The digital kids technology camp: A course for teaching pre-service teachers effective technology integration

Albert D. Ritzhaupt
University of Florida
Gainesville, FL, USA
aritzhaupt@gmail.com

Youngju Kang
University of Florida
Gainesville, FL, USA
youngju.kang@gmail.com

Abstract
This paper describes an innovative course that blends together online learning with a pre-service teacher experience in the context of a technology camp. Pre-service teachers engaged with designing digital music, stop-animations, games, and multimedia productions; and subsequently, worked with rising 3rd to 6th graders to teach them how to create the same type of artifacts. Pre-service teachers responded to a prompt about student-generated multimedia both before and after the experience. These data were analyzed using the constant comparative method. Results collapsed into four themes: learning together, produce or consume, expression of ideas, and 21st century skills. Results and discussed and an overview of the course is provided.

Introduction
There remains a strong tradition in the field of educational technology to share the discourse on practices and research about effective technology integration into teacher education programs. In fact, journals have been established for this very purpose (e.g., *Journal of Technology and Teacher Education* or the *Journal of Digital Learning in Teacher Education*) and conferences as well (e.g., *Society for Information Technology and Teacher Education*). This paper follows this tradition by describing a course for pre-service teachers called the *Digital Kids Technology Camp*, a graduate course offered by a large land-grant university in the southeastern United States. This course serves dual purposes: 1) the Camp is an opportunity for 3rd to 6th graders to develop technology skills in designing and creating games, producing digital animations, creating music, and developing programming skills, and 2) the Camp is an opportunity for pre-service teachers to develop this same set of skills but to also teach these skills to the campers, a population with which many of the pre-service teachers will soon be working in a classroom setting. This paper will describe the core components of this course and will use qualitative analysis (analysis of student responses to a prompt and analysis of student artifacts) to describe the perceptions and experiences of pre-service teachers that have taken this course on two occasions. It is our goal to provide educators a framework for offering similar courses at their respective institutions.

Course Framework
The *Digital Kids Technology Camp* (DKTC) is focused on student-generated multimedia as an overarching framework (Ellis, 2001; Gobert & Clement, 1999; Green & Brown, 2002; Hall, Bailey, Tillman, 1997; Mitchell, Andreatta, & Capella, 2004; Mitchell, 2003). That is, both pre-service teachers and campers develop multimedia artifacts to demonstrate their understanding in a learner-centered setting. Specifically, within the DKTC, learners are provided the opportunity to develop a wide variety of digital multimedia artifacts, including digital music, interactive multimedia, virtual stop-animations, physical stop-animations, and games. Table 1 provides an overview of the six assignments that were required to be completed by the pre-service teachers. The first five weeks of the course are focused on pre-service teachers learning how to use various software packages, including GarageBand, Scratch, Pivot/Stykz, Moviemaker or iMovie, and GameMaker. The course during the first five weeks is online with optional sessions to learn how to use the software tools from the instructor. The course is facilitated using the Moodle learning management system.

The final week of the course is a camp held on the campus of the institution during the five day work week. The DKTC invites rising 3rd to 6th graders from across the region that the university serves for a small fee of $125.
The fee includes a custom t-shirt and food on the final day of the camp. Campers come to campus from 8 am to noon five days to work with the pre-service teachers. The campers are assigned to a pre-service teacher in a 2:1 ratio on the first day of the camp. That is, there are two campers assigned to each one pre-service teacher and the campers will work with these pre-service teachers for the remainder of the camp. The pre-service teachers are provided some direction on the gradual release of responsibility model (Pearson & Gallagher, 1983) in which strong scaffolds were gradually decreased to the point at which the campers are working independently on their digital artifacts. To illustrate, on the first day, the pre-service teachers would showcase the types of artifacts that could be created by showing their personal digital artifacts. As the campers develop expertise in using the various software packages, the pre-service teacher would gradually enable the campers to work independently.

