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Web 2.0 Tools and its Effect on Math Instruction and Achievement

**Introduction**

Longstanding research indicates that effectively integrating technology into the classroom increases student engagement and achievement. It also is beneficial to teachers by improving their technology integration skills, connecting learning to the community, providing personalized learning experiences, presenting alternative assessment techniques, and enhancing social interaction. Studies show that integrating technology extends to having positive outcomes for teachers to understand and develop authentic and higher order lessons. However, technology alone is not the sole success of student achievement, but the way that it is implemented along with professional development creates a larger effect (Booth, 2008). Providing teachers with professional learning supports the development of a more rigorous academic environment and builds authentic classrooms that help students make real world connections.

While research shows that integrating technology into the classroom directly effects student engagement and achievement it can bring many challenges including ethical issues, lack of support, equitable access, experience, mobile bans, and curriculum adaptations (Baran, 2014). Studies also show that the attitude and beliefs of hesitant teachers regarding technology integration is not easily overcome, especially when there is a lack of meaningful professional development available (Booth, 2008). When trainings are available, it helps to foster teacher knowledge, which then generates a meaningful and positive relationship between the stakeholders and technology integration. However, the more important that technology becomes to students the more anxiety teachers experience. As a result, it is implied that teachers need more professional training and support. Moving teachers through the levels of adoption can be challenging, but when professional learning is present and ongoing, teachers and students are more likely to adopt technology (Christensen 2002).

Many teachers at Norton Park Elementary use technology in the classroom, but few successfully integrate it in an authentic and academically challenging way. Technology is mostly used for drill and skill type practices in the classrooms. This is evident by teacher observation and the types of programs that the school purchases for teachers and students. Unfortunately, there is a lack of consistent and ongoing professional learning directly relating to technology integration at Norton Park. However, as more teachers are starting to incorporate technology and are beginning to see it as a helpful tool, the confidence and competence of teachers is rising, which is beneficial when considering seeking professional development regarding technology integration.

With research indicating the positive impact of technology integration on teacher and student success, this capstone project seeks to develop and implement a professional development plan to introduce key Web 2.0 tools and increased authenticity to directly support math instruction.

**Description of Experience**

This project took place at Norton Park Elementary School in Smyrna, Georgia. As part of the Cobb County School District, it is a Title I school with approximately 950 students in grades kindergarten through fifth grade. Norton Park serves predominantly African-American and Hispanic students. The gender make-up of the school is 54% male and 46% female. Ninety-five percent of the student body is eligible for free and reduced lunch.

During the summer of 2015, a fifteen-week professional learning plan was created in order to instruct teachers on how to authentically use Web 2.0 tools to support math instruction in their classroom. The plan was designed to meet with willing teachers who teach third, fourth, and fifth grade once every other week for one hour after school. The following schedule was created prior to the start of the 2015-2016 school year.

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| Week 1 | Introduction – Teachers will be instructed on the rationale behind technology integration and authenticity. Teachers will also be given an overview of what the professional development aims to accomplish and the tasks that they will be completing. A pre-survey evaluating teacher beliefs, attitude, confidence and experience regarding professional development and technology will also be given. |
| Week 3 | Lesson development – Teachers will develop a short series of math lessons using Nearpod. |
| Week 5 | Lesson development - Teachers will continue to develop a short series of math lessons using Nearpod. |
| Week 7 | Lesson implementation – Teachers will implement the series of math Nearpod lessons with their students and collect and record results.  |
| Week 9 | Project development – Teachers will develop a short series of math lessons using Nearpod and will develop an authentic project or task that relates to the lessons.  |
| Week 11 | Project development - Teachers will continue to develop a short series of math lessons using Nearpod and carry on to develop an authentic project or task that relates to the lessons. |
| Week 13 | Project implementation – Teachers will implement the series of math Nearpod lessons and project. They will also collect and record results.  |
| Week 15 | Reflection – Teachers and the Coach will reflect on the experience and review and analyze the results from the student data collected. A post-survey evaluating teacher believes, attitude, confidence and experience regarding professional development and technology will also be given.  |

The professional development plan was purposefully designed to build knowledge from session to session while giving teachers ample time to develop meaningful and authentic lessons and projects. Offering professional learning opportunity not embedded within school hours, the priority of having teachers develop lessons was of high importance in order to bridge learning from the sessions to the classrooms. Developing the sessions over a fifteen-week period was also intentional in order to create professional development that is ongoing and will provide ample opportunities for the coach to provide modeling, feedback, and support to teachers.

