Student Perceptions of Object-based Learning With Digitized Museum Materials During Classroom Science Instruction

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Abstract: Digitization initiatives at modern museums have created unprecedented opportunities to use online collections objects in classrooms. A key question is whether digitized objects can engage students and promote perceptions of scientific authenticity. Students' perceptions were gathered via embedded surveys immediately following online investigations with digitized museum objects. Responses showed strong engagement and positive perceptions of authenticity (e.g., feeling like a scientist) with bimodal patterns for negative boredom and confusion.

Keywords: Object-based learning, student engagement, museum objects, digital models, middle school

Introduction

A significant critique of classroom learning has been that it is "decontextualized from direct experiences with objects" (Dierking, 2002, p. 4). Research on learning in museums generally has shown positive impact of objects on learner engagement and satisfying user experiences (Schwan, Grajal, & Lewalter, 2014). Because real objects have inherent motivation, expectations, and interest (Dierking, 2002), object-based learning may have strong potential for engaging students in classroom instruction. Some research has shown that bringing physical museum objects into a classroom environment can increase student engagement (Wyner, Koch, Gano, & Silvernail, 2010), but authentic objects from museums can be difficult to acquire for K-12 use. Modern advances in digital imaging have greatly increased opportunities for object-based research and learning in classrooms via digitized museum objects, but little is known about how digitized objects are perceived by students during classroom instruction. The current research examined students' perceptions of a set of online, inquiry-based research investigations that used digitized museum objects.

Method

Participants

Data was analyzed for 617 unique session IDs (about 1234 students working in pairs) from 34 teacher accounts for investigation 1 and 411 unique session IDs (about 822 students) linked to 37 teacher accounts for investigation 2.

Materials and Procedure

Classrooms used Research Quest (www.researchquest.org) investigations 1 and 2. Investigation 1 used 3D models of authentic museum objects (i.e., dinosaur fossils) to identify the type and species of three mystery fossils. Investigation 2 used digital museum materials (e.g., an interactive quarry map) to explore why so many animals died in one location. Surveys consisted of nine, Likert-type items modeled after rapid feedback "mini surveys" employed by Penuel and colleagues (Penuel, Van Horne, Severance, Quigley, & Sumner, 2016). Two items targeted positive emotions (confidence, excitement); two items addressed negative emotions (boredom, confusion); one item assessed perceived authenticity (feeling like a scientist); four items gauged self-reported critical thinking processes. Student surveys were embedded at the end of each online Research Quest investigation and were completed by a collaborative pair for each computer logged into a teacher account. Survey responses were anonymous and logged according to a random session ID that could not be linked with individual students but were linked to teacher accounts.

Results

Positive emotions and critical thinking processes showed strong patterns of agreement, with response frequencies growing from slightly agree to strongly agree. Following each investigation, between 58% and 68% of students indicated some level of agreement with positive emotions (min = 58%, max = 68.2%), with strongly agree being the most frequently selected response (see Figure 1).

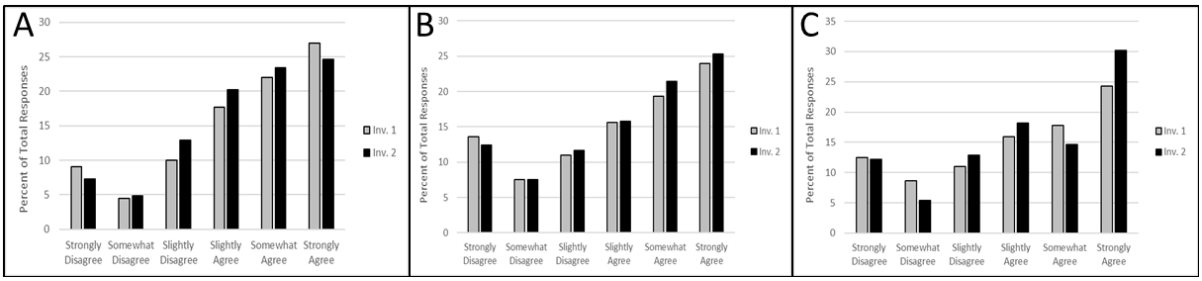

Figure 1. Response frequencies for positive emotion items: confident (1a), excited (1b), feeling like a scientist (1c).

As seen in Figure 2, frequencies of student responses to negative emotion items were largely bimodal. For the item "Today in science class, I felt bored" (Figure 2a), the largest percentage of students chose “strongly disagree” (Inv 1: 24.6%; Inv. 2: 23.8%), but the next most common response was “strongly agree” (Inv. 1: 20.9%; Inv. 2: 21.4%). Confusion showed a similar but less divergent pattern (Figure 2b); the largest percentage of students strongly disagreed (Inv. 1: 24.6%; Inv. 2: 23.6%), with “slightly agree” the second most common response (Inv. 1: 17.2%; Inv. 2: 19.5%).

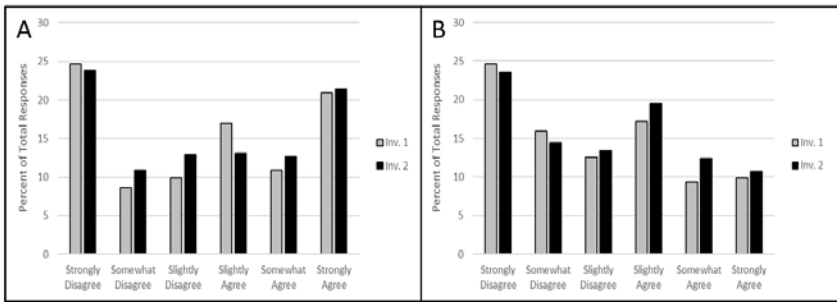

Figure 2. Response frequencies for negative emotion items: bored (2a), confused (2b).

Conclusions

Overall, students who used digitized museum objects and materials for scientific investigations were highly engaged by the digitized materials, responded positively to the perceived authenticity of the investigations, and reported strong engagement in critical thinking processes. A majority of student collaborative pairs reported feeling confident, excited, and like a scientist when working with digitized objects. Thus, efforts to increase object-based learning opportunities in classrooms may benefit from using digitized museum collections. However, results were not uniformly positive. Items gauging boredom and confusion showed bimodal responses. This may indicate the need for more personalized scaffolds to customize investigation objects and adapt instructional features. Future research is needed to better understand when and how to engage all students in object-based investigations using authentic, digitized objects. Additional research on Research Quest is using educational data mining with logged interactions to predict moment-by-moment student engagement and learning needs.

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