occur in the planning, doing, and completion of an assigned task. Group assessment would measure the collaborative skills of students and the collective work of a learning group. Portfolio assessment becomes

particularly important because it acknowledges the embodied nature of the students' learning, and that, within the multimodal context, learning outcomes will vary greatly among students. All four of these assessment approaches call for significant changes not only in classroom assignments, but also in teacher and student thinking, and hence the use and understanding of the literacies that underlie this thinking.

Lankshear and Knobel (2011) talked about new literacies and Kress's ideas about design could be considered as presenting a new literacy. Lankshear and Knobel do not believe that all new literacies must relate directly to the use of new technology. However, they argue that there are new technical considerations when discussing new literacies (for example, software programs, keyboarding etc.), and there is a new ethos to consider (for example, seeing the world as changing in fundamental ways and needing to change our literacy practices to stay current).

One example of literacy that is not technology dependent, but as Lankshear and Knobel (2011) argue, relevant and necessary to learn in this new society and economy is scenario planning. Scenario planning involves reading succinct narratives that outline a possible situation in the future. These scenarios are designed to help people think about possible future outcomes before undertaking specific actions. By delving deep into one particular situation and predicting possible outcomes, one takes on various roles within that scenario (such as perhaps corporate executive, curriculum planner or policy maker, and teacher). Taking on these various roles and participating in the discourses of these roles builds literacy and supports the type of thinking strategies that people need in the workforce of this new economy. So, while scenario planning may lack the technical considerations of a new literacy, it encompasses the ethos considerations. New literacies can emerge that will not involve the use of a computer.

Thinking of teaching and learning, and potential curricula used for those purposes, to researchers such as Grumet (1992) curriculum means more than simply the listing of and the delivery of content. Instead, curriculum can be said to be the fluid, daily lived experience of school. It is always unique and is constantly in flux. As students and teachers continually define and revise their thoughts and ideas with one another, and share individual perspectives, Pinar (2004) argued that this lived experience of school is a "complicated conversation" in which one is often asked to think and respond with ideas outside of the prescribed body of information found in a curriculum document. Within the context of such a complicated conversation, students and teachers learn, through conversation, a deeper understanding of a discipline. A conversation is not won or lost and there is no conversion to or from but rather, there are perspectives shared and ideas expanded (Pinar, 2004). This kind of "think-on-your-feet" teaching requires preservice teachers to learn new kinds of skills that they can apply across any discipline given particular situations (Selmer & Graham, 2010). Selmer and Graham (2010) talk of critical and evaluative skills teachers need with professional literature, which they also need with their classroom practice—for example in developing a classroom community. These are reflection-in-action (Schon, 1983) skills and they are practical as well as reflective; teachers will rely on their critical thinking skills and evaluative skills of the professional literature as teachers respond to students in the milieu of the classroom context and teachers' classroom practice.

Literacy in the teacher preparation context

Teacher education researchers must begin to critically examine the kinds of skills and the type of knowledge most beneficial to our new preservice teachers entering into classroom contexts reflective of the vast and ongoing societal changes mentioned above. For example, Bissaker, Davies and Heath (2011) report on a partnership between the South Australian

Department of Education and Flinders University in Adelaide, Australia which led to the building of a purpose-designed school to provide state-of-the-art learning for Science and Mathematics. In order to make this school happen, they acknowledged the need to teach preservice teachers the skills to match this kind of learning environment. They focused on teaching preservice teachers how to teach group inquiry and how to manage students engaged in meaningful self-directed learning. In the end, one of the critical elements to the success of the school was the need to teach the preservice teachers because the ways of teaching and the kinds of literacies these teachers needed to promote the kind of learning desired in a state-of-the-art school were unique compared to the regular teacher education programs typically offered.

There are many discourses preservice teachers are exposed to in a short amount of time as they begin a teacher preparation program. Discourses from subject areas, assessment and evaluation, leadership, safe school and mental health, learning disabilities, technology in education, and pedagogy are a few, and not an exhaustive list of examples. To participate in a discourse may require a certain level of literacy in that discourse. For example, when considering the use of technology in classroom practice, media literacy is an inherent element of participating in the teacher preparation classroom discourse. The context of teacher preparation programs and curriculum course-work in Ontario also assumes another literacy, that of the Ontario College of Teachers' (OCT) ethical standards and standards of practice in an effort to promote the professionalism of classroom teaching.

