

Teacher Digital Resource
Overall Findings and Recommendations

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Top-line Finding

The prototypes developed for this project have received an overwhelmingly positive response; this is a tool teachers not only enjoy using, but also one which they find helpful and are motivated to use with students on Science Museum visits. These preliminary prototypes should be developed further as a resource, as it is something teachers want and find useful.

The intention of this project was to create an app that was so easy to use that it would eliminate the need for teacher preparation before a Science Museum school group visit. However, we have found through testing that, although teachers find the app easy to use and the content useful and relevant, they would still prefer to have access to the information pre-visit. If a tool were to be created such that teachers truly did not need it in advance of a visit, it would lack in content so much as to be useless as a teacher tool.

Key Findings

Content

- All the teachers found it helpful to have the activities and questions arranged in the order of increasing difficulty.
- Some topics and content are too challenging for all students. This is because the abilities of KS3 students vary greatly.

Engagement

- Reactions to the application were very positive and the teachers were clearly engaged while using it. Teachers stated that this tool would be a very helpful museum resource.
- All of the teachers claimed to have learned something new from the application, whether it was about the objects or new ways to engage students in the museum.
- Although all teachers reported that the app would help them engage students, some expressed a desire to have supplemental materials for students to use while on their Science Museum visit.
- Teachers generally felt that the sections (e.g., Object Information, Visual Aids, etc.) would be easy to share and believed that all four sections would be engaging for students.

Usability

- All teachers reported that they would find the app helpful on a museum trip and the majority of teachers (5/7) who tested Prototype 2 felt that the app would especially help with logistics. This is because the app provides teachers with easy access to information and navigation, allowing them to focus on organizing their students.
- After using the app for one or two objects, it was observed that all the teachers could navigate through the app and use it effectively because they found it simple and easy to use.
- All the teachers tested felt that it would be important to have access to the app's content, if not the app itself, before using it with students. The majority of teachers (10/13) would

want the app in advance of arriving at the Science Museum rather than just before using it on the museum floor.

Recommendations

Content

- Organize each section by order of difficulty in accordance with the National Curriculum levels.
- Ensure the app's content is kept up-to-date with the current curriculum standards.
- Development of content should be aided by KS3 teachers to ensure:
 - Relevancy to KS3 curriculum
 - A range of activities and questions for students of varying abilities
 - Flexibility within the app's content

Engagement

- Allow teachers access to the resource content pre-visit to ensure:
 - An understanding of the app's purpose and functions
 - The opportunity to plan lessons and prepare students
- Develop content-based materials for post- visit work.
- Provide pre-made materials (worksheets, booklets, etc.) for the museum visit

Usability

- Choose an interface most compatible with iPads and that utilizes iPad capabilities
- Avoid confusion by clarifying home page options
- Remove extraneous features such as the tab feature seen in prototype 1
- Improve various design aspects
 - Clarify map, improve tutorial, simplify navigation buttons

Introduction

Background to the Project

Museums are excellent opportunities for visitors of all ages to learn in a free and open atmosphere. The self-directed learning allows visitors to make personal connections to museum exhibitions and thus create more meaningful learning. However, this atmosphere can be challenging for teachers, who often struggle to connect exhibitions and objects to the curriculum and to engage students in the museum; this is especially true for object-rich galleries, like the *Making the Modern World* gallery.

The Project Goal

To help address this issue, we created a prototype teacher tool suitable for an iPad. The purpose of this prototype tool was to help teachers teach with confidence and engage students in the *Making the Modern World* gallery. Because this gallery is an object-rich, historic collection, students are often less engaged with it than with other, more interactive galleries at the Science Museum. Thus, the successful creation and implementation of this teacher tool

would not only help bridge the gap between the different learning environments of the classroom and the museum, but also support the Science Museum's mission to deepen visitor engagement with historic collections.

Aims and Objectives

- Development of a prototype version of the app including content and concepts. For example:
 - What interface to use?
 - What KS3 topics to include?
 - How to organize the information?
- Testing of the app with the intended audience; key stage 3 science teachers and using knowledge obtained through testing to make improvements to the prototype. Evaluation objectives:
 - Is this a usable tool?
 - Is this an effective tool?
 - Is this something teachers want and enjoy using?

Methodology

1. Front end research

- Preliminary stage: This stage was completed at our university, Worcester Polytechnic Institute, in preparation for arrival on-site at the Science Museum.
 - Archival research into current technologies, the Science Museum, learning in museums, and school group behaviours.
 - Interviews with field experts via email and telephone
 - Observations of general visitors and school groups at the Boston Science Museum
- On-site at the Science Museum
 - Training about observing visitors in museums, qualitative testing, and data analysis with Hannah Clipson
 - Observations of KS3 school group behaviours in the *Making the Modern World* gallery
 - Attended a teacher training course by the Science Museum Learning Resources Team, Talk Science.

2. Formative research

- Testing the App Prototype
 - Qualitative face-to-face interviews with testing participants.
 - Accompanied visits with 13 KS3 teachers recruited via email by Hannah Clipson
- Prototype 1
 - Identifying and removing barriers to usability, motivation, and engagement.
 - Accompanied visits with 6 KS3 teachers followed by an in-depth interview.
 - Findings used to revise prototype
- Prototype 2
 - Identifying and removing barriers to content comprehension and suitability, engagement, and usability
 - Accompanied visits with 7 KS3 teachers followed by an in-depth interview.
 - Findings used to provide recommendations to the Science Museum for further development

Main Findings

Content

In general, teachers found the content within the prototypes to be relevant to the KS3 National Curriculum and that it had covered a good range of topics that was suitable for students at different ability levels. Positive feedback was received on the content of the prototypes.

- Many of the teachers liked that an estimate of how much time each activity would take to do was written very plainly because knowing this information would allow them to send students off to complete an activity while simultaneously looking ahead into the app and gallery. This is because teachers often have limited time in the gallery and advance knowledge of how long an activity will take helps in budgeting their time.
- All the teachers found it helpful to have the discussion questions arranged in the order of increasing difficulty. This is because teachers like the ability to choose the questions that cater best to their group of students.
- Some topics and content are too challenging for all students. This is because the abilities of KS3 students vary greatly.
 - Opinions ranging from “Some of this material is good for KS2 students” to “This would be challenging for my KS3 students, but KS4 students should be fine” have been given to us during the testing of the app.
 - Teachers mentioned they wanted a greater range of activities or more activities and questions to choose from in order to cater for the different student ability range within a group of students.
- Teachers really like the concept of having flexibility and control of the activities and questions. While teachers loved having a set of example activities and questions given to them, many also expressed interest in adding their own creative or personal touch to these examples to better cater for their own group of students. This is because each student group is unique, and students learn better when activities relate on a more personal level.

Engagement

- Reactions to the application were very positive and the teachers were clearly engaged while using it. Teachers stated that this tool would be a very helpful museum resource. This is because:
 - The design of the application was simple and it was easy to follow once the teachers became acclimatised to it. Every teacher quickly learned what each section would contain due to the consistent material within each section.
 - All of the app’s sections were well received, although the discussion questions and activities were the most useful and interesting to teachers because they are interactive, relevant to the curriculum, and thought-provoking.
 - The sections (e.g., Object Information, Visual Aids, etc.) would be easy to share and they believed that all four sections would be engaging for students.
 - Overall, the application’s content caters to a range of KS3 students (i.e., according to ages and abilities). Although two teachers felt that the content was too

challenging for younger or less advanced ability students. This is because the content of the app, although intended to engage KS3 students, is quite advanced.

- It was a common misconception that this application could be used by students instead of being used solely as a teacher's resource. However, all of the teachers ultimately understood and could see how this application would be used by the teacher to engage students with the objects seen in the museum through interesting facts, visuals, activities, and discussions.
- The app's flexible and relevant content and the inspiring museum environment convinced teachers that the application is better suited for a museum setting. However, they also stated the app would be a useful tool to use in the classroom; all of the teachers expressed interest in finding a way to connect the application to lessons in the classroom.
- All of the teachers claimed to have learned something new from the application, whether it was about the objects or new ways to engage students in the museum.
- Although all teachers reported that the app would help them engage students, several teachers who tested Prototypes 1 and 2 expressed a desire to have supplemental materials for students to use while on their Science Museum visit. This is because, although the content is engaging, it is hard to hold the students' focus for long periods of time. In addition, a tangible outcome helps students learn.

