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Training teachers to employ a digital art history curriculum: An evaluation of the Crystal Bridges mixed distributed and virtual reality professional development

Dennis Beck[1], and Scott Warren[2]

[1] University of Arkansas, Department of Curriculum & Instruction, Fayetteville, AR, U.S.A.
debeck@uark.edu
[2] University of North Texas, Department of Learning Technologies, Denton, TX, U.S.A.
scott.warren@unt.edu

Abstract. Rural students may lack access to equivalent art content and resources compared with their urban peers. In this study, a museum of American art partnered with a private contractor, university, and online course provider to create two online art courses for high school students - on art appreciation and studio art. The courses use ArtSpace, an online art portfolio tool, ArtChat, a tool that allows for synchronous and asynchronous discussion around a specific piece of art, and Gallery 5, a 3D immersive museum gallery. Professional development for teachers using the courses was evaluated using semi-structured interviews and focus groups. Results focused on teachers' depth of art experiences, the digital tools, and the collaborative experience of being learners within the museum.

Keywords: Art · immersive · unity · rural

1 Objectives and Purposes

While, many K-12 schools face continued budget cuts as well as reduced time for the arts in the face of time needed to prepare for high stakes standardized exams [1]. While advanced placement exams in art history are available, many rural districts lack the financial and physical resources to adequately support those efforts or even art in general. This means that students cannot visit large cities that are often three hours from a rural school district to experience the art museums and physical works they discuss in preparation for exams or even in introductory art history or appreciation courses.

Beyond putting these children behind in terms of preparation for exams and future work in areas of digital literacy, digital art, and other professions, this limits student growth on the exams that states now prioritize. Research in recent years has explored the relationship between art exposure in museums with improvements on standardized exams [2, 3].

As a result, rural students may have a disadvantage versus their urban peers in terms of access to equivalent content and art resources. Continued decreases in art education mean these gains cannot be realized without help.

One approach to overcoming the rural-urban divide that separates many learners from experiences with arts has been to use online resources and tools. Artsy and others now provide access to artworks from museums around the world, as well as curricular materials to

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help teachers guide students to thinking about art, including appreciation and knowledge of historical contexts. The tools can also provide video that shows expert views and critiques of art within global context, as well as simply provide access to a world they are too far away from to experience in person.

Some museums are seeking to address this inequity in rural-urban access to art education. In this study, Crystal Bridges Museum of American Art partnered with the Educational Development Corporation, the University of Arkansas, and Virtual Arkansas, the online provider for the state of Arkansas for public school students. Two courses were authored for high school students - one focusing on art appreciation and another on studio art. In the first course, *Art Appreciation and the American Identity*, students make connections between art, history, and identity, and they practice and apply the skill of curation to create two online exhibits: one about their individual identity and one about the American identity. The second course, *Art + Process: Creating a Body of Work*, explores the works of several contemporary artists working with a variety of techniques, with a final goal of experimenting with these artists' techniques, ideas, and concepts by creating original artworks. Both of the courses include custom learning objects, engaging, hands on assessments, and extensive use of Gallery 5, an immersive, 3D online experience in which students curate their own art collection. Gallery 5 will be the main focus of this presentation.

Both courses were rolled out for use in Fall, 2016 by approximately 25 teachers in the midwest/midsouth region of the United States. Teacher training for the courses was performed at Crystal Bridges Museum of American Art in Bentonville, Arkansas during Summer, 2016. This proposal describes a mixed methods evaluation of the teacher training's objectives, materials, process, and outcomes.

2 Framework

Both courses use a social constructivist instructional model [4] that emphasizes a visible thinking conceptual framework. The Visible Thinking initiative began as a way to develop a research-based approach to teaching thinking dispositions. The approach emphasized three core practices: thinking routines, the documentation of student thinking, and reflective professional practice [5]. Applied to these two courses, it coalesces in an artful thinking approach that emphasizes the development of six thinking dispositions: Comparing & connecting, exploring viewpoints, finding complexity, observing & describing, questioning & Investigating, and reasoning [6]. Each work of art has primary, secondary, and multimedia source materials that include essays and videos. Throughout the courses, videos with Crystal Bridges staff and original artists also unpack the curatorial and exhibition process. The courses also use ArtSpace, an online art portfolio tool (see Figure 1) and ArtChat, a tool that allows for synchronous and asynchronous discussion around a specific piece of art.

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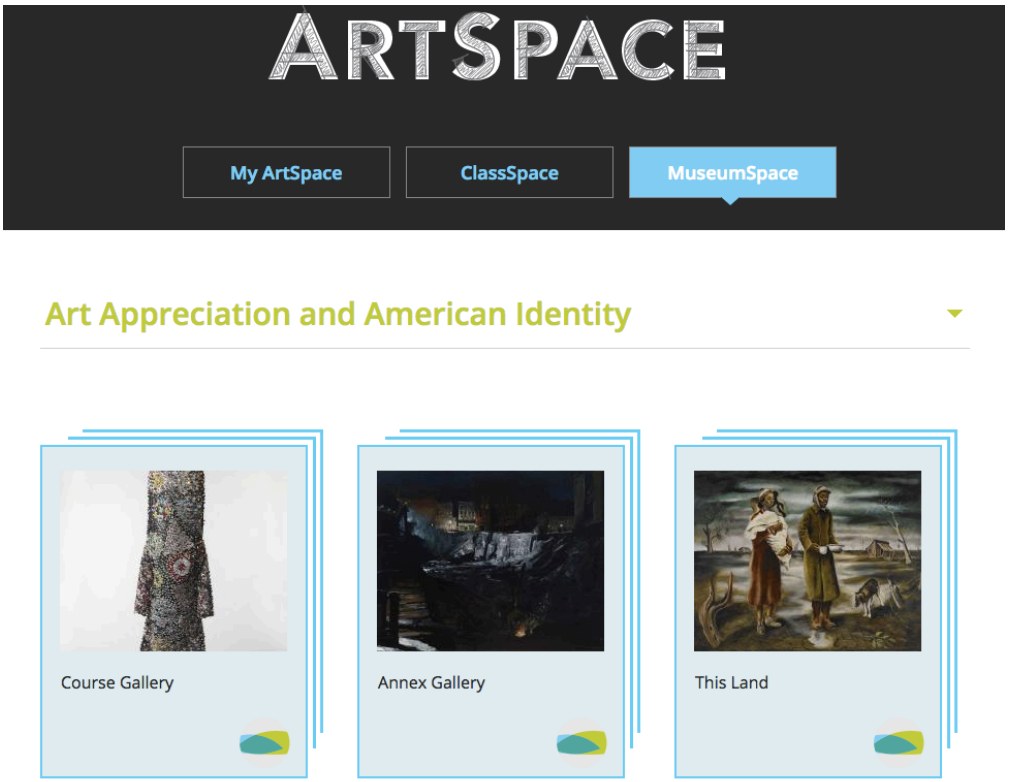

Fig. 1. Art Space ePortfolio tool for students to curate their own collection of artwork.

They also employ Gallery 5 (shown in Figure 2), an immersive three-dimensional interactive "blank canvas" rendering of one of the museum's galleries.

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Fig. 2. Gallery 5 Introduction screen displays an external view of the Crystal Bridges Museum of American Art.

Using game engine Unity3D, this virtual gallery application was created by staff and students from the Tesseract Studio for Game Design and Immersive Environments at the University of Arkansas. This tool allows students to create multiple gallery projects and share them with fellow students and their teachers.

3 Course Navigation

The courses employ a point and click navigation using a standard, left hand navigation menu to access specific lessons and a tool palette to access ArtSpace, ArtChat, and Gallery 5. However, due to the nature of the immersive environment, Gallery 5 is different. How can teachers move around in the space? How do they arrange and rearrange artworks? The environment utilizes a three-quarter overhead perspective, common in real-time strategy games, permitting users to zoom in and out and pan the camera view. A map of the museum space is on the left of the environment allowing teachers to see where they are from a big picture perspective and to instantaneously "jump" to specific places in the museum gallery.

To place a piece of art, teachers access a drop-down display of mini-artworks and can choose specific works of art and click and drag it onto the 3D gallery walls (see Figure 3). Teachers can also describe each piece of art by typing text about the artwork and positioning it around the piece. An eye-level guide is also available to aid users in determining where to place artwork compared to a person's average eye level. A walkthrough mode permits users to virtually walk through the gallery and experience their art collection in first-person view, and

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adjust the placement of the paintings (see Figure 4). Teachers can also manipulate lighting in order to best display their art (see Figure 5). The end result is a curated collection of art for the teacher or student to display (see Figure 6).

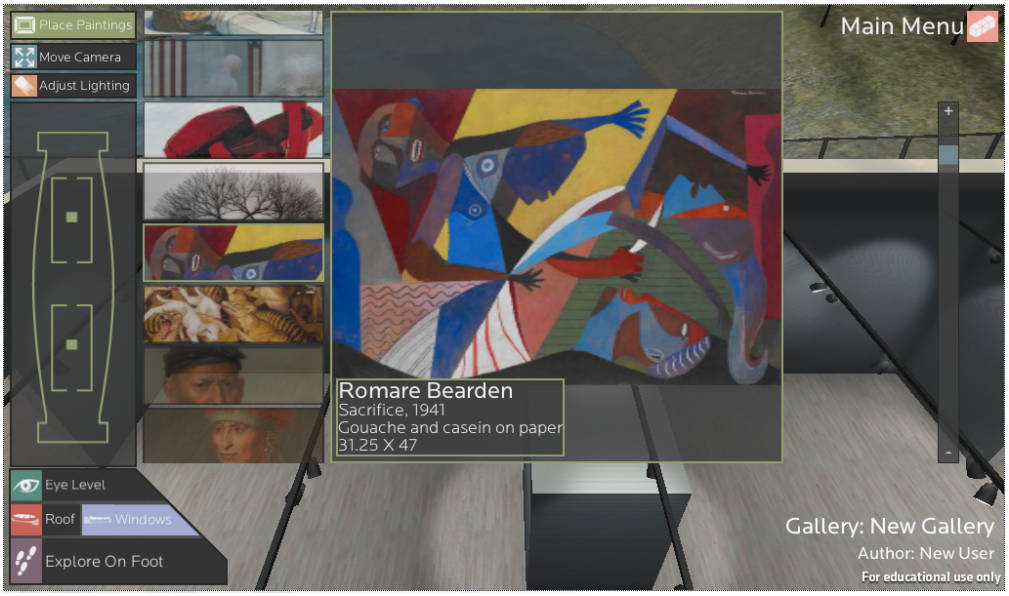

Fig. 3. Gallery 5 Place Painting screen where students can choose from many different artworks from the collection at Crystal Bridges Museum of American Art.

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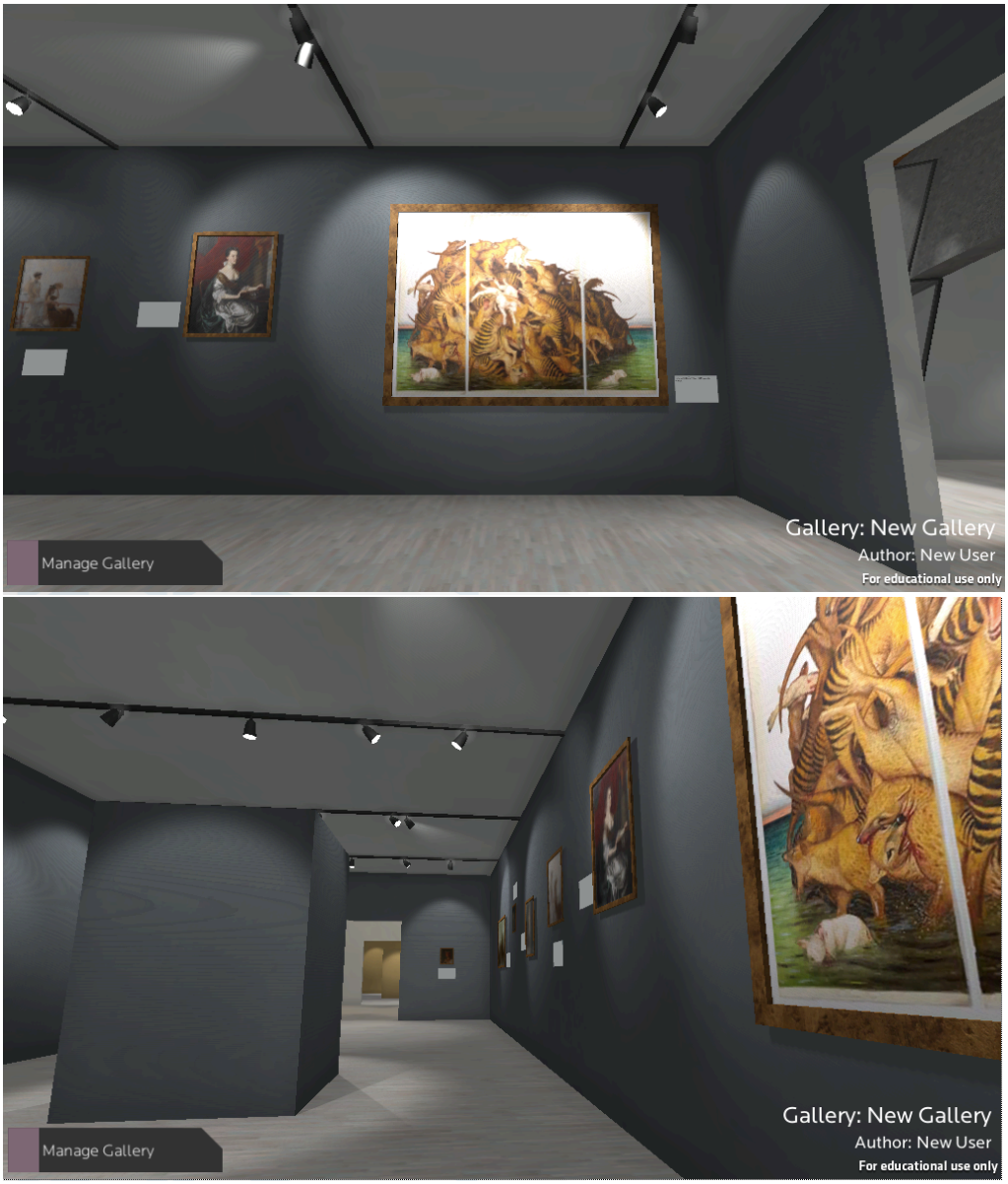

Fig. 4. The Explore on Foot feature of Gallery 5 allows students to explore their own or peers' art collections and provide critique.

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Fig. 5. Gallery 5 Adjust lighting tool allows students to manipulate lights in order to highlight specific works of art.

Fig. 6. Student curated collection of Crystal Bridges' Museum artwork.

4 Methods

Semi-structured interviews and focus group discussions were conducted and recorded during the onsite training. The focus group was scheduled during the first day of the training and was attended by five teachers. The interviews were attended by 14 teachers, three employees of the Educational Development Corporation, and the Director of Education and research in learning at the museum. The interview and focus group questions were synthesized from technology in education usability protocols related to teacher professional development.

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Pre and post test data was also collected to provide basic demographic information as well as limited evidence of effectiveness.

After transcribing the focus group and interview audio files, the transcript was reviewed by the researchers to ensure accuracy. The constant comparative method [7, 8, 9] was used to code the interviews, focus group, and pre and post test data. To do this, we developed an initial codebook, which included the code, a definition of the code, and guidelines for using the code. Our goal was to achieve categorical saturation, a technique suggested by Lincoln and Guba (1986). A confirmatory analysis was also conducted through three rounds of coding. A pretest survey was also administered to students during the first few weeks of the course. The survey contained 24 questions, 5 of which were open-ended text entry. Nineteen teachers completed the survey (86.4% response rate). A posttest survey was also administered the week after the training containing 14 questions, three of which were open-ended text entry. Nineteen teachers completed the survey (86.4% response rate).

5 Qualitative Results

The interviews we conducted with teachers regarding the training resulted in a number of outcomes related to their perceptions of the training to use the digital museum curriculum. Some focused on their experience with the depth of materials presented by the trainers, while others related to the digital tools, and still others focused on the experience of a learner within the museum itself with a group of collaboratively minded teachers. Each of these are described briefly below, to be expanded on in the presentation.

5. 1 Rich curricular materials

The teachers described the museum curriculum materials presented in the training as having "lots of depth, context, and historical explanation," as one teacher with more than 20 years in the classroom described. In nearly all of the interviews, the connections made within the digital tools presented in a proprietary Moodle and Drupal content management system were praised for their value to help students think. Further, they felt that the trainers provided strong hands on activities that helped model the teaching approaches they should use with their own students, whether in the classroom or using synchronous online communication tools. However, they asked for more time to practice the associated art skills associated with the materials, because that time helped them uncover issues they would face in their own classrooms.

5.2 Teacher concerns from the training regarding local classroom use

Teachers believed that additional time would further help them develop strategies for coping with any differences between how the digital products worked during the training and how they would likely perform in their own rural classrooms. In their home districts and buildings, they reported that it is likely that the Internet speeds are slower, connectivity issues abound, and the machines are perhaps not as robust as those in wealthier, suburban school districts. There were also some concerns from those that taught fully online about whether or not they would be able to troubleshoot some of the products, especially the *Gallery 5* virtual world space.

5. 3 The virtual world's high system requirements

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During the training, the teachers explored the *Gallery 5* immersive space with help from its lead developer. The immersive environment acts as a simulated, real-world context and its purpose is to situate student learning about art curation. There were difficulties observed by the researchers and reported in interviews and focus groups by the teachers. These tended to stem from computers that were sometimes locked down by their districts, so they could not install plugins for Firefox to allow the virtual museum space to load. Other teachers found their batteries expired quickly and a lack of power strips available in the room exacerbated the problem. Three of the twenty two teachers could not actively participate in the training activity and therefore did not receive the full training. Some suggested that in the future, trainers should provide a checklist for what they need to have access to on their local computers as well as a sample computer with comparable specifications to what their students might use to test at the training to ensure it can meet the requirements of the digital products.

5.4 Administrative and technical outcomes and concerns

A need for preparation before the training was one area the teachers highlighted in the interviews. When they arrived, the first day much time was devoted to having teachers develop logins for multiple systems including the content and learning management systems. Some expressed frustration at not having a single sign on for all systems and at having not done this technical administrative work a week or two before. Not knowing what they would need to have prepared to participate in some of the activities was a also a challenge for some instructors. For example, one learning activity required that teachers have personal photos to use, but many did not have access to their photos at home, sometimes because their work laptops locked out access to their Facebook pages if they had them, or they simply did not have an online photographic presence to draw from at all.

The classroom where the training was held was a large classroom used by the museum for presentations and instruction. The teachers were pleased with the technology available and used to deliver the training, which included high powered projectors and a central presentation computer, movable desks and chairs to allow for collaboration and art creation. The room included pinboard walls to post sheets of paper that collected student work. For the first three days of the training, there were no power strips for the teachers to plug in their laptops. Given that this was a bring-your-own-device (BYOD) training, this was a challenge for teachers because their batteries would die at different rates, though very few made it through the training day with any charge, making participation in online activities difficult or impossible. Further, some had brought tablets such as iPads, which did not meet the needs of the online curriculum, with some components requiring Firefox add-ins that do not yet exist. The technical issues and technology in general were explained by one participant, though heard from many, as “the big concern is the tech...adding a virtual classroom and helping kids navigate at a distance.”

5.5 Learner excitement about process and products

The learners were especially excited about the modeling of teaching that they would do in the future because they took a learning by doing approach where they stepped into the shoes of the students. One example that the group especially appreciated from a Florida teacher is shown in Figure 7.

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Fig. 7. Sample teacher artwork created at the training.

This process allowed the teachers to understand better how to teach based on their own experience and project how they would have to prepare to teach in their own classrooms.

In addition to making artworks that would be used in the fall version of the course as models, the teachers enjoyed developing strategies for teaching their individual students, often compiling them on large blue sheets of paper or notebook paper as seen in Figure 8.

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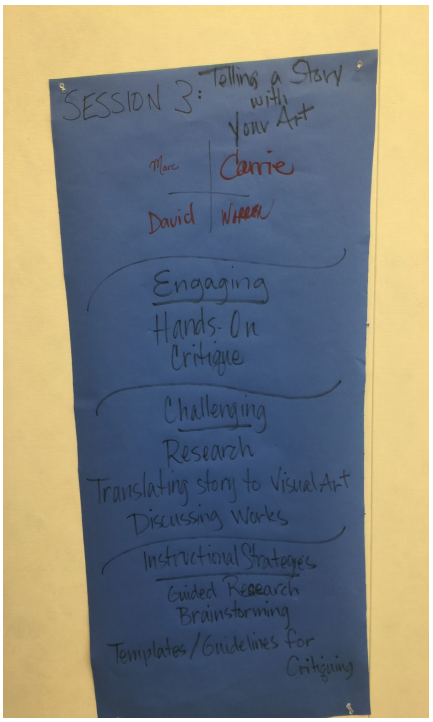

Fig. 8. Example session outcome with strategies developed by the teacher participants.

This strategy construction process was often done through group-based tasks in which the teachers constructed their own intersubjective agreements about appropriate outcomes they would expect in their courses. They were also given the opportunity to provide the developers with feedback in the form of a wish list that included what they would like to see in future iterations of the curricular product shown in Figure 9.

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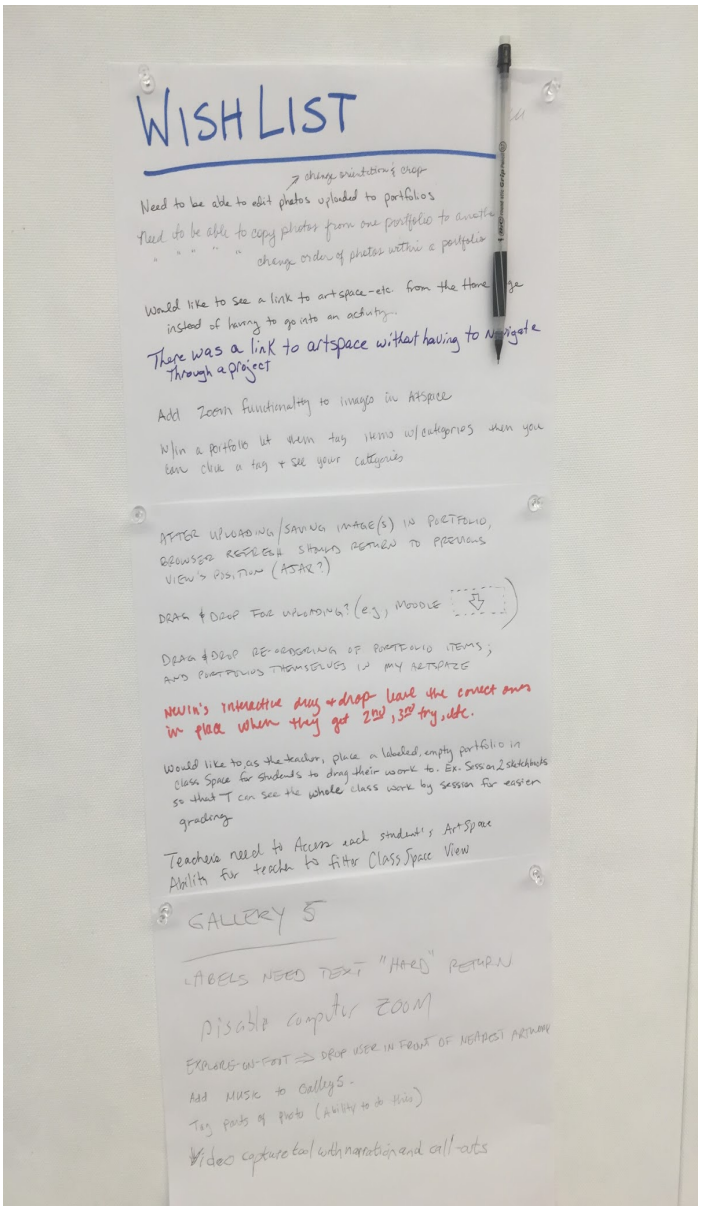

Fig. 9. The teacher future development wishlist.

Overall, the teachers liked the opportunity to tailor their strategies together during the summer training rather than alone at their schools, with one participant saying that "the best part is going in and working and talking as a group."

6 Scholarly Significance and Discussion

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In the field of learning technologies, part of our purpose is to explore the new and determine its efficacy. However, once the likely effectiveness of a technology tool has support and we want to test it in a naturalistic setting, our role shifts from building and testing the technology to one of professional development and support as the implementation begins. As anyone that works in the field knows, whenever new technology is introduced in schools, there will be challenges. Doing something for the first time can be a daunting proposition, especially with high technical solutions we do not develop personally as teachers. However, professional development is one way that we as educators mitigate the difficulty of doing something new for the first time, both by providing technical training on the devices, as well as pedagogical approaches.

The museum training here both showed where the training succeeded and still has improvements for the next summer, which is what we hope to discover through any evaluation of professional development training and technology use. Our goal is always to do it better next time. The following are some of the recommendations that stemmed from our research for the next iteration of professional development, but are applicable more broadly.

6. 1 Give a great experience: Use exciting collaborative tasks that model what you want teachers to do

A great strength in the training was that the training teachers received mirrored the pedagogical approaches expected by the curricular materials. The teachers had many hands on activities that matched the constructivist paradigm and were engaging and authentic so that they could understand from the student's point of view what they would experience. This helped them understand the technology affordances as well as "pitfalls" in the words of one teacher. In the future, we recommend that more time be devoted to fewer activities, as several teachers hoped for more time to this work because they saw great benefit to know the teaching process and depth of the rich materials the museum provides, but wanted more time with them since during the school year that is something they would lack. The training providers were responsive to this during the five days and that time grew each day.

6.2 Provide administrative task training online and allow pre-work before the training

One area for improvement in the future was allowing teachers to get administrative tasks out of the way ahead of time. The first day, much time was spent creating multiple logins and troubleshooting technical problems, some of which required a solution back on the teacher's home campus with their own technology support personnel. To improve the efficiency of the training, we recommend that any administrative tasks that can be automated for the teachers such as having a single signon be included or that the teachers be allowed to do these ahead to provide more time for instruction, collaboration and support. Further, have the teachers bring at least one of the devices that their students will likely be using so that the development team can test them to ensure their compatibility and to know what workarounds to develop before the product is integrated during the implementation following training.

6.3 Ensure the professional development classroom is ready for technology

A simple way to ensure a positive teacher experience is to do an analysis of what you want them to be able to do and determine whether your classroom will support it. If it is not ready, identify missing resources such as adequate wireless and power for your teachers. If

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possible, spend a day with a local teacher or two walking through the training with them to have them help you identify needed resources you may have missed in the rush to get everything ready to go. We are human and it is not possible to be aware of everything, especially if you are traveling to provide the professional development.

6.4 Be sure your products match the technology the teachers will use

A major issue that about two-thirds of the teachers had was that they did not have technology in their school districts that could support one of the three main tools in the curriculum, the *Gallery 5* simulated immersive experience. These teachers, for whom the curriculum was developed, were in rural districts with limited bandwidth and often have inexpensive Chromebooks that only have Chrome web browsers when the product requires Firefox and the Unity web player plugin. While the professional development itself could not overcome this, taking the time to analyze one's audience at the onset of instructional design to understand their technical limitations in full could limit challenges later and ensure that they can fully use all aspects of the product.

In the future, we recommend spending additional time visiting the classrooms where the product is expected to be used to more fully understand the limits on technology that can restrict a curriculum's use, This, in turn, can ensure that the training they receive meets their needs or provides workarounds for when a technology may simply not work for them, regardless of their restrictions. Understanding the continuum of technology access in a world that still has many strong digital divides, even in the U.S. can contribute to improved training and acceptance of new technologies in the classroom.

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