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Making History Active: Archival Interventions for Engineering Education

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Making History Active:
Archival Interventions for Engineering Education

Abstract

This paper demonstrates how methodologies of liberal education can be used to enhance an undergraduate engineering education. In a 2-credit introduction to Science and Technology Studies course at New York University's Tandon School of Engineering,[i] we engaged in what we call "archival interventions": the introduction of primary sources in the classroom and a visit to the school's library to engage with archival materials. The interventions were the result of a team effort between the course instructor, teaching a humanities course, and the archivist from NYU Libraries. This activity shows how liberal education can have a natural fit within the engineering curriculum. In particular, we wish to demonstrate how even a small-scale project, using available resources, will help to accomplish ABET Criterion 3: Student Outcomes. ABET's Student Outcomes encourage engineering education to follow an active learning model, to discuss the social context and ethics of engineering solutions, and to develop skills of analysis, teamwork, and communication. Our archival interventions, though admittedly limited in scope, embody the principles ABET's Student Outcomes. By working in groups with primary source materials related to science and engineering, we encouraged students to rethink what it means to be an inventor or entrepreneur and to consider the larger social context of innovation. As a reflective project, students wrote short response papers or made presentations based on their work. We measured the students' responses to the interventions through anonymous surveys conducted at the end of the course. We knew from earlier projects of this sort that students enjoyed the insight into the world of working engineers that archival collections provided them. In this intervention, we were particularly interested in responses from first year students, compared to students farther along in their engineering education. Engaging first-year engineering students with the real-world experiences of engineers may support their interest in the field and bolster the retention of students in engineering programs.

Introduction

The concept of humanities research may, at first, puzzle engineering students. To an engineering student, research is evaluating design choices, testing materials, inventing new methods of fabrication, applying new techniques to current problems. How could someone who reads books and teaches about history conduct research? Although a humanities faculty member might react with incredulity to this presumption, it is a fair question for a student who has had limited exposure to the humanities. If engineering students are to understand the work of humanities research, and if they are to successfully integrate this work into engineering, it is important that the tools of liberal education are incorporated into the curriculum in a meaningful way. Moving

[i] Until 2008, the school was known as Polytechnic University. At that time, the school began a merger with NYU and an interim organization was formed known as the Polytechnic Institute of NYU. In 2014, with the merger completed and the school becoming one of NYU's institutes, the name NYU Polytechnic School of Engineering was used. Recently, in gratitude for a generous donation, we have taken the name NYU Tandon School of Engineering.

beyond the goal of a solid general education, it is possible to use the techniques of liberal education to directly enhance the capabilities of engineers.

The ideal engineering education, within the current teaching paradigm, is a progression from abstraction to idealization to mathematical modeling to simulation to performance evaluation to, finally, relating to reality.[1] First-year students learn mathematical and engineering concepts and then progress through courses involving design testing and assessment. Ultimately, engineering programs should produce graduates who can successfully apply engineering concepts to real world problems. The Accreditation Board for Engineering and Technology (ABET) sets the criteria that colleges and universities should follow in order to produce engineering professionals. ABET Criterion 3: Student Outcomes, originally published 20 years ago, has been revised over the years, but has always included an emphasis on student learning outcomes that will persist beyond the classroom into the engineering workforce.

Surveys of engineering faculty, students, graduates, and employers have sought to measure the impact of Criterion 3: Student Outcomes.[2] A 2006 study showed positive improvements since the adoption of Criterion 3, which enumerates some soft skills such as problem solving, teamwork, communication, and life-long learning. Engineering faculty were more likely to engage students in active learning, graduates rated their ability to apply engineering skills and to understand social context as higher, and employers ranked these skills as important.[3] It would seem that, for ABET at least, the goals of a liberal education and an engineering education are not so far removed.