<table>
<thead>
<tr>
<th>Title</th>
<th>Module Description</th>
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<tbody>
<tr>
<td>Digital Music</td>
<td>During this module, you will learn how to create music and record your voice in GarageBand.</td>
</tr>
<tr>
<td>Interactive Multimedia</td>
<td>During this module, you will learn how to design and create interactive media project using Scratch, a graphical programming language designed for young people.</td>
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<tr>
<td>Virtual Stop Animations</td>
<td>During this module, you will learn how to design and create a stop-motion animation using Pivot/Stykz and iMovie or MovieMaker.</td>
</tr>
<tr>
<td>Physical Stop Animations</td>
<td>During this module, you will learn how to design and create a stop-motion animation using a Digital Camera and iMovie/MovieMaker.</td>
</tr>
<tr>
<td>Video Games</td>
<td>During this module, you will learn how to design and create a game using GameMaker.</td>
</tr>
<tr>
<td>Week of the Camp</td>
<td>During this module, you will use your knowledge of constructing media-rich artifacts to assist young learners to design and create their own media-rich artifacts.</td>
</tr>
</tbody>
</table>

There is strong evidence that suggests having learners construct multimedia artifacts to demonstrate their learning is as effective as or more effective than traditional instruction (Gobert & Clement, 1999; Hall, Bailey, & Tillman, 1997). The DKTC uses this as a framework to expand on student interests in technology and other subject-areas that support the use of technology. Campers and pre-service teachers are exposed to a wide variety of concepts, including computer programming (e.g., decision, looping, sequence), science concepts (e.g., collision detection or gravity), storyboarding, frames and loops, and many other important concepts that are illustrated by the various digital artifacts the campers and pre-service teachers create for this course.

**Method**

**Participants**

Pre-service teachers and their respective reflections are the units of analysis within the scope of this research. The course is offered in the summer semesters. This research reports on two semester of the course offering (the Summer of 2011 and the Summer of 2012). The course in the Summer of 2011 had 15 pre-service teachers, and the course it the summer of 2012 had nine pre-service teachers for a total of 24 participants being analyzed. There was one male participant and the remaining were female, which is not unusual for a course offered to elementary education majors. All participants were enrolled in a master’s program for elementary education majors at a land-grant university in the southeastern United States.

**Materials**

All pre-service teachers completed a number of activities in each module. Pre-service teacher had to create their digital artifact, showcase their artifact to their peers via a discussion board, and write a comprehensive reflection about the process of creating that digital artifact. Additionally, all participants had to complete the same pre/post reflection prompt, which is shown below:

_Videogames and other multimedia are portrayed in positive and negative ways by the media. However, most of this coverage is based on the notion that young children and adolescents are consumers of videogames and other multimedia. Little has been discussed about the impact of young children and adolescents producing videogames_
and other multimedia. What is your personal opinion of the impact of producing videogames and other multimedia by young children and adolescents? What do young children and adolescents learn when they produce videogames and other multimedia?

In the post reflection, pre-service teachers were provided additional instructions: “After experiencing this course and engaging with youth in the camp, how have your opinions changed or evolved regarding this prompt? Based on this experience, what do youth learn from producing videogames and other multimedia? Feel free to review your pre-course reaction.” The responses to these prompts served as the data for this study.

Procedures and Data Analysis
In this paper, we focus on qualitative analysis of responses received from pre-service teachers on the two open-ended questions. The pre-service teachers responded to their beliefs about the use of video games and other multimedia in education. The pre-service teachers generated an average of 185.90 (SD = 93.31) words on the pre-reflection and an average of 135.86 (SD = 118.52) on the post-reflection. The responses were analyzed using a constant comparative method (Glaser, 1965, 1967).

The constant comparative qualitative procedure was selected because it “is concerned with generating and plausibly suggesting (but not provisionally testing) many categories, properties, and hypotheses about general problems” (Glasser, 1967, p. 104). The constant comparative method involves four stages (Glasser, 1967): 1) comparing incidents applicable to each category, 2) integrating categories and their properties, 3) delimiting the theory, and 4) writing the theory. Each incident in this research was a pre-service teacher’s response to one of the two open-ended questions, which were compared to all other responses during each iteration of the data coding process. Members of the research team independently coded each aspect of the responses, and subsequently merged their categories and properties together after review by other members of the team. The themes emerging from the categories and properties were then used to generate descriptions of the beliefs of pre-service teachers prior to the camp and after the camp experience.

Results
Four themes emerged across the pre-reflection and post-reflection in this research. These themes are summarized below. The four themes that were apparent across the reflections include: learning together, produce or consume, expression of ideas, and 21st century skills. The themes are illustrated with pre-service teacher comments and are elaborated based on practice.

Learning Together
The pre-service teachers involved in this course were provided an act of humility as it relates to the profession of teaching. The campers asked very difficult questions to the pre-service teachers about the various software packages used in this course. Many of these questions pre-service teachers did not have an answer to, and thus, the campers and pre-service teachers had to jointly address the problems together by searching the Internet, asking a peer, or looking for examples. One teacher illustrated this point well by saying “My campers were fairly young and I found they learned to have a lot of patience. We established the fact that we were both learning together and it would take time to get there. They learned to value their products that took them awhile to create.” Other pre-service teachers made similar comments about fielding student questions and the directing the passion of their campers.

