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An Uncommon Use for an Uncommon Press:
Approaching Object-Based STEM Education in Cultural Institutions
By Way of a Reconstructed English Common Press

A THESIS SUBMITTED
IN PARTIAL FULFILLMENT OF THE
BACHELOR OF SCIENCE DEGREE
IN MUSEUM STUDIES

DEPARTMENT OF PERFORMING ARTS AND VISUAL CULTURE

BY

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Abstract

The Uncommon Press Project was a cross-departmental, multi-disciplinary capstone project by students from the Kate Gleason College of Engineering and the College of Liberal Arts at Rochester Institute of Technology which aimed to create a historically accurate reconstruction of a circa 1790 English common press for the Cary Graphic Arts Collection. As a member of the team undertaking this project, I was involved in the research, materials acquisition, construction, and social media engagement efforts. In addition to my role as part of this team, I desired, as an individual scholar, to learn how a reconstructed press can serve as an educational device. This led to the question: what is the most successful way for a reconstructed 18th-century printing press to be utilized as an educational object? To examine this question, I began by analyzing current scholarly literature on museum educational methods, with a focus on object-based education, in addition to examining Common Core and Next Generation Science Standards for STEM education. I helped facilitate the user-testing of the press with 200 visitors, a majority of whom were K-8 students. I further explored the application of STEM education standards to a cultural object by defining the ways in which the Uncommon Press, through both hands-on use and observation, could be correlated to individual standards for STEM education of students in kindergarten through eighth grade. Building upon my participation in the multi-disciplinary team, the interactive demonstration, and my additional research findings, I conclude that the Common Core and Next Generation Science Standards for STEM education provide an appropriate lens for facilitating object-based, STEM education in cultural institutions.
Introduction

In this thesis, I summarize the existing literature on museum education, with an emphasis on object-based education, and particularly K-8 curriculum aligned with STEM (Science, Technology, Engineering, and Mathematics) subjects, to demonstrate how authentic or reconstructed objects in a museum, archive, or library setting can be employed as focal points for STEM education.¹ I begin by providing a brief overview of the current literature pertaining to the research area that is the focal point of the reconstruction; that is, literature which examines the wooden common press, so as to assure the historical accuracy of such a reconstruction. Accuracy and adherence to historical facts are certainly imperative in museum education, and such writings therefore create a solid foundation for this research. Next, I offer a summary of two sets of education standards, Common Core and Next Generation Science Standards, which align with STEM principles. Ultimately, I utilize the case study of the Uncommon Press, a historically accurate reconstruction of a late-eighteenth-century English common press, as an example of how one could craft an educational plan that merges object-based learning and STEM standards. A printing press reconstruction is both an object which provides opportunities for both hands-on interactivity and observational engagement, and a machine which requires an understanding of STEM principles for its creation and reflects these principles in its operation. Accordingly, the combination of object-based learning methods and STEM education standards seems to be most fruitful when seeking to maximize the press’s educational potential.

¹ Judith A. Ramaley, who served at the National Science Foundation as Assistant Director for Education and Human Resources 2001 to 2004, is widely credited with the creation of the acronym STEM, although the focus on "improv[ing] education in mathematics, science, engineering, and other technology-related subjects" was noted to be the goal of a 1985 Carnegie Forum on Education and the Economy.
The Uncommon Press Project was a cross-departmental, multi-disciplinary capstone project by students from the Kate Gleason College of Engineering and the College of Liberal Arts at Rochester Institute of Technology which aimed to create a historically accurate reconstruction of a circa 1790 English common press for the Cary Graphic Arts Collection. As a member of the team undertaking this project, I was involved in the research, materials acquisition, construction, and social media engagement efforts. In addition to my role as part of this team, I desired, as an individual scholar, to learn how a reconstructed press can serve as an educational device. This led to the question: what is the most successful way for a reconstructed 18th-century printing press to be utilized as an educational object? To examine this question, I began by analyzing current scholarly literature on museum educational methods, with a focus on object-based education, in addition to examining Common Core and Next Generation Science Standards for STEM education. I helped facilitate the user-testing of the press with 200 visitors, a majority of whom were K-8 students. I further explored the application of STEM education standards to a cultural object by defining the ways in which the Uncommon Press, through both hands-on use and observation, could be correlated to individual standards for STEM education of students in kindergarten through eighth grade. Building upon my participation in the multi-disciplinary team, the interactive demonstration, and my additional research findings, I conclude that the Common Core and Next Generation Science Standards for STEM education provide an appropriate lens for facilitating object-based, STEM education in cultural institutions.²

² To review the NGSS standards, visit https://www.nextgenscience.org/overview-dci. To examine the Common Core mathematics standards, visit http://www.corestandards.org/Math/.
**Case Study: The Uncommon Press Project**

The Uncommon Press Project was born of two assets from Rochester Institute of Technology (RIT)—engineering and special collections. The Uncommon Press team originated at RIT in January of 2017, as a group of three mechanical engineering students, Seth Gottlieb, Randall Paulhamus, and Ferris Nicolais, and one Industrial and Systems Engineering student, Veronica Hebbard.\(^3\) RIT’s campus is home to many special collections, including the Cary Graphic Arts Collection, which focuses on graphic communication history and practices, with a collection that includes rare books, books and materials related to the graphic arts, and books and objects related to printing and printing history. While the Cary Graphic Arts Collection had numerous iron presses in its possession, the absence of a wooden common press created a significant collections gap, as wooden presses were utilized throughout the majority of printing history.\(^4\) Accordingly, the Cary Graphic Arts Collection sought to obtain a wooden common press, in part to flesh out its nearly comprehensive collection of printing presses, although the goal was certainly greater than merely obtaining a collections piece. As Dr. Steven Galbraith, curator at the Cary Graphic Arts Collection, explained: “The initial goal of the project was to add a wooden common press to our collection of historical printing presses. Future goals include using the press for exhibitions and hands-on teaching, as well as extending access to the press through virtual and augmented reality.”\(^5\) Original English wooden common presses are quite

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\(^3\) All RIT students are required to complete a senior capstone project to qualify for graduation, and the Uncommon Press Project served this goal for Seth, Randall, Farris, and Veronica.

\(^4\) The wooden press was in utilized for a majority of printing history, beginning with Johannes Gutenberg’s 15\(^{th}\)-century press and continuing until the start of the 19th century, when the iron press was first created.