Literacies such as media literacy have a distinct sense in a school classroom context with school students. This literacy will be a shared literacy with students, however, at the teaching level rather than the learner level the literacy may take a different form as teachers' discourse includes pedagogical knowledge and interpretations of media in classroom practice. Joyce

(1995) used the term "cardinal technology" to explain the iterative relationship that hypertext technology can create with a learner: the nature of the technology changes that in turn causes a change in the nature of the learning that takes place. Therefore, as teachers begin to learn new technologies and incorporate new literacy and assessment practices into their classroom teaching, the nature of their thinking and teaching begins to change. It is critical that as teachers introduce digital literacy skills into their classrooms research needs to be done on how their thinking changes, when it begins to change and why.

We take the perspective that in teacher professional preparation programs there is a relatively short length of time in which preservice teachers are exposed to the discourse related to professional practice. To be a participant in this discourse requires a complex interplay of subsets of knowledge related to professional practice. Various literacies from subject content, assessment and evaluation, leadership, safe school and mental health, learning disabilities, technology in education, and pedagogy, to name a few, provide support for, and a foundation to the teacher discourse.

We are identifying these various literacies required of teachers in their professional practice as 'professional literacies.' Ultimately, the more literacies of which a learner has knowledge and facility, the more efficacious one may feel he/she has employing the teacher discourse.

A design of a study of preservice teachers' acquisition of professional literacies

Teacher education researchers must begin to notice and critically examine the literacies most closely related to the kinds of knowledge and the types of skills most beneficial to preservice teachers. We propose that teacher discourse and the supporting professional literacies play an essential role in informing preservice teachers' classroom practice so that they teach

differently from the ways they were taught. To better understand the nature or the professional literacies our preservice teachers were learning in our curriculum courses towards the development of their teacher discourse, we are embarking on a study of elementary and secondary school level preservice teachers of mathematics, English language arts, and science. Two questions guide this study,

1. What curricular program elements facilitated the development of preservice teachers' professional literacies?
2. What sense of personal change do preservice teachers' feel they have experienced over the duration of a teacher preparation program?
    a. What particular or combinations of professional literacies are evident in preservice teachers' discourse?
    b. What is the nature of the literacies that emerge in preservice teachers' classroom practice?

We are taking a phenomenological stance to this exploration of preservice teachers' acquisition of professional literacies. Not only are we interested to better understand the preservice teachers' acquisition of professional literacies, we were looking for a deeper understanding of the interplay between the preservice teachers' learning of professional literacies and our teaching strategies. As three instructors in a teacher preparation program from three different subject areas, we appreciated the similarities in our thinking about preservice teachers' need for professional literacies as they develop their teacher discourse, and, we were intrigued by the inherent subjectivity of our teaching and learning approaches because of our subject area differences. Instructor journals and course materials were considered a valuable component to the body of data for this study.

We have designed four phases to this study. Phase one consists of identifying the course design, goals of the courses as defined by the instructors, and initial conceptions instructors carry for the intended outcomes of the courses. This data exists as course outlines and instructors' journal notes of their intended goals and outcomes for their courses. Phase two involves instructors maintaining a journal of their thinking and observations throughout the duration of the curriculum courses. In particular, the instructors will note,

a. Thoughts of professional literacies
b. A log of professional literacies brought to the learners' attention
c. Observations of professional literacies during class lessons
d. Reflections of course/program features that facilitated the development of professional literacies.

Phase three occurs concurrently with phase two and consists of questionnaires inquiring into preservice teachers' knowledge and understanding of professional literacies, and where they perceive they learned these literacies. These questionnaires will be managed by a research assistant and occur on September 1st, January 1st, and April 1st. Phase four is a focus group with a subset of preservice teachers discussing what they have learned about professional literacies, how their perspective of teaching and learning has changed because of a focus on professional literacies, and exploring their awareness of the impact of professional literacies as they respond to a classroom scenario case study.

The analysis of data will consist of three phases, i., coding for emergent themes (Corbin & Strauss, 2015) from the questionnaires and focus group data, ii., coding for common and different themes in instructors' journal notes, and iii., a comparison between part i., and part ii.,

results to make inferences that identify potential influences to the changes in preservice teachers' thinking.

Next Steps

The results of this study will be used by the instructors to better understand the professional literacies that contribute to one's teacher discourse. There may be tensions in our thinking about a sense of basic literacy, functional literacy, and the incredibly contextual space of the classroom teaching experience for these professional literacies. One question we have concerns the nature of knowledge of the vocabulary of the professional literacies, and the application of the professional literacies in one's teacher discourse. For example, do preservice teachers get past a 'buzz words' stage in their language use, how much are they aware of the impact of their language on their ability to communicate their pedagogical intentions to various audiences such as students, parents, or administrators. Additionally, and personally, we expect what we learn will also factor into our thinking about our course curriculum and course design. The implementation of the results and the subsequent course improvements will become planning and development of our future curriculum courses.

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