Produce or Consume
Pre-service teachers had strong convictions about the difference between producing and consuming video games and other multimedia artifacts. Pre-service teachers, on average, believed that the campers would learn more by having to produce artifacts rather than simply consume them. One pre-service teacher made the point by saying “Any time that a child has to create or produce something rather than simply understand or consume it, their depth of learning is greater.” Other pre-service teachers illustrated similar sentiments such as “I believe that the act of producing videogames and other multimedia has a very strong impact on young children and adolescents.” Pre-service teachers cited problem-solving skills, advances in cognition, and many other benefits to this process. The overarching theme, however, was that the production of multimedia led to deeper levels of processing and cognition than simply consuming multimedia.
Expression of Ideas

Pre-service teachers believed that campers were provided an opportunity to express their ideas in a non-traditional way by having to create digital artifacts to manifest their ideas. One pre-service teacher described it best by saying “This process allows children to express themselves and to make connections between their interests or hobbies and what is being learned. Along with this, when children enjoy doing certain activities, they are much more likely to become engaged in the activity and the material that is being learned, making it more personal and meaningful to them, and increasing the chances that they will retain the information.” The pre-service teachers generally felt the campers were afforded the opportunity to express themselves in a novel way. This notion of expression is vitally important to student generated multimedia in that students are asked to demonstrate their learning in innovative ways that are inconsistent with traditional method of assessment.

21st Century Skills

Today it is common practice to speak of 21st century skills. Pre-service teachers described many attributes that relate to 21st century skills in their pre-reflections and post-reflections. The basic belief is that having students generate their own digital artifacts leads to 21st century skill development, including things like collaboration, problem-solving, trouble-shooting, leadership, communication skills and more. One teacher summarized this point by saying “Just a few points of what we should be teaching are children that I see addressed are core subjects and interdisciplinary themes (any game will address at least one subject or theme), learning and innovative skills (children are learning problem solving, creativity, and innovation skills, and if they are working together, communication and collaboration skills), and information, media, and technology skills (children are learning key technological terms, ways to use technology, and how to be media literate when using the media for sources and ideas ).” These 21st century skills are a major topic among educational circles with many developing formal standards and outcomes for these types of skills (P21, 2013).

Discussion

The tools employed in the course were selected carefully. We wanted to make sure that students could showcase their work to friends and family or continue to work on their digital artifacts in their own homes with parental supervision, and thus, the software tools were available by default on most machines (e.g., MovieMaker or iMovie), were free to download and use (e.g., Scratch), or had trial versions with limited functionality (e.g., GameMaker). Other tools certainly fall into these categories and are age-appropriate (e.g., Alice). Instructors of such courses should conduct a needs assessment of their service regions to make an informed decision about the tools that will be used at a camp like this. Careful attention should also be paid on what types of outcomes they want the students to learn (e.g., programming).

The results of our study set a stage for future research with both children (the campers) and pre-service teachers. Our educational system is slow to transform and traditional method of instruction and assessment are still at the forefront of schools and universities alike. Educational researchers have only scratched the surface with providing evidence of the efficacy of student-generated multimedia on a variety of learning outcomes and other relevant 21st century skills. The small, but growing body of literature on student generated multimedia shows promise in helping transform teaching and learning, and providing a framework to explain this newer form teaching and learning.

Our work is not without limitations. We had a small sample teachers each time this course was offered (15 the first time and nine the second time), which made the initial instruction about each of the tools more manageable from an instructor-perspective. Given that the course only had a handful of pre-service teachers, we only invited a proportional number of campers (2:1 ratio) to participate in the camp, even though demand for the camp was high among parents in the university service area. Replicating this course requires serious dedication and time from the instructor to support the pre-service teachers in learning the various tools, and facilitating a successful camp. It also requires a great deal of coordination among the community to adequately market the event to interested parties. This study contributes to a growing knowledge base about pre-service teacher practices with educational technologies. We believe that our results demonstrate the importance of effective technology integration practices for student-generated multimedia and the beliefs of pre-service teachers about this form of pedagogy. Further, our results suggest that providing teachers the opportunity to work with campers (e.g., field experience) amplifies their understanding of why the technology is important to the process. The results are of value to teacher educators looking to successfully integrate technology into the curriculum across the globe using an innovative approach.
References

Ellis, T. (2001). Multimedia enhanced educational products as a tool to promote critical thinking in adult students. *Journal of Educational Multimedia and Hypermedia, 10*(2), 107-123.