After creating the professional learning plan, 3rd-5th grade teachers were encouraged to participate and were provided with an overview. Out of nineteen teachers, two teachers from each grade level voluntarily joined the professional learning opportunity.

The first session took place two weeks after school began and focused on the research behind technology integration. The participants looked at research regarding the impact of technology integration on student engagement and achievement. The group investigated the Levels of Teaching Innovation (LoTi) framework and distinguished between the different levels. Teachers also got a chance to evaluate some lessons and determine which LoTi level the lesson reached. The session allowed teachers to evaluate the advantage of creating authentic lessons in order for students to demonstrate their understanding through complex opportunities and to explain, interpret, apply, and evaluate knowledge. Through this investigation, teachers see that effective technology integration comes from students using technology to connect knowledge to the real-world, to solving problems, and to applications instead of solely through skill and drill type practices. Teachers see that in order to reach the higher levels of LoTi, learning must be student centered and go beyond the four walls of the classroom. Lastly, a pre-survey was given to evaluate the beliefs, attitudes, confidence and experience regarding technology integration and professional learning.

The second and third sessions were dedicated to developing math lessons using the student-centered presentation application, Nearpod. The application allows for teachers to prepare lessons, presentations, and assessments in order to explicitly teach skills. Research indicates that using this tool increases student engagement and allows students to tune into their particular learning style (Delacruz, 2014). Additionally, real-time results allow the teacher to quickly assess students and provide immediate feedback and support. These two sessions aimed to instruct teachers on the benefits of using Nearpod for instruction and how to effectively navigate and incorporate the various tools within the application in order to highly engage students. It also helped to develop a sense of, and to reach, the mid-levels of LoTi before developing lessons that would reach the higher two levels. Teachers were tasked with creating a series of math lessons for whole-group or small-group instruction and incorporated an assessment at the end of each lesson to show student achievement. The teachers were also tasked with involving an overarching authentic component that connects all the lessons to the real world. Teachers were encouraged to work with a partner in their grade level to complete the task more efficiently. During these sessions the coach facilitated lesson development and offered strategies for creating engaging and authentic lessons. With the assistance of the coach, teachers gained confidence and competence in their ability to use the Nearpod application and developed better lessons.

During weeks seven and eight, teachers implemented their lessons with their classes. The coach was available to model and observe the lessons. All teachers implemented their lessons and collected student performance results and student attitude results based on formative assessments and a survey conducted at the end of each Nearpod lesson. The group then got together and reflected on the experience of implementing the lessons with their classes. Teachers expressed that they enjoyed using the application and shared that it helped increase student engagement. Teachers also agreed that it helped them compose lessons that were more purposeful. Teachers indicated that the authentic application of the lessons helped students grasp understanding as evidenced in the success of the students.

For the next two sessions, teachers were encouraged to create another series of Nearpod lessons, but extending the lessons to involve an authentic task for students to complete that uses a different Web tool. The coach facilitated the teachers in the development of tasks mainly focusing on how to help their project reach Expansion or Refinement levels of LoTi. At these levels student collaborations extend beyond the classroom and students are given an opportunity for authentic problem-solving. Throughout this process, teachers were encouraged to ask questions and to collaborate with other teachers in their grade level. The coach suggested and reviewed a variety of Web 2.0 tools with teachers based on the needs of their authentic tasks, which helped differentiate the needs of the teachers.

The teachers then implemented their lesson and project with their classes over a two-week period. Again, the coach helped implement the lessons with teachers and observed the implementation process. Teachers continued to provide students with a Nearpod lesson and then bridged the learning objectives into an authentic task or project. Teachers also collected student data that indicated student success and survey questions regarding student attitudes and engagement.

Lastly, the teachers came together to reflect on the implementation of their lessons and authentic tasks. Teachers expressed the success and challenges they experienced and discussed how the lessons and projects could be improved. The teachers also analyzed the student achievement data that was collected and celebrated successes. