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Cycle One Report

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For Cycle One, my research question was:

If I provide open access to primary source documents, how will teachers decide to use them for K-12 classroom learning?

My Action

I began to answer this question by inviting three in-service teachers to work as adjunct members of my Educational Technology Programs team while we were actively digitizing and presenting historical artifacts from the Museums' collections. I chose to invite teachers who were pre-disposed to working with my team so that there was a baseline of common prior knowledge about the Museum and its educational technology work. As expected, all three teachers eagerly accepted the invitation.

Leigh is a veteran sixth-grade teacher at a public school in Philadelphia. She expresses a preference for teaching math and language arts, although enjoys teaching science and social studies as well. She works collaboratively with her two grade partners to share resources and provide common learning experiences for all of their students. Over the past decade, Leigh has attended numerous professional development workshops at The Franklin Institute on topics ranging from science inquiry to software applications. She had never, however, encountered any of the Institute's primary source materials.

Gail is also a veteran teacher at a public school in Philadelphia, where she teaches seventh grade. Her favorite subject is math and she has a deep expertise in math education. Her science teaching inevitably features a strong integration of math applications. For example, plant growth investigations in her science class are likely to include spreadsheets and graphing activities. Like Leigh, Gail has frequently attended professional development events at the Institute but had never worked with historical collections.

As teachers with the School District of Philadelphia, Leigh and Gail both use prescribed curricular materials. For Science, they use the Holt Short Course materials. The District provides a curricular sequence to accompany the materials, such that all teachers in the District are teaching the same way on the same day. Leigh has one computer in her classroom with a reliable broadband connection to the Internet and an attached data projector. Gail's school keeps a few projectors in the media center; she frequently borrows

one to attach to the computer in her classroom so that she can project web-based resources for her students.

The third teacher, Anne, works with early-elementary school students at a private school just outside of the city limits. As the “computer teacher” in the Lower School, Anne works with the classroom teachers to identify opportunities to integrate technology with student learning. In many cases, these integrations occur in Science, perhaps because of Anne’s personal interest in Science. Anne’s school features technology access in the classroom as well as in the computer lab. Teachers select curricular materials for science from an approved list, giving them the flexibility to use materials that are most comfortable for them. Like Leigh and Gail, Anne had not previously worked directly with primary sources but she had attended workshops and seminars at the Institute.

Each teacher came individually to meet with my team and to spend time with the primary sources. During the Cycle One timeframe, my team was working with three documentary files related to the work of Marie Curie, Elmer Sperry, and William Burroughs. I had intended to have each teacher work with a different file. When all three teachers independently expressed a strong interest in Curie, I quickly realized that it would be more productive to allow them to select the scientist who interested them most. In retrospect, the decision to have the three teachers work with the same file dramatically enhanced the quality of the Cycle One conversations and outcomes.

Each teacher came to the Institute on a weekday afternoon, after having spent the day teaching. My team and I welcomed her and we spent approximately thirty minutes talking about her existing understanding of primary sources and what we hoped she could add to the interpretation of the material. I gave her minimal instruction and encouraged her to be as creative as possible. We then gave her protective gloves and showed her to the artifact table where the Curie file awaited. We left her alone to spend time reading through the file. After about an hour or so, I re-joined her to talk briefly about the experience. I deliberately kept the individual conversations brief. In all three cases, the main theme of that quick conversation was about how “cool” the experience had been. I asked them to take some time in the days to come to think about potential classroom applications.

After all three teachers had worked independently with the Curie file, we set a date to meet as a group. Again, the teachers came to the Institute after conclusion of their school day. Leigh and Gail already knew each other well, but had only met Anne casually at Institute workshops in the past. However, common enthusiasm for the Curie file made them bond immediately as co-learners. Each was effusive, bursting with ideas and excitement about the experience. This was the point at which I realized that I had been wise to adjust my plan and allow them to work with the same file. If each had worked with a separate file, I would have been challenged to sustain the

conversation. Since each had worked with Curie, we found ourselves still talking ninety minutes after we had begun. Anne, in particular, had been tremendously inspired by the experience. She had purchased and read a biography of Madame Curie and, as a result, was able to tell the others many interesting details of Curie's life and work. At one point in the conversation, Anne reached for the case file to show us the document—written in French—that included a chart for determining the half-life of a radioactive element. Neither Gail nor Leigh had noticed the chart.

My Research

Cycle One exists as an important segment of my larger action research. I am attempting to learn how primary sources are made most useful for K-12 science education. I predict that the utility is maximized when in-service teachers participate directly in the online interpretation of the materials.

My action research responds to a national call for students to learn about the nature of science, despite the fact that few teachers are ready themselves to answer that call. Teachers can use primary source materials to develop their personal understanding of the social nature of the scientific process. Through investigation of primary sources, teachers can become social actors in science. Only then will they stand ready to answer the call and help turn the tide of student disinterest in science.

My knowledge of The Franklin Institute's collections of primary source materials compels me to learn how we can make them most useful for teachers and students. I know that our holdings have value for learning about the nature of science. My research, therefore, is driven by the national need for science education reform. The outcomes of this effort will provide needed intelligence for the cause.

My Evidence

Throughout Cycle One, I looked closely at how the three teachers responded to the primary sources. I looked at the similarities and differences. I also looked at how the teachers influenced my team. I used observational data as evidence of the effect of my intervention. I used a simple instrument to record qualitative impressions of the individual interactions. First, I noted how long the teachers stayed on task during their scheduled hour of individual time with the file using a metric of how long they remained at the artifact table. I also captured evaluations of the quality of each teacher's questions and responses during the meetings using a five-point scale. I also asked my team to use the same instrument to record their impressions. This table presents our average impressions.

Observational Impressions of Engagement

	Leigh	Gail	Anne
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Length of individual interaction with file	60 mins	55 mins	65 mins
Total Length of optional break(s) during interaction	5 mins	0 mins	0 mins
Perceived enthusiasm during first meeting	3	4	5
Perceived enthusiasm during final meeting	5	5	5
Quality of questions during first meeting	3	3	4
Quality of questions during final meeting	5	5	5
Quality of responses during first meeting	2	2	4
Quality of responses during final meeting	4	4	5

The final dialogue was a source of important data. For example, I asked the teachers to articulate their perceived value for primary sources. The table below charts the use of common terms. As the chart suggests, Anne was the most varied in her articulation about the value of primary sources. She did not, however, monopolize the conversation. All three spoke carefully and at length. Leigh and Gail, however, seemed to focus on a few key ideas while Anne seemed to have thought more broadly about the question. All three had the same direct experience, but Anne had opted to purchase and read a biography of Marie Curie after her first session and before our final meeting. This is a likely influence on the diversity of her expressions.

Commonality of Reflective Descriptors

	Leigh	Gail	Anne
personal / personalization	x	x	
authentic			x
direct interaction			x
brings stories to life			x
kids love it			x
fascination / fascinating		x	x
people	x	x	x
back in time	x		
role models			x
"you" / the second person	x	x	x
inspires	x		
interesting	x	x	x

real / reality / realistic	x	x	x
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Collectively, Leigh, Gail, and Anne came to the conclusion that the Curie file (and any primary source like it) is unique in its ability to engage learners. For the reasons expressed in the chart above, the Curie file has numerous entrypoints. Anne came to the task with a longstanding enthusiasm for science; Gail had no such disposition, but did bring a high regard for European history. Leigh is a voracious reader of historical novels. They met in the Curie file and each found her place in the social network that was the science of radium.

After about forty minutes of talking about Curie and primary sources, I steered the conversation toward classroom applications. All three teachers were ready and eager to share their ideas. The chart below summarizes the range of applications.

Classroom Applications of the Curie File

	Leigh	Gail	Anne
Science			
Look at the properties of radioactive elements			x
Explore the concept of half-life			x
Social Studies			
Look at the unintended consequences of scientific discovery	x		
Consider the role of women in science.		x	x
Contextualize the file with the geopolitics of the time.			x
Math			
Use the charts of Curie's data for determining medians, means, and modes.		x	
Transfer Curie's half-life data to a spreadsheet and generate graphs.		x	
Language Arts			
Use Curie's letters as models for student letter writing.	x		
Compare and contrast the persuasive quality of the nomination letters. Create your own letter to add to the case.		x	
Look at the evolution of style between letters in the file and communication		x	

today.

In subsequent cycles, I will investigate the relative creativity and generative contribution of teachers who encounter the Curie file in a structured workshop setting. The quantity and quality of these ideas serve now as benchmarks for ongoing work with primary sources.

My Analysis

I measured success in Cycle One based upon whether or not I effectively engaged the teachers with the creative process of interpretation of primary source materials. Based upon both the quantity and quality of ideas that Leigh, Gail, and Anne generated, I am confident that this was a successful learning experience that deepened my expertise.

In particular, I reinforced my belief that primary source documents can generate enthusiasm for learning about the nature of science. Neither Leigh, nor Gail, nor Anne had any pre-existing experience with primary sources. All three were inspired to learn more—for themselves—about Marie Curie. All three were excited to introduce the primary sources to their students, via the Web.

When I began Cycle One, I posited that the teachers would be more inclined to “adopt” a separate scientist. This hypothesis derived from the behaviors that exist within my professional team. I see that my team works best when each member is comfortable with a defined workload. If two or more people are working with the same subject matter, conflicts arise. I suspected that the teachers would also value having a clear understanding of what each one “owned.” At the time, I thought that this “ownership” of the primary sources would generate pride and desire to share ideas. In effect, I believed that the three teachers would form a learning circle in which each one had a distinct role to play as a spokesperson for Sperry, Burroughs, or Curie.

Instead, I learned that my notion of “ownership” was premature. Given time, Leigh, Gail, and Anne could grow into that professional model. At this early stage, however, they were much more inclined to think together about the same scientist. Perhaps there is perceived safety in numbers. None felt overly burdened with responsibility, confident that the other two could fill in the conversational gaps. As a result, our closing dialogue was extremely balanced and generative. As Leigh finished a thought, Anne was ready to follow. Gail noticed a connection and articulated it.

My regard for the educational expertise that Leigh, Gail, and Anne brought to my team may have clouded my objectivity about their complete lack of primary source expertise. I did not think clearly about the fact that they

would be absolute newcomers to my community of practice. For example, when I handed Gail protective gloves to wear, she said "No, thank you." She assumed that they were for her protection. In my community of practice, all members know that we wear gloves to protect the historical artifacts.

My Reflection

Cycle One of my action research has proven to be an important learning experience for me, generating numerous positive outcomes. First of all, when I began this cycle, I had a notion of what a primary source is. When I said "primary source," I meant an original, historical document/artifact. Working with the teachers to help them understand the meaning of "primary source," I began to construct a different definition. They helped me realize that primary sources don't necessarily need to be old. A raw data set from an experimental reaction that happened a minute ago is a primary source. A live image of a solar flare seen through a telescope is a primary source. I need to be more specific in my use of the term. I need to characterize the nature and state of the primary source.

This experience has been intellectually enlightening. I did not fully appreciate the impact of action research. I am honestly surprised by how impactful the experience has been for me. Cycle One has crystallized fluid learning models and theories for me. By helping the teachers think about primary sources, I re-constructed my own understanding. Together, we co-constructed new ideas about how to use primary sources. I now see how the action research experience is a manifestation of social constructivism.