Despite the gains attributed to Criterion 3, in 2000 a National Science Foundation study identified lingering competency gaps in engineering graduates.[4] Gaps were identified as the difference between the employers' rating of the competency's importance and the employer's perception of their employees' performance of the competency. Top competency gaps included: adapting to changing work environments, sharing information and cooperating with co-workers, listening skills, commitment to the organization, customer satisfaction and customer focus, the big picture of the organization, integrating one's functions with others, and ethical decision making.[5] According to the authors of the study, these competency gaps exist because of three curricular shortcomings: (1) traditional engineering and technology accreditation standards do not require students to take enough general education courses, (2) faculty may use these prescriptive standards as a reason not to change or update course materials, and (3) individual faculty members have a difficult time integrating non-technical/engineering concepts into their courses.[6] This points to the important and direct role liberal education can play in the education of engineers.

Surveys of working engineers also help to elucidate skills important to the profession. A 2012 survey asked recent engineering graduates to rank the ABET student outcomes from "extremely important" to "not at all important" in their professional experience.[7] The top cluster of alumni-ranked competencies, which includes ratings that are statistically distinct from all competencies in the bottom cluster, include: teamwork, data analysis, problem solving, and communication. The study's author acknowledges that "engineering faculty may groan inwardly at the notion of adding anything to their jam-packed curriculum," but points out that other disciplines, such as medicine, are also working to successfully combine technical and professional competencies without simply “tacking on” competencies.[8] While it may be difficult for engineering faculty to modify their curricula to meet these needs, what happens in the general education classroom can be adapted based on what the faculty member thinks are the primary goals of the course.

It is acknowledged that “engineering students have so much to learn before they can actually start practicing in the field, safely, that a formal rigorous engineering education at the Bachelors level is inescapable.”[9] However, because competency in soft skills is also critical to the profession, it is essential to look beyond textbook learning. A National Science Foundation study recommends engineering faculty engage students in “collaborative problem-solving, analysis, synthesis, critical thinking, reasoning, and reflections to real-world situations,” and that “new learning approaches must be put to use that heighten practical learning and allow students to demonstrate the application of their studies to real-world situations.”[10] Interestingly, the proposed revision to Criterion 3 still notes the importance of “global, economic, environmental, and social contexts” but adds the notion that students should be able to make “informed judgments” about them. The statement about life-long learning has been enhanced with a greater emphasis on information literacy, expecting that students should have “an ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.” Given the close affiliation of these goals with the standards of a liberal education, it seems possible that general education courses within the engineering curriculum could meet these needs.

One way to address these competency gaps is to introduce engineering students to case studies. Case studies provide students with real world examples of engineering problems and encourage them to consider aspects of society beyond a textbook problem. Brown and Brown describe using case studies from early 20th century publications, such as *Science and Invention* and *The Electrical Experimenter*, in order to compel physics undergraduates to examine the practicality of engineering solutions within a particular context.[11] One benefit to examining case studies is that students are forced to move beyond idealized mathematical formulae to take into account confounding, real world elements such as wind resistance, friction, or imperfect trajectories.[12] Case studies also present students with ill-defined problems and/or solutions. They may be presented with too much, or not enough, information, forcing them to think critically about which components of the problem should be eliminated and where to find additional information in order to come up with a reasonable solution.[13] Forcing students out of their particular here and now may help them to understand that seemingly illogical engineering solutions may be rational in a different time, place, society, or political climate. Brown and Brown assert that an added benefit to using historical articles “where the technology did not end up being implemented, or where the technology is humorous, reduc[es] the potential fear some students may have about being ‘wrong’ in their conjectures.”[14] In other words, the exercise allows students to gain essential practice in real world problem-solving in a low-stakes situation.

Case studies are also valuable teaching tools in civil engineering courses. Both Cleveland State University[15] and University of Pittsburgh at Johnstown[16] offer courses that engage engineering undergraduates in archival research about local civil engineering projects. In the Engineering History and Heritage course at Cleveland State University, students gain practice in studying the historical, social, political, and ethical considerations in engineering. This course was designed specifically to address these “principles that are vitally important to the professional practice of engineering, but are often difficult to incorporate into the curriculum."[17] The case studies, which included landmark buildings and bridges in Cleveland, also helped the students to "make a connection between their local built environment and their chosen profession."[18] Students in the University of Pittsburgh course had a similarly positive experiences, finding that "archival materials provide a more complete picture of the events and views of those involved," especially relating to the intersections of civil engineering and public policy.[19]

The use of case studies in these physics and engineering courses are examples of how non-technical ABET student outcomes may be smoothly incorporated into the curriculum. Furthermore, history and engineering are related disciplines in their dependence on understanding and interpreting context. Engineering, more so than pure science, is bound to creating elegant and inventive solutions within a particular time, place, and social climate.[20] Literature in the history of technology may be particularly instructive to engineering students' understanding of why "engineering solutions cannot be transplanted from one situation to another."[21] Just as the past may inform, but not predict, the future, engineers may not be able to rely on past experience to predict solutions for new contexts and clients. "As such, engineering students and practitioners probably need good doses of history, because an appreciation of a parallel discipline will give greater insights into the way one's own discipline should operate…[and may] arouse in students a curiosity for asking why something did or did not happen."[22]

Information literacy not only teaches students how to locate and evaluate sources that will help them to solve engineering problems, it also teaches students to develop research skills, to ask good questions, and, ultimately, to think critically.[23] Engineering students should be able to think critically about a problem as well as to "[think] critically *about* engineering, asking questions about the production of technology and our relationship to it: Who does engineering, and for whom? Who decides what is and is not engineering, and what ways of knowing (epistemologies) are appropriate to the discipline? Who benefits and who loses from engineering?"[24]

Our use of "archival interventions" in an undergraduate Science and Technology Studies course at NYU Tandon is similar to the case studies approach, but it also encourages students to work with materials in multiple formats, and to compare different archival engineering collections to each other. The archival interventions are a way to introduce engineering students to information literacy concepts, to encourage critical thinking, and to address ABET's proposed Student Outcomes 4-7 within engineering curricula. Our aim is to encourage students to explore archival collections as a way to think critically about engineering within particular contexts, to understand and cope with unstructured problems, to learn how to access and evaluate information, to practice communication within teams, and to feel closer to the work of real engineers. The practice of archival research, often a methodology of liberal education, has an equally important role to play in the education of engaged, analytical, and ethical engineers.

The Interventions

The two-credit Introduction to Science and Technology Studies course was an elective within the general education requirement (courses at the school are generally three or four credits, so this course consumed less time than the typical course). This course, which required no prerequisites, was evenly split between twelve first-year students and twelve advanced students. The students' majors were mixed; they represented eight different departments, as well as undeclared.

The first archival intervention occurred during the fourth meeting of the course, during the Invention and Entrepreneurship section (Appendix A). The archivist selected four collections from the school's archives: Judith Bregman Collection, Henry Jasik Papers, Keller Mechanical Engineering Corporation Collection, and Samuel Ruben Papers and pulled four or five items from each collection. These items represented the variety of formats that may exist in engineering archives: lab notebooks, patents, photographs, advertisements, prototypes, videos, informal writings, and publications. We did not give the students details about each collection, other than the general area of study; for example, electrical engineering. The students were asked to pick a collection, explore their objects within a group, and attempt to determine the larger scope of the collection. Students were given a set of questions to prompt their thinking about the creation of, and the connections between, the archival materials (Appendix B).

After studying their collection as a group, the students were re-distributed into new groups with one student representative from each collection. The students presented findings about their original collections: Who or what was the collection about? When were these items created? For what purpose or for whom were these items created? As a group, they were asked to discuss what each collection might have to say about science or engineering during its time of creation. They were also asked to think about what information was missing from the collections, which would have helped them to better understand the subject and its ties to the field (Appendix C).

After the second round of group discussions, we came together for a full class discussion about the collections, their ties to science, engineering, and invention, and broader class themes about the history of technology and innovation. We also conducted a clicker[ii] activity to help students identify primary versus secondary sources. The purpose of this activity was to get students to understand that a primary source is determined by the context and use of the source, as well as to discuss knowledge production in the sciences (i.e., a primary source, such as a laboratory notebook, can be the basis of a secondary source, such as a journal article, which may become part of generalized knowledge of a tertiary source, such as a handbook).

The second archival intervention occurred in the library, during the next class session. At this point, the students had been exposed to items from all of the collections. The archivist introduced more of each collection (1-3 boxes). The students were asked to select a collection for further exploration. This time, students were able to see the finding aids for each collection, which provide background information and a container list, and the archivist was on hand for questions and/or discussion. Students were given a very open-ended objective: explore a collection and relate it to course themes through a paper or presentation.

We designed these interventions in a way that would encourage the students to work together in teams to solve unstructured problems, to analyze and interpret the raw data of the archival

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[ii] Classroom clickers, or student response systems, are wireless handheld devices that enable students to respond to questions and to project the aggregate class response on the board. Grateful acknowledgement is given to training and equipment provided by NYU Tandon School of Engineering's Center for Faculty Innovations in Teaching and Learning.

materials, and to communicate their findings to the rest of the group. While the exploration of the archival materials was open-ended, we provided the question sets for the students as a way to guide them towards understanding the context of these materials within their time and place. Here, we are borrowing a humanities methodology of deeply reading documents within the context of engineering, invention, and innovation. The deep reading of the document, which in the case of primary sources may mean a photograph, video recording, or other non-text based item, refers to critically examining the item to understand its creation, time period, and importance.[25] For example, the travelling salesperson's suitcase of sample products from the Keller Mechanical Engineering Collection does not have a date stamped on it, but students should be able to reasonably guess when the suitcase was made and used based on their knowledge of manufacturing and machines in the United States. Similarly, a lab notebook might be dated, but its connection to a particular scientific field is not going to be written in its pages; the students need to use the content of the notebook, along with other documents in the collection, to surmise how the lab notes might have contributed to scientific literature within the field.

Results and Discussion

After completing the archival interventions and their written responses or presentations, students were asked to fill out a voluntary, anonymous survey (Appendix D). The survey measured the students' grasp of the material as well as their reactions to working with archival collections. Out of 24 students in the class, 18 students took the survey. The students in this sample included 6 first-year students, 3 sophomores, 1 junior, and 8 seniors. Their majors included: business and technology management, chemical and biomolecular engineering, computer engineering, construction engineering, electrical engineering, mechanical engineering, mathematics, science and technology studies, and undeclared.

We created a rubric to score each student's answer to the first three questions, which asked about the relationship between archival, or primary, sources, and engineering and innovation (Figure 2).

	Weak	***Moderate***	***Strong***
Question 1	The student leaves the question blank or gives an incorrect definition of a primary source. The student either provides no examples, or incorrect examples, of primary sources.	The student gives a correct definition of a primary source, but does not cite examples. Or, the student gives a lacking definition of a primary source, but does provide examples.	The student's definition of a primary source is correct and he/she provides correct examples of primary sources.

	Weak	*Moderate*	*Strong*
Question 2	The student leaves the question blank or gives an answer that does not relate to the question.	The student answers why someone might use primary sources, but does not connect the use specifically to scientists or engineers.	The student fully explains why a scientist or engineer might use primary sources. The student understands context plays a role in engineering/invention.
Question 3	The student leaves the question blank or the student answers why primary sources might be helpful, but not specifically to invention, innovation, and/or entrepreneurship.	The student provides a superficial connection between primary sources and invention, innovation, and/or entrepreneurship.	The student provides a thoughtful answer about the connection between primary sources and invention, innovation, and/or entrepreneurship and/or ties to STS concepts.

Figure 2: Rubric for scoring student responses to survey questions 1-3.

Giving one point for weak, two for medium and three for strong allowed us to calculate weighted averages for the three questions. In Figure 3, these are broken into averages for first-year and advanced students as well as an overall score for the class. There was not a great deal of differentiation between the two groups.

	Question 1				*Question 2*				*Question 3*			
	W	*M*	*S*	*Avg.*	*W*	*M*	*S*	*Avg.*	*W*	*M*	*S*	*Avg.*
First-year	2	0	5	2.4	2	4	1	1.9	2	3	2	2.0
Upperclass	2	6	4	2.2	5	4	2	1.6	3	6	3	2.0
Entire class	4	6	9	2.3	7	8	3	1.7	5	9	5	2.0

Figure 3. Scores and weighted averages, separated by class level

Averaging the scores for all three questions gave us the student's overall score of a weak, moderate, or strong grasp of the connections between primary sources, engineering, and STS concepts. First-year students contributed 2 weak, 3 moderate, and 1 strong overall responses. The upperclass students' overall responses were 6 weak, 5 moderate, and 1 strong.

The basic lesson of learning about primary sources was achieved fairly well, with three-quarters of the students being able to identify qualities of primary sources and nearly half providing examples. The scores on questions 2 and 3, however, were not as high. Some students seemed to be struggling to find words to answer these questions or answered in vague generalizations. Some answers to question 3 were notable from both groups, however:

- "[They] show us that the process of innovation and entrepreneurship is not always smooth and glamorous. The changes and events that happen (e.g., world wars and revolutions) could greatly impact the development path" (First-year)
- "They show us the trail of how inventions came to be. The auxiliary factors that culminate to form the direction of progress" (Senior)

Questions 4-7 asked the students to reflect on their experience of working with archival materials in the course. They were asked to give us feedback about what they liked best, what they liked least, challenges of working with archival materials, and suggestions for how to improve instruction with archival materials. These questions, which were less pointed than the first three, showed a genuine engagement with the issues of history.

We were interested in the challenges identified by the students. It was gratifying to us that their challenges were issues that would lead to more critical investigations of history. The idea that the sources were "unclear," that there was "too much information without a search engine," that there was "bias" and "unreliable information" were all lessons one would hope students would learn from this active experience in history. All too often, students think that history is an objective reporting of what happened in the past, and in the context of the history of technology students believe that the history is just the recording of how one development lead to the next. Thinking of history as a record of who passed the torch to whom fails to consider the interpretive action of history. The challenge students saw – that "all is subject to interpretation" – is, in our opinion, a successful lesson. Giving students unstructured information, which they had to synthesize, encouraged them to start thinking about the process of invention.

Top "likes" for the students were the feeling that they had gained insight into the past, or the profession, and the physical handling of original documents. For example, one student explained, "I felt like a real archaeologist/researcher. Mainly I felt I received an experience that placed me into the context of a historical analysis of the progression of technology." Another student commented that exploring an inventor's papers aided his or her understanding of the process of invention. "It was interesting to see a successful inventor's first hand notes of what failed and what didn't." As we have seen in other classes, students also felt like history became real.[26] The archival experience "allowed me to have a 'window' into the past that I would not otherwise have seen." For these students, all of them advanced, handling primary source documents helped them to place innovation within a specific context and to feel closer to the work of scientists and engineers.

A similar excitement was seen among first-year students. Although many of them commented about the physical experience of handling aged materials, some of them enjoyed the "glimpse into the past." One wrote, "I could look back in time and see what it took to implement i^2e."[iii] Another drew a colorful metaphor, writing that "I like[d] the Batman-ish feel of doing somewhat detective word in figuring out what it is exactly that our person was known for."

Although many students reported that handling the physical documents was the best part of working with archival materials, the care needed to handle older documents was one of the top listed challenges, and complaints, about the activity. While some students were nervous about damaging fragile, unique materials, others were more frustrated by the care required to keep materials in a certain order. In response to the survey question "What did you like least about working with archival materials?" one student replied, "Having to be so careful. I would like to mix and match things from other folders and put things together." This student's least favorite aspect of archival work is interesting in an era of digital media. In many digital humanities

[iii] i^2e, which stands for invention, innovation, and entrepreneurship, is part of the educational mission of NYU Tandon.

projects for special collections, a feature is the ability to pick, discard, and remix objects. With analog archives, there is no backend database keeping track of where each item belongs; the user must focus attention not only on the content of the materials, but also on keeping each item its proper folder and box. This type of searching can be tedious, another challenge students cited. One student, again comparing analog searching to digital searching, stated, "Too much information without a search engine."

In an effort to improve our next archival interventions, we asked the students to tell us what was missing from this introduction to archives and primary sources. Most students either left the question blank (4/18) or said nothing was missing from the introduction to archives (8/18). However, a third of the class (6/18) said they needed more guidance. This set of students said they wanted more background information about the materials, more time spent on the introduction to primary sources, and a more explicit focus on how the archival collections relate to present day research. Students react in different ways to the open-ended nature of this type of activity; some enjoy the freedom of piecing together undefined puzzles, while others are frustrated by the lack of direction. While some students may crave a more concrete set of questions and answers, these interventions give them a brief exposure to the unstructured and iterative process of real research.

Finally, we asked the students to rate, on a 1-5 Likert scale, their confidence level of working with primary sources in the future, with 1 being "not at all confident" and 5 being "extremely confident." The class average was 3.9, and no individual student marked below a 3. Although these interventions did not result in a uniform grasp of the connections between primary sources and engineering, and some students needed more support, the students' self-perception of how well they could work with primary sources in the future was confident.

We were particularly interested to see if there were any differences between first-year and students farther along in the engineering program. In this sample, there was no correlation between the student's year in the engineering program and his or her grasp of the connections between primary sources, engineering, and STS concepts. There was also no correlation between the student's major and his or her grasp of the material. One of the more surprising results is that STS majors did not fare better than other engineering majors in making these connections. These findings lead to future research questions, which would require a longitudinal study to fully understand: Do STS majors who experience the archival interventions go on to do better in future STS courses? Are first year students who are exposed to archival interventions more likely to feel engaged in the engineering program, or are they more likely to use primary sources in future research, such as capstone projects? While our study cannot answer these larger questions, it shows that these interventions can be integrated into an STS course without being "tacked on," and that engineering students who are exposed to methodologies of liberal education, such as archival research, feel more confident about engaging with primary source materials in the future.

Conclusion

The archival interventions in this Science and Technology Studies course related to current and proposed ABET student outcomes. Students were exposed to a different type of raw data than they might normally encounter in engineering classrooms. The raw data of the humanities often takes the form of primary source documents, which must be analyzed and interpreted in order to draw conclusions. The students were also asked to think about the context in which these primary sources were created.

Working with archival materials also gave students the opportunity to practice developing strategies to deal with uncertainty. Archival collections do not present a clearly formed argument, such as a scholarly article, and they are often missing vital pieces of information. Conversely, the piece of information needed to make an informed engineering decision (an environmental impact statement, a technical report, original lab notes) may exist not online, but in an archive. Learning that the archives are not only the domain of humanities scholars, but also hold important documents relating to engineering and invention, aids the students' ability to locate these forms of knowledge. Finally, students were asked to either present an oral report to the class, or a written summary of their findings, which required them to communicate with other students from a range of majors. Although the overall gains students achieved through using these collections were mixed, it is important to allow them to practice these skills within engineering curricula.

In future work, we realize in this analysis that more data could have been collected. The somewhat strained answers to questions 2 and 3 contrasted to more interesting insights found in questions 4-6. This, to us, suggests that a more open-ended survey would be helpful in eliciting students' insights into history. What is more, focused interviews about the impact of the experience on the students' understanding of engineering would have been a way for us to gain better insight into the effectiveness of our approach as well as to help students think about what they had experienced.

Appendix A

Archival Intro Activity for STS_UY 1002
September 24, 2015 | 110 minutes

Objectives:

1.) To discuss the differences between primary and secondary sources through hands-on experience with archival materials.

2.) To understand how primary and secondary sources contribute to knowledge production in scientific fields.

3.) To think about different types of formats and the means of their creation. When, how, for what purpose/for whom, where were these documents created.

4.) To gain a preliminary understanding of the types of items archives collect and how they can be used for research.

Class outline:

1.) Ask the students to pick a collection of materials to explore (4 groups of 6). The students will be asked to explore pre-curated set of materials and will be given a set of questions to prompt their thinking about the creation of the materials and connections between materials. Students will answer Question Set 1 (**30 minutes**).

2.) The groups will re-mix and present their findings to each other in small groups. The groups will have a new set of questions to answer. These questions will focus on primary/secondary sources, archival research/archival silences. Students will answer Question Set 2 (**30 minutes**)

3.) After each group has discussed, we will have a full class discussion about how these objects tie into knowledge production in the sciences and broader course themes. Led by Prof. Leslie (**30 minutes**).

4.) Explain next week's archival activity. The same collections will be used. (**10 minutes**).

Appendix B

Question Set 1

1.) Describe the objects in your collection:

What is the format of each item?

Who made or used these items?

When were these items created?

Are these items primary or secondary sources?

2.) What is the purpose of these objects?

Why were these objects created?

How would these items be used at the time they were created?

Why might we study these items today, or how could we use them today?

Would these items be used in different ways by scientists, historians, or students?

Appendix C

Question Set 2

1.) Describe your collection to the other groups. Note the topics/items in other collections:

2.) What field(s) of science is associated with each collection? What might these collections add to the understanding of these fields during the time the objects were created?

3.) What is missing from each collection that would help you to understand it better?

4.) Identify whether the following items from the archival collections are primary or secondary sources:

- "Handbook of the Elements," Samuel Ruben, 1967

  Primary or secondary? Why?

- "Swinging Quanta," Judith Bregman, 1973

  Primary or secondary? Why?

- "American Machinist" advertisement, Keller Mechanical Engineering Corporation, 1916

  Primary or secondary? Why?

- "Henry Jasik Papers on X-Ray" binder, Henry Jasik, 1934-1986

  Primary or secondary? Why?

Appendix D

Post-Intervention Survey

This is an anonymous survey that for a study being conducted by your instructor in this class, Dr. Christopher Leslie, and Lindsay Anderberg, Archivist and User Services Librarian. We do not think that anything you write here would impact your reputation in the class or your grades, but to make sure, Professor Leslie will not have access to the survey responses until after grades have been submitted for the semester. Furthermore, your participation in this study if voluntary. Feel free to skip any questions that you do not want to answer. We will use this information, along with a survey we conduct at the end of the semester, to make presentations and write articles about the experience of undergraduates who conduct library research. If you do not want to be quoted (anonymously) about any of these questions, please do not write anything for an answer. If you have questions, please feel free to email one of us at chris.leslie@nyu.edu or landerberg@nyu.edu Thank you for your time.

Year of study (circle one): Freshman Sophomore Junior Senior **Major:** ____________

1. What is a primary source? Please provide a few examples from this class.

2. Why would scientists or engineers use primary or archival sources?

3. How can primary sources improve our understanding of invention, innovation, and/or entrepreneurship?

4. What are some challenges with using primary sources?

5. What did you like best about working with archival material?

6. What did you like least about working with archival material?

7. What was missing from this introduction to archival materials that could have helped you?

8. How confident are you that you could do research with primary sources in the future?

   1 (not at all confident) 2 3 4 5 (extremely confident)

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