\(^5\) Steven Galbraith, email to the author, November 1, 2017. Dr. Steven Galbraith holds a Ph.D. in English Literature from Ohio State University and an M.L.S. from the University of Buffalo. Before being named
rare, however, and the preservation requirements for an original, even if it could be obtained, would prevent the Cary Graphic Arts Collection from utilizing the press for educational purposes. Accordingly, in January 2016, the engineering team took on the task of researching, designating, and building a historically accurate press, with a plan to work from January 2016 to December 2016. At the start of the project, the team consulted with the Dr. Galbraith to determine the parameters of the Cary Graphic Arts Collection’s needs, and ultimately decided to create a reconstruction of a circa 1790 English wooden common press.

The team began by conducting research using existing literature on printing and printing presses. The next step was to visit numerous cultural institutions which housed both original English wooden common presses and reconstructions, to conduct on-site research, which included taking a broad range of measurements and photographically documenting the presses.

At each of the five sites the team visited, we measured individual parts of the press, and took

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Curator of the Cary Graphic Arts Collection in 2011, Galbraith served as the Andrew W. Mellon Curator of Books at the Folger Shakespeare Library in Washington, D.C.

6 Fewer than two dozen presses of this type currently reside in North America.

7 The team defined the term “reconstruction” as a representation of what might have been, instead of a direct copy of a specific press which had already been created. A set of four criterion were also established by the team to define a wooden common press: 1. It must primarily consist of wood. Otherwise, it wouldn’t be an English wooden common press. 2. It must use a screw to apply force to the platen. In this case, that screw is called the spindle, and applies force to the platen, which is a flat, rectangular piece of wood which then presses the paper into the inked type. 3. It must require two pulls for full printing, meaning that due to the smaller size of the platen, two pulls of the bar are required to print the entire side of one full sheet of paper. 4. The characteristics of its design must predate 1800, which would allow the press to predate Earl Charles Stanhope’s invention of the iron printing press, which occurred at the turn of the century.

8 Caleb Stower’s 1808 manual, The Printer’s Grammar, Joseph Moxon’s Mechanick Exercises from 1703, and the Ralph Green papers from the mid-19th century

9 The team’s first research trip occurred in February 2016, during which Seth, Veronica, Randall, and Ferris visited the Mackenzie Printery and Newspaper Museum in Queenston, Ontario, Canada, to analyze the Louis Roy Press (Figure 1). On the second research trip, in March 2016, Seth, Randall, and I visited the Museum of Newport History in Newport, Rhode Island, to see the Franklin Press (Figure 2); The Printing Office of Edes & Gill in Boston, MA, to study Ralph Green’s reconstruction (Figure 3); the Exeter Historical Society of Exeter, NH, to examine the Robert Luist Fowle Press (Figure 4); and, finally, the Vermont Historical Society in Montpelier, VT, to analyze the Dresden Press (Figure 5).
over 300 photographs per press. This resulted in a collection of between fifteen hundred and two thousand photographs for documentation and further study.\footnote{The photo collection, while currently not accessible to the public, can be viewed by appointment at the Cary Graphic Arts Collection.} I joined the team in March 2016, and assisted with research at the four sites we visited that month. The decision to add a team member whose primary purpose was to provide a research and museum studies focused perspective to the work also served to illustrate the way in which STEM facilitation best works, a manner which is reflected in the culmination of this thesis.\footnote{As explained by the 2016 report from the U.S. Department of Education, \textit{STEM 2026}, “interdisciplinary approaches to teaching and learning that appropriately and effectively integrate and show connections among key concepts and ideas between two or more STEM disciplines or between one or more STEM disciplines and a non-STEM discipline are more nuanced than simply integrating content across traditionally siloed classes.”} Back at RIT, the team studied the data gathered on the research trips, and utilized it to begin creating plans for the press, which were largely completed by the end of the May 2016.

Summer 2016 marked the beginning of the team’s relationship with the Genesee Country Village and Museum (GCV&M); Matthew Schofield began forging pieces for the press in the village blacksmith shop, and Ron Maguire began to turn the wooden handle of the press.\footnote{In addition to serving as Coordinator of Historic Trades and Agriculture at the Genesee Country Village & Museum, Schofield is also their blacksmith, and created a majority of the metal pieces for the press, including the bar, ribs, cramp irons, hooks, multiple parts for the rounce handle, and many more pieces. Ron Maguire is a volunteer at the museum. A glossary of terms is available. See Appendix 2.} From September through early December, the team and an array of engineering student volunteers worked in the machine shop to create more intricate metal pieces, while our contracted master woodworker, S. F. Spector, worked to build the extensive wooden parts of the press. During October and November, the team made near-weekly visits to Harrisburg, Pennsylvania, to assist Spector with his work, and ultimately brought all the wooden pieces back to RIT near the end of November. During the next two weeks, the fabrication and forging of the remaining metal pieces
were completed. On December 8 and 9, the team and our volunteers assembled the press, and ultimately presented it at an unveiling ceremony at the Cary Graphic Arts Collection on the evening of December 9.\footnote{The Uncommon Press team has released a technical paper detailing their project, which can be found at http://edge.rit.edu/edge/P16510/public/creo/final/p16510_tech_paper.pdf}
Literature Review

The English Common Press

When searching for recent scholarly writings on the construction of the English common press, one will undoubtedly encounter the work of three individuals. The first, and primary source consists of the works by Elizabeth M. Harris and Clinton Sisson. Harris published a number of pieces of scholarship related to printing presses, including the wooden common press, and printing processes. Sisson often assisted Harris in her studies, providing both drawings and insight into engineering and construction. The other source is Ralph Green, an engineer and amateur printing press historian, who created a common press reconstruction during the 1950s, along with plans for said press, in addition to writing multiple books on the subject.

In the “Materials and Tools” chapter of The Common Press, Harris and Sisson seek to address the question of what types of materials and tools should be used to replicate an early 18th-century wooden common press. Their methodology, which included the use of personal historical knowledge of wooden printing presses, the review of literature from experts in the field, and research into materials used in the construction and maintenance of modern replica presses, provide readers with a range of evidence in support of the authors’ claims. This information includes data from historical presses, information on materials used in press operations at Colonial Williamsburg, and first-person historical knowledge of wooden printing presses. It also includes data from experts such as William Savage (1770–1843), an 18th-century printer, and Joseph Moxon (1627-1691), a printing expert who wrote the earliest-known English

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14 Elizabeth Harris served as Curator of Graphic Arts at the National Museum of American History from the early 1970s until her retirement in 1997, and Clinton Sisson was a scholar and engineer.
manual of printing,\textsuperscript{15} which detailed the construction and care necessary for a wooden common press.\textsuperscript{16}

The information offered by Harris and Sisson includes a range of materials which were historically used in the construction of an English common press, such as hardwoods, leather, brass, and iron. This work also gives details on the wide range of modern tools which one would need to create their own press, such as instruments for both metalworking and woodworking, including hammers and forging equipment, saws and sanders.

In \textit{Works of Ralph Green}, the author details the processes he utilized to create multiple presses during the mid-19\textsuperscript{th} century. The methodologies used in his overview are drawn from his past experiences with presses, and include research into commercially sold presses and examinations of historical guides and documents which related to printing presses in general and to building presses. Green incorporates evidence such as his personal knowledge as a structural engineer, historical data obtained from preparing press plans for Colonial Williamsburg, and information from photos and catalogs of various presses. In essence, his conclusion is that there are a variety of options for building a printing press, with perhaps the best choice being to combine historically accurate components with more modern, and therefore historically inaccurate, steel reinforcements, which Green recommends because the pressure exerted during the printing process has the potential to damage the many wooden parts of the press.

\textsuperscript{15} Moxon’s \textit{Mechanick Exercises} was released in a series of publications during the 1670s and 1680s, and was published as a book in 1703.
Museum Education Methodologies

Object-Based Education

In 2009, Dorothea Lasky, who was at the time a third-year doctoral student concentrating in Teaching, Learning, and Curriculum at the University of Pennsylvania, examined the nature of object-based education, specifically focusing on learning at art museums. In her Penn GSE Perspectives on Urban Education journal commentary, “Learning from Objects: A Future for 21st Century Urban Arts Education,” Lasky highlights the connection between the mind and the body's actions, and the perspective that this connection helps a person to learn through the physical experiences of their body. Based on research by Olivia C. Frost, a professor at the University of Michigan, Lasky posits that the success of object-based education is due in part to the fact that physical objects are linked to cultures, and therefore individuals who are learning from the object are able to interact with its culture and that culture's ideas, all on a physical, bodily level. Citing the 1989 book New Museology, specifically a chapter written by Charles S. Smith, a British cultural historian who currently serves as the Secretary and Chief Executive of the Royal Academy of Arts, Lasky asserts that the way in which an artifact's status changes throughout history provides students with an opportunity to better understand how ideas similarly evolve through history. Ultimately, this allows students to realize not only the object's relationship to the world around it, but also their own relational place within the world.

The positions for which Lasky advocates in this article appear to be well-researched and well-argued. She utilizes a broad range of sources to support her perspective, including additional writings by experts, such as John Dewey and George Hein, analyses of museum-school partnerships, and in-depth case study from the Victoria and Albert Museum.²²

**Interactive-Based and Interpreter-Based Education**

In certain situations, such as when a museum has an educational collection, object-based education can become a hands-on, interactive experience. For more conceptual education, where an object from the collection is not specifically utilized, both low and high technology interactives can be utilized. This prevalence of object-based and digital interactives makes it necessary to examine the merits of interactive-based education. In her 2006 article, *Interactive Experiences and Contextual Learning in Museums*, published in the *Studies in Art Education* journal, Dr. EunJung Chang, an Associate Professor in Art Education at Francis Marion University (SC, US), investigates the way in which interactive experiences in the museum space can serve to create more meaningful learning experiences.²³

While interactive experiences can consist solely of the visitor’s engagement with an object, there are also circumstances in which visitors can benefit from guidance, and perhaps

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²² Readers may be particularly interested in John Dewey's *Experience and Education* and George Hein's *Learning in the Museum*.

²³ Chang analyzes John H. Falk and Lynn D. Dierking’s Interactive Experience Model, their Contextual Model of Learning, a psychographic study on the motivations for museum visit frequency, a Cleveland Foundation study on the impacts of cultural experiences on a child’s attitudes toward and participation in the arts later in their life, and multiple studies on label reading times. She offers five suggestions for ways that museum education can provide future visitors with more meaningful learning experiences: 1. Museums should provide learning experiences which make the most use of visitors’ personal perspectives on and approaches to learning; 2. They should utilize social forms of learning by facilitating interactions between visitors, and between visitors and museum staff; 3. Museums should provide physical contexts which support meaningful experiential learning; 4. Institutions should build upon their visitors’ culturally derived contexts of learning; 5. Museum environments and facilities should be accessible and inclusive.
further education. In these scenarios, along with ones which do not focus specifically on objects or interactivity, the use of an interpreter-based educational method can be useful. In her 2012 doctoral dissertation, *An Exploration of Learning in a Living History Museum: Family Groups, Costumed Interpreters, their Interactions, and the Making of Meaning*, Johanna Margot Bromberg Craig examines the learning experiences of families visiting a living history museum, specifically focusing on interactions with costumed interpreters and the perspectives regarding museum learning held by both the families and the interpreters.  

In the case of a cultural artifact which can be personally operated by visitors, such as a reconstructed English common press, a digital interactive is likely to be far less necessary, meaning that the interactive-based method of education is essentially subsumed into a hands-on object-based education method. Furthermore, a written educational guide for students, while certainly not a substitute for an interpreter, can still be paired with a collections object to educate visitors using the institution’s narrative, predicted motivations for visiting and predilections for interaction, and generalized standards for past knowledge. Certain key factors from interpreter-based education, then, can be employed within an object-based method of education. Accordingly, a primarily object-based education method, instilled with aspects of interactive- and interpreter-based methods, seems best suited for use with such a cultural object.