Usability

- All teachers reported that they would find the app helpful on a museum trip and the majority of teachers (5/7) who tested Prototype 2 felt that the app would especially help with logistics. This is because the resource enables the teachers to organise their students with a focussed task and the app provides teachers with easy access to information and navigation around the *Making the Modern World* gallery.
- The tutorial as a step-by-step process is effective in encouraging teachers to read the information provided more fully. The majority of teachers who tested prototype 2 (6/7) read all the information and felt that the tutorial was helpful (as opposed to the teachers who tested prototype 1 who were observed to skip or only skim read the tutorial when it was presented all on one screen). This is because the information on each page is concise and teachers are explicitly instructed to test the buttons and links.
 - 4 out of 7 teachers who tested prototype 2 tried to click on the side buttons and/or the gallery map icons while within the tutorial, believing that they had active links. This is because the examples are not clearly marked and it is not explained that the app's content cannot be accessed while within the tutorial.
- The majority of teachers (10/13) reported finding the gallery map helpful. However, 5 out of 13 teachers were confused by or could not orient themselves using the gallery map. This is because the gallery map is not labelled and has no directions as to what teachers are meant to do.
- Although all teachers reported that they understood the home page and its options on prototype 2, 3 teachers reported being confused by the "All" option on the home page.

This is because the Home Page is titled “*Making the Modern World*” and thus the title “All” is ambiguous.

- The majority of teachers (5/7) who tested Prototype 2 did not fully understand how to navigate the app using the buttons at the bottom of the screens (e.g., the “Back” button). This is because the path to return to the Home Page is complicated – teachers have to return to the object home page before returning to the Home Page – and the back button only takes users back to the previous page viewed, rather than regressing in a linear fashion.
- All teachers felt that the app flowed well and was easy to use after some initial acclimatisation. This is because the design features are consistent.
- All the teachers who tested the app felt that it would be important to have access to the app’s content, if not the app itself, before using it with students. The majority of teachers (9/13) would want the app in advance of arriving at the Science Museum rather than just before using it on the museum floor.
 - All teachers felt that having the app in advance would help them with planning their Science Museum visit.
 - The majority of teachers (6/7) who tested Prototype 2 felt that having the app in advance would help them better understand the function of the app.

This is because teachers want time to prepare relevant lessons and materials, as well as to decide which aspects of the app’s content are most relevant for their students.

- 4 out of 7 who tested prototype 2 would like the app information emailed to them
- 5 out of 7 teachers who tested prototype 2 would prefer the information in the form of a PowerPoint, but 2 teachers expressed a desire to download the entire app.

The Future of the App

This project is first of its kind at the Science Museum in terms of a digital resource for teachers. We have begun to explore a portion of the advantages that this type of application could provide, though there are many facets of this application that are still undeveloped in terms of evaluation and research. To further develop this resource, we have developed the following top-tips for the Science Museum:

- The Science Museum should test further prototypes of this application and test them with school groups in order to truly evaluate the prototypes’ effectiveness in engaging KS3 students.
- KS3 teachers must be consulted in areas of application content and pre- and post-materials in order to ensure that content is useful for teachers and relevant to a wider range of the KS3 curriculum and KS3 student abilities.
- We recommend adding more objects, galleries, curriculum topics and curriculum years in order to reach and engage a wider range of school group audiences since the overwhelming majority of teachers felt that the resource:

- aided them in connecting the objects to the curriculum
 - would deepen their students engagement with the collections.
- Explore adapting the app to create a student version, and creating similar apps for public use, as this has proved to be a well-liked and useful tool.
- Advertise the app to ensure that the final application is well advertised so that teachers are aware of the application, its function, and how it can be accessed.
- In future iPad projects ensure that testing occurs with an iPad interface that suits the aims and objectives of the projects.
 - For our testing, we were limited to Keynote as our interface choice since it is currently the only presentation software that allows transitions through hyperlinks, but is limited to Apple products.
 - As more presentation softwares are developed, it is important to choose one that is most appropriate for the needs of the testing. For example: Should the app feature iPad gestures (swipe, pinch, double tap, etc.)? Does this application need transition features? What are the limitations of the interface? Do I need to test on the iPad? All of these factors must be considered in choosing the appropriate interface for testing.