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24 In her qualitative study, Craig utilized observations, interviews, and document collection to examine six family groups (each including at least one child between 7 and 18 and one parent, with a cap of 5 members per group), seven costumed interpreters, and an upper-level museum administrator, to examine engagement aspects such as eye contact, body language, question asking, and interpreter strategies. She found that the learning experiences consisted of intricate interactions between the interpreter’s conveyance of the institution’s narrative and each family group’s predilections for interaction and motivations for visiting, that each visitor made personal connections to the experience based on their past knowledge and personal identities, and that while the interpreters are primarily educators, they also seek to provide a duality of education and entertainment in their interactions.
STEM Education Standards

The Common Core (CC) is a set of academic standards focused on mathematics and English language arts/literacy, created in 2009 by a partnership of the Council of Chief State School Officers (CCSSO) and the National Governors Association Center for Best Practices. CC standards are intended to ensure that students from Kindergarten to grade 12 obtain the knowledge and skills necessary for successful collegiate and professional careers. According to the CC website, the standards are "research- and evidence-based; clear, understandable, and consistent; aligned with college and career expectations; based on rigorous content and application of knowledge through higher-order thinking skills; built upon the strengths and lessons of current state standards; informed by other top performing countries in order to prepare all students for success in our global economy and society."25

In 2009, educational and political leaders from forty-eight states, the District of Columbia, and two territories formed the Common Core State Standards Initiative (CCSSI), through which they began working together to develop "consistent, real-world learning goals… to ensure all students, regardless of where they live, are graduating high school prepared for college, career, and life." Building upon the most successful preexisting state standards, the CCSSI sought to craft a new and consistent set of standards by incorporating experience and knowledge supplied by teachers, states, and content experts, tempering these sources with public feedback.26 The CCSSI's goal, as noted in their standards-setting criteria, was to create "essential,  

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rigorous, clear and specific, coherent, and internationally benchmarked" standards, which would serve to “ensure [that] all students are prepared for all entry-level, credit-bearing, academic college courses in English, mathematics, the sciences, the social sciences, and the humanities.”

The standards are divided into two sections: English Language Arts Standards and Mathematics Standards. The standards under the latter section are categorized into groupings of related standards called “domains,” and can be sorted by grade level or domains. These domains include “Counting & Cardinality,” “Operations & Algebraic Thinking,” “Number & Operations in Base Ten,” ”Number and Operations — Fractions,” “Measurement & Data,” “Geometry, Ratios & Proportional Relationships,” “The Number System,” “Expressions & Equations,” “Functions,” and “Statistics & Probability.” The standards for Kindergarten through 8th grade are divided into four to six domains per grade, with higher grades requiring more domains due to their increased level of complexity.

Ensuring students' competency in English and mathematics is clearly the primary focus on the Common Core Standards, even though the CCSSI's Standards-Setting Criteria did note that its goal of preparing students for academic college courses included other areas of study, such as the sciences. While a strong competency in mathematics is certainly important for success in essentially all scientific fields, Common Core Standards are visibly lacking standards which specifically address learning in the fields of science, technology, and engineering. Accordingly, it appears necessary to locate and utilize additional resources along with Common Core Standards, if one is to create a fully comprehensive framework for STEM education.

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The most prominent and widely adopted instance of such a resource is another set of education standards which has emerged during the last decade, Next Generation Science Standards (NGSS). NGSS is a set of STEM education standards which debuted in 2013, and has been adopted by 18 states and the District of Columbia. This standards system utilizes a three-dimensional approach to science education, with each dimension simultaneously supporting and being supported by its counterparts. These three dimensions are disciplinary core ideas, science and engineering practices, and crosscutting concepts.

A “disciplinary core idea,” as defined by the National Research Council, is an idea which “focus[es on] K–12 science curriculum, instruction and assessments on the most important aspects of science disciplinary content knowledge.” For an idea to be classified as “core,” it must meet at least two of four criteria, which state that the idea must “[h]ave broad importance across multiple sciences or engineering disciplines or be a key organizing principle of a single discipline; provide a key tool for understanding or investigating more complex ideas and solving problems; relate to the interests and life experiences of students or be connected to societal or personal concerns that require scientific or technological knowledge; be teachable and learnable over multiple grades at increasing levels of depth and sophistication.” Teams working in four domains of science: engineering and technology, physical sciences, earth and space sciences, and

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28 As of December 2016, the states which have adopted the Next Generation Science Standards include Arkansas, California, Connecticut, Delaware, Hawaii, Illinois, Iowa, Kansas, Kentucky, Maryland, Michigan, Nevada, New Hampshire, New Jersey, Oregon, Rhode Island, Vermont and Washington, along with the District of Columbia, in total representing more than 35% of U.S. students. While New York has not adopted the standards, I chose to employ them because they offer a significant focus on engineering practices.


30 Ibid.
life sciences, conducted extensive analysis of existing literature and data to assist the NRC committee.  

The term “scientific practices,” as utilized by the NGSS, refers specifically to engineering practices which ultimately design solutions for stated problems, through the use of science and mathematics. While scientific inquiry creates a question which the process of investigation can solve, “scientific practices” such as engineering design are focused specifically on creating a problem which can be solved by the formulation of an engineering-based design.  

In using the term “crosscutting concepts,” NGSS is referencing the NRC Framework's application of the term, which is defined as concepts "that bridge disciplinary boundaries, having explanatory value throughout much of science and engineering." These concepts bridge divides between the various disciplines, thereby creating a system of interrelated knowledge which provide students with a cohesive and scientifically founded view of the world.  

NGSS standards, which are broken into K-12 groupings, are intended to provide students with an advanced comprehension of the crosscutting concepts, science and engineering practices, and disciplinary core ideas which they will need to understand to be sufficiently prepared for college and STEM careers. In combination with Common Core standards, which offer literary and mathematical supplements to science standards, NGSS serves to prepare students for their academic or professional careers. Furthermore, it provides teachers and educators with a set of

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31 The committee and teams examined National Academies Press publications including *How People Learn, Taking Science to School, Learning Science in Informal Environments, Systems for State Science Assessment,* and *America’s Lab Report,* the NAEP 2009 Science Framework, the College Board *Science Standards for College Success,* the National Science Teacher Association's Science Anchors initiative, the *National Science Education Standards* developed by the NRC, and the *Benchmarks for Science Literacy* developed by American Association for the Advancement of Science.  
33 *Next Generation Science Standards,* https://www.nextgenscience.org/faqs##2.5.  
34 The crosscutting concepts include: cause and effect; systems and system models; energy and matter; scale, proportion, and quantity; patterns; stability and change; and structure and function.
objectives, which can be viewed by domain or subject, and are broken down by grade. This set of objectives can then be applied to a variety of educational opportunities, including examinations of and interactions with cultural objects.
Hands-on Demonstration of the Uncommon Press at Imagine RIT 2017

On May 6, 2017, as part of Imagine RIT, the Cary Graphic Arts Collection hosted a hands-on printing demonstration just outside the Cary Graphic Arts Collection, on the second floor of RIT’s Wallace Center, where the Uncommon Press is currently located. The event provided visitors an interactive opportunity with the press, in which they could personally perform the act of printing on an English wooden common press. With the assistance of Dr. Steven Galbraith and Amelia Hugill-Fontanel, three members of the team, Seth Gottleib, Randall Paulhamus, and I, spoke with visitors about the Uncommon Press Project, the press itself and some of the ways it relates to STEM learning, and the history of the English common press and printing history, in addition to helping participants operate the press.

During the seven-hour event, hundreds of visitors came to see the Uncommon Press and to speak with the team, Steven, and Amelia. A majority of those in attendance made up family groups, including one or two parents with their children, grandparents with their grandchildren, and adults with their younger siblings. Approximately two hundred people accepted the opportunity to operate the press themselves, and each one printed a commemorative copy of the First Amendment of the United States Constitution, which they then took home as a keepsake. Children and teenagers comprise the primary audience for Imagine RIT, making the event a prime testbed for my theories of and approaches to education. Over half of the visitors who used the press were children ranging from Kindergarten to 8th grade. Throughout the day, the three

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35 Rochester Institute of Technology, https://www.rit.edu/imagine/. Imagine RIT: Innovation and Creativity Festival is an annual campus-wide event created to highlight the creativity and innovation of RIT students, faculty, and staff members, through the public presentation of research projects, interactive presentations, hands-on demonstrations, and exhibitions.

36 Amelia serves as Associate Curator at the Cary Graphic Arts Collection, publishes and lectures on the history and practice of the typographic arts and printing history, as is also an active printer herself. Although she was unable to stay throughout the day, she made the preparations necessary for the printing which took place during the event.
team members were constantly dialoguing with these students, speaking about the history of printing presses and the practice of printing, the nature of Uncommon Press Project itself, and the ways in which STEM fields and practices intersected with and were critical in the development and execution of the project. The particular emphasis on STEM practices which naturally emerged during our conversations with students served, in part, to inspire the goal of this thesis. Ultimately, the conversations which Seth, Randall, and I had with these young students were integral in my work to fully correlate the Uncommon Press, as a cultural artifact, to STEM education standards utilized in the United States.

**Evaluation of User-Testing at the Imagine RIT 2017 Demonstration**

The demonstration of the press in May 2017 provided a perfect opportunity for user testing of my object-based and STEM learning infused approach to education, as I could actively observe visitors as they interacted with the press and conversed with team members who were facilitating the event and speaking about the project. The informal visitor engagement study I was able to conduct through the demonstration not only meant that I could determine how well the user testing was received at Imagine RIT, but importantly meant that I could evaluate the success of a hands-on experience with the press which offered an educational focus that emphasized STEM learning. Accordingly, I formed the research question to be analyzed through the user testing at Imagine RIT: how successful might a STEM-focused hands-on learning opportunity be when utilizing a reconstructed press as a touchstone?

To appraise the user testing which took place at Imagine RIT, and to answer the research question, I identified a set of three criteria to examine in my evaluation: (A) The approximate length of time visitors engaged with the demonstration both actively by printing on the press, and passively by listening attentively while waiting in line or waiting for a companion who was
utilizing the press (engagement time); (B) The extent to which visitors engaged with the facilitating team members’ explanations of the press’s mechanical operation and the physical nature of its construction, through actively looking at and touching relevant pieces of the press; (C) The number of copies of the First Amendment which were printed by visitors who then took them home as souvenirs of their experience.

The first two criteria were selected as important indicators of proximal learning, as they are frequently used in exhibition visitor studies and informal science education fields, while the third criterion was chosen because it is an easily evaluated variable which reflects visitor engagement simply by providing a tally of how many individuals actually printed on the press themselves. 37

In terms of criterion A, “[t]he approximate length of time visitors engaged with the demonstration both actively by printing on the press, and passively by listening attentively while waiting in line or waiting for a companion who was utilizing the press,” there was consistently a line of visitors waiting for their turn to operate the press. This meant that there was also a significant amount of downtime before one could use the press and speak directly with team members. Still, it was consistently apparent that at least 75% of visitors who were close enough in line to hear and see what was going on paid a surprising level of attention to the ongoing interactions between the visitor whose turn it was to operate the press and the team members, and those in line were also frequently watching the ongoing use of the press. Upon reaching the front of the queue, most of these visitors continued to attentively engage with the press and the

facilitator as they operated the press, while many of those who chose not to print on the press still watched its operation while listening to and conversing with the facilitators.

The analysis of criterion B, “[t]he extent to which visitors engaged with the facilitating team members’ explanations of the press’s mechanical operation and the physical nature of its construction, through actively looking at and touching relevant pieces of the press,” showed very positive results for visitor engagement. Many visitors, especially younger learners, were quite likely to engage extensively with the demonstration of the press, through actively looking at and touching parts of the press that were being discussed or pointed out by the facilitators. In addition to turning the rounce handle to move the plank in and out, and pulling the bar to print their copy of the First Amendment, visitors would often touch wooden pieces of the press to see how smooth or hard they were, in addition to feeling forged metal pieces to gain a tactile understanding of the way in which the historic method of production affects the surface of the metal parts.\(^38\) Most visitors would actively look at whatever part of the press to which the facilitator was drawing attention. The especially curious visitors, however, often students in Kindergarten through 4\(^{th}\) grade, would even crouch down to look at less visible parts, such as the girth barrel and its leather straps which moved while the press was in action, to see the way in which these parts shifted the plank back and forth as the rounce handle is turned.\(^39\)

Finally, criterion B, “[t]he number of copies of the First Amendment which were printed by visitors who then took them home as souvenirs of their experience,” showed that approximately two hundred visitors to the demonstration printed copies of the First Amendment, which they took home with them afterward. In general, even visitors who did not print their own copies, such as parents who had brought their children to the event, were still visibly watching

\(^{38}\) A glossary of terms is available. See Appendix 2.
\(^{39}\) Ibid.
the operation of the press, listening to the team speak to those trying out the press, and often engaging verbally both with the facilitating team members and with their companion who was using the press. These visitors discussed the physical and scientific aspects of the press’s operation, the nature of the project, and the history of printing.

The user-testing and visitor engagement at the demonstration provided very encouraging results, as visitors of all ages, but especially K-8 students, were actively focused on the press and its operation, in addition to engaging with the team members who were facilitating the demonstration and speaking about the STEM, historical, and contemporary aspects of the project and the press itself. The extent to which students were actively exploring the press through sight and touch, and the degree to which visitors in the queue to print interacted with the demonstration similarly indicated a successful user-testing experience. Finally, the tallied number of printed copies of the First Amendment, which signified the number of visitors who printed on the press, showed that the experience motivated many visitors to desire a hands-on interaction with the press. Ultimately, the data obtained in this evaluation imply that the user-testing event was successful, and served to engage visitors in a learning experience with provided historical, cultural, and STEM education.
## Science Standards

<table>
<thead>
<tr>
<th>Grade</th>
<th>Standard</th>
<th>Application of Press</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-2</td>
<td>Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.(^{40})</td>
<td>Students can turn the rounce handle: clockwise turn pulls the plank of the press out, while counter-clockwise pulls the plank into the press.(^{41}) Different levels of strength when turning the handle results in faster or slower movement of the plank.</td>
</tr>
<tr>
<td>K-2</td>
<td>Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.(^{42})</td>
<td>Through the lens of shifting heat levels, and thereby shifting humidity levels, and their potential effects on wooden parts of the press, students can complete a project requiring them to design and building an apparatus which shields the press from sunlight, such as reflecting light from a nearby window.</td>
</tr>
<tr>
<td>3-5</td>
<td>Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.(^{43})</td>
<td>Students can investigate various parts of the press in terms of balanced and unbalanced forces; applying force on the rounce handle in one direction causes the plank to slide left, while force in the other direction makes slides it to the right. Asymmetrical force on a platen creates clear, visible evidence of imbalance, as only part of the page will print.(^{44})</td>
</tr>
<tr>
<td>3-5</td>
<td>Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.(^{45})</td>
<td>Advanced approach to K-2 humidity project: students can create tables or graphs which include temperature and humidity forecasts, along with predictions on the ways in which the wooden areas of the press will likely react to the changes in weather.</td>
</tr>
</tbody>
</table>


\(^{41}\) A glossary of terms is available. See Appendix 2.


\(^{44}\) A glossary of terms is available. See Appendix 2.

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Activity Description</th>
<th>Scientific Insight</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-5</td>
<td>Make observations and measurements to identify materials based on their properties.</td>
<td>Students can examine different types of wood, and use their observations about grain size, patterns, color, and hardness to identify the different species present in the press.</td>
</tr>
<tr>
<td>6-8</td>
<td>Plan an investigation to provide evidence that the change in an object’s motion depends on the sum of the forces on the object and the mass of the object.</td>
<td>Advanced approach to K-2 push and pull example. Students can consider both the degree of force put on the rounce handle and the mass of the press bed, which includes multiple pieces of hardwood such as the plank, and a stone that weighs approximately one hundred fifty pounds.</td>
</tr>
<tr>
<td>6-8</td>
<td>Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.</td>
<td>Students can analyze which materials are necessary to create a historically accurate press, such as Honduran Mahogany. Examine the resulting trade laws intended to minimize human impact on the environment where the species grows.</td>
</tr>
</tbody>
</table>

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48 A glossary of terms is available. See Appendix 2.

### Technology Standards

<table>
<thead>
<tr>
<th>Modern Technology</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Computers</td>
<td>Most K-8 students will be at least somewhat adept with computers, but most are unlikely to be particularly familiar with CNC machines, which were used to create more complex metal parts of the press like the spindle and its nut.</td>
</tr>
<tr>
<td><strong>Computer Numerical Control (CNC) lathes</strong></td>
<td></td>
</tr>
<tr>
<td>Standard metal lathes</td>
<td>Students could potentially be familiar with wood lathes, or perhaps even metal lathes. This is still an opportune time to introduce students to these tools, through the lens of the press, so that they can be prepared for future shop classes or their own potential hobbies.</td>
</tr>
<tr>
<td>Wood lathes</td>
<td></td>
</tr>
<tr>
<td>Welding machines</td>
<td>Students in middle school and below will likely have little knowledge of or familiarity with welding machines, grinders, drill presses, table saws, and jointers. This is a prime opportunity for introducing students to the tools, either through actual hands-on use of safer tools such as a drill press, or more theoretical learning about the use of welders and power saws.</td>
</tr>
<tr>
<td>Grinders</td>
<td></td>
</tr>
<tr>
<td>Drill Presses</td>
<td></td>
</tr>
<tr>
<td>Table saws</td>
<td></td>
</tr>
<tr>
<td>Jointers</td>
<td></td>
</tr>
<tr>
<td><strong>Calipers</strong></td>
<td>Calipers are specialized tools, so it is quite possible that students will not have much experience using them or knowledge about them. In terms of educating students about technology to bolster their engineering knowledge and skills, teaching them how to use and read a caliper is critical. The tool was used frequently during the Uncommon Press Project, both for research, when exact measurements were desired, and in the construction process, when it was necessary to ensure that adjoining parts were fabricated to complementary sizes.</td>
</tr>
<tr>
<td><strong>Hand drills</strong></td>
<td>Younger students will likely be somewhat familiar with hand drills, and will almost certainly know how to use a screwdriver, but even these simpler tools played a significant role in the construction of the press, and are utilized in countless building projects, so reinforcing this preexisting knowledge is vital.</td>
</tr>
<tr>
<td>Screw drivers</td>
<td></td>
</tr>
</tbody>
</table>

50 The core standards for Technology education are essentially focused on having students learn about tools and how to use them. These standards are far less specific than the standards for Science, Engineering, and Mathematics, so this case study’s application section for Technology primarily emphasizes the various modern and historic types of technology which would have been used to create the press, and their relevance to different grade levels.

51 A glossary of terms is available. See Appendix 2.

52 The assumed likelihood of this preexisting knowledge stems from the proliferation of both physical and digital toys and games which utilize drills and screwdrivers.
<table>
<thead>
<tr>
<th>Historical Technology</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forges</strong></td>
<td>Using a forge, anvils, hammers, and bellows, Schofield created many of the metal pieces for the press. Students might not utilize these tools in their careers, but this is still a useful opportunity for education, whether the focus is on the technology itself; the scientific requirements to heat a 1.5” metal bar to the point where a single person can bend it alone; the need to ensure a steady flow of air through a forge so that the fire has sufficient oxygen; or even the different types of fuel, such as high-carbon coke, which is generally made from coal and was used in Schofield’s forge.</td>
</tr>
<tr>
<td><strong>Anvils</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Hammers</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Blacksmith’s Bellows</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Nails and Screws</strong></td>
<td>Old nails would have been created by hand, instead of mass-produced in a factory, and they would often be shaped differently from the type of nail familiar to a modern student. Screws would have also been created on a much smaller scale, but perhaps more significantly, until early in the 20th century screws were slot headed. Hexagonal, square, and Phillips head screws have all been in existence for less than a century.</td>
</tr>
</tbody>
</table>

53 Historical technology does not fall solely into the realm of the past, of course, as all the listed types of technology are used in modern society for various purposes. In the context of creating the press, however, they were used in ways that would now likely replaced by more advanced technology or at least improved versions of the same technology.

54 Accuracy of materials was something for which the Uncommon Press team had to account during the construction process: we needed specific sizes of screws for a few portions of the press, but our goal of historical accuracy meant that we needed to use slot-head screws. Most screws in the type we needed are only available with Phillips heads. After contacting a number of suppliers, from big box hardware stores to smaller shops, we were eventually able to locate what we needed.
## Engineering Standards

<table>
<thead>
<tr>
<th>Grade</th>
<th>Standard</th>
<th>Application of Press</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-2</td>
<td>Ask questions, make observations, and gather information about a situation people want to change, to define a simple problem that can be solved through the development of a new or improved object or tool.</td>
<td>Students can be given a basic problem, such as the printing area being too small to print in just one pull, and they could then seek to solve this issue by making observations, gathering data, and suggesting improvements or alterations.</td>
</tr>
<tr>
<td>K-2</td>
<td>Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.</td>
<td>This standard is particularly easy to meet in an institution like the Cary Graphic Arts Collection, where both wood and iron printing presses are available, as students can utilize both presses, and analyze data from both tests to compare the strengths and weaknesses of each object.</td>
</tr>
<tr>
<td>K-2</td>
<td>Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.</td>
<td>Students can sketch or model the screw-shaped spindle that presses the platen down, the rounce barrel that helps the plank of the press move in and out, or the cramp irons and ribs which allow the heavy plank slide without too much effort.</td>
</tr>
<tr>
<td>3-5</td>
<td>Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.</td>
<td>Using the design plans and the broader project data, students can adapt the plans to create a simple design problem that is focused on producing a smaller portion of the press, and then use the provided data to determine the various constraints.</td>
</tr>
<tr>
<td>3-5</td>
<td>Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.</td>
<td>Building on their work toward the previous standard, students can create a variety of potential solutions, such as utilizing different woods or metals, outsourcing work, or doing the work</td>
</tr>
</tbody>
</table>

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56 Ibid.

57 Ibid.

58 A glossary of terms is available. See Appendix 2.


60 Ibid.
<table>
<thead>
<tr>
<th>Age Range</th>
<th>Activity Description</th>
<th>Additional Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-8</td>
<td>Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.</td>
<td>In a more advanced version of the previous standard, students can again utilize the design plans and project materials, this time along with possible factors that might impact their solutions, and then students would be required to adapt their designs and plans to account for such potentialities.</td>
</tr>
<tr>
<td>6-8</td>
<td>Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.</td>
<td>The various design adaptations created in the previous standard can be systemically evaluated by students, to determine the success of each proposed solution.</td>
</tr>
</tbody>
</table>

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62 Ibid.
### Mathematics Standards

<table>
<thead>
<tr>
<th>Grade</th>
<th>Standard</th>
<th>Application of Press</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-2</td>
<td>Identify and describe shapes. 63</td>
<td>Students can identify and describe the many squares, rectangles, circles, and cylinders which are visible in various sizes within the press.</td>
</tr>
<tr>
<td></td>
<td>Classify objects and count the number of objects in each category. 64</td>
<td></td>
</tr>
<tr>
<td>3-5</td>
<td>Represent and solve problems involving multiplication and division. 65</td>
<td>After discussing the topic of a wood’s moisture content and how to mathematically determine what the specific content is, students can calculate it themselves using different types of wood. 68</td>
</tr>
<tr>
<td></td>
<td>Multiply and divide within 100. 66</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perform operations with multi-digit whole numbers and with decimals to hundredths. 67</td>
<td></td>
</tr>
<tr>
<td>3-5</td>
<td>Use appropriate tools strategically. 69</td>
<td>Students can use calipers or rulers to measure different parts of press, to ensure that each piece’s measurement conforms to the measurement dictated in the design plans.</td>
</tr>
<tr>
<td>3-5</td>
<td>Understand concepts of area and relate area to multiplication and to addition.</td>
<td>Students can discuss and calculate various areas of the press, like the type-setting area</td>
</tr>
</tbody>
</table>

66 Ibid.
68 By dividing the weight of wood by the weight of the water found in the wood, students would calculate a decimal, which they would then multiply by 100, which would give them the wood’s Moisture Content Percentage. Such an exercise meets all three standards.
<table>
<thead>
<tr>
<th></th>
<th>Understand concepts of angle and measure angles. Draw and identify lines and angles, and classify shapes by properties of their lines and angles.</th>
<th>made possible by the stone and the printing area determined by the platen.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-5</td>
<td>Students can measure different angles found in the press, such as the threads on the spindle. They can also classify the shapes of different parts by their angles and the relating measurements obtained in the examination.</td>
<td></td>
</tr>
<tr>
<td>3-5</td>
<td>Represent and interpret data.</td>
<td>After taking measurements, students can draw their own designs for part of press, then compare them to the official design plans and interpret the differences.</td>
</tr>
<tr>
<td>6-8</td>
<td>Solve real-world and mathematical problems involving area, surface area, and volume.</td>
<td>Students can examine parts of the press where volume is significant, such as the stone, girth barrel, or the platen, and then consider ways to make improvements while potentially decreasing material usage.</td>
</tr>
<tr>
<td>6-8</td>
<td>Draw, construct and describe geometrical figures and describe the relationships between them. Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.</td>
<td>As a more in-depth form of the last 3-5 standard, students can work to improve on the official design plans by sacrificing historical accuracy to determine ways in which the press could be more efficient.</td>
</tr>
<tr>
<td>6-8</td>
<td>Construct viable arguments and critique the reasoning of others.</td>
<td>Finally, students can analyze their classmates’ designs and discuss their respective strengths and weaknesses, ultimately creating as a class a unified and maximally successful design.</td>
</tr>
</tbody>
</table>

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70 A glossary of terms is available. See Appendix 2.
72 A glossary of terms is available. See Appendix 2.
73 Ibid.
75 A glossary of terms is available. See Appendix 2.
77 Ibid.
Conclusion

The extent to which I was able to correlate the examination and use of the Uncommon Press, as a cultural object, to the STEM learning standards put forth by Common Core and Next Generation Science Standards, shows that the merging of an object-based education method with STEM learning standards provides a rewarding educational lens through which K-8 students can be taught about history, culture, and the STEM fields. For both science and engineering, I was able to apply an average of nearly one standard per grade level to specific aspects of the press which could be examined through hands-on operation, visual observation, physical measurement, or analysis of the press plans. To meet education goals for technology, I connected over a dozen examples of historical and contemporary tools which were utilized in the press’s creation, which students could learn about either through hands-on use or theoretical methods of study, depending on the level of safety required for each technology. Finally, due to the Common Core Standards’ emphasis on mathematics, I was able to correlate fourteen standards with the press, primarily through measurement and examination.

The success of the user-testing event at Imagine RIT further supports this cross-disciplinary method of education. The results of the informal visitor study imply that the user-testing event was successful, and served to engage visitors in a learning experience which provided historical, cultural, and STEM education. In particular, the degree to which students explored the press on visual and tactile levels and their dialogue with the facilitators about the STEM nature of the project illustrate that the team was indeed able to achieve the goal of utilizing a cultural artifact as a touchstone for helping students learn about science, technology, engineering, and mathematics.
The observed visitor engagement with the team members who facilitated the hands-on experience at the demonstration also implied, however, that a greater focus on interpretation and visitor experience could also be successfully incorporated into an educational plan which utilizes the object-based, STEM-focused lens advocated in this thesis. While the facilitators did speak about the individuals who would have utilized such a printing press in the past, the introduction of a costumed interpreter could help visitors better engage both with the historical and cultural nature of the object and with the STEM fields which were pertinent to the creation and maintenance of a press. Such an expansion, while likely to provide positive results, would extend beyond the parameters of this thesis, but could certainly serve as a useful pathway for future endeavors which seek to adapt and adopt the educational plan put forth in this paper.

Ultimately, the Uncommon Press Project appears to have been successful in meeting the goals prescribed for it by the Cary Graphic Arts Collection, in addition to achieving the goal for the press which I formulated at the start of this thesis project. The alignment of STEM learning standards offered in this paper should provide the Cary Graphic Arts Collection with a baseline educational plan through which the press can be utilized to engage visitors in both historical and STEM exploration. If one were to build upon this project, there are two avenues which would likely be particularly fruitful. The adaption to utilize costumed interpreters in the educational process seems ripe for enhancing visitor learning and immersion, as it would expand the historical nature of the experience, with could increase the extent to which visitors learn and retain the knowledge gained during their interaction with the press. The implementation of a more formalized visitor engagement analysis would likely be beneficial as well, to better assess the strengths and weaknesses of this plan from a more focused and structured perspective.79 In

79 An enhanced engagement study could collect a greater amount of intentional data for mathematical analysis, to observe dwell time and other visitor tracking patterns.
addition to providing an immediately usable plan for the use of the Uncommon Press itself, this thesis serves to provide other cultural institutions, including museums, libraries, and archives, with a foundational case study and educational plan upon which these organizations could build their own plans to align collections objects with educational standards for STEM learning. In conclusion, this paper provides cultural and historical fields with an adaptable STEM-focused educational plan, while also serving to further enhance the Uncommon Press Project.
Appendices

1. Maps

Figure 1. Location of the Louis Roy Press at the Mackenzie Printery and Newspaper Museum in Queenston, Ontario, Canada.
Figure 2. Location of the Franklin Press at the Museum of Newport History in Newport, Rhode Island.
Figure 3. Location of the Ralph Green Press at the Printing Office of Edes & Gill in Boston, Massachusetts.
Figure 4. Location of the Robert Luist Fowle Press at the Exeter Historical Society in Exeter, New Hampshire.
Figure 5. Location of the Dresden Press at the Vermont Historical Society in Montpelier, Vermont.
2. Glossary

1. **Bar**: A long, curved, metal cylinder which provides the leverage necessary to turn the spindle, to which it is attached.

2. **Carriage**: A large, unmoving, wooden piece of the press, which provides support for the plank and stone.

3. **Cramp Irons**: Pairs of metal pieces which keep the plank aligned on the carriage, and reduce the force required for it to slide back and forth.

4. **Girth Barrel**: A cylindrical piece of wood located on the underside of the press, which when turned by the operation of the rounce handle pulls leather straps attached to the plank of the press, thereby moving the plank underneath or out from under the platen.

5. **Nut**: A metal piece with a threaded interior, into which the spindle is screwed. The nut is secured inside the wooden frame of the press, and thereby causes the spindle to press down on the platen when turned.

6. **Plank**: The wooden section of the press slides underneath and out from under the platen, on which the stone is located.

7. **Platen**: A thick, smooth, wooden plate which presses the paper down into the inked type.

8. **Ribs**: Smooth metal rails attached to the carriage of the press, on which the cramp irons slide, thereby reducing the amount of force necessary for the plank to move.

9. **Rounce Handle**: A handle which turns the girth barrel, which uses leather straps to move the plank of the press back and forth from beneath the platen.

10. **Spindle**: A long metal screw which, when turned through a pull of the bar, applies pressure on the platen, pressing it down into the paper.

11. **Stone**: A large, rectangular piece of stone which sits on the plank of the press, and provides a stable, flat surface on which the print.
Bibliography


Galbraith, Steven. Email to the author, November 1, 2017.


Mackenzie Printery and Newspaper Museum in Queenston, ON, CA. Site visit. February 20, 2016.


NGSS Lead States. Next Generation Science Standards: For States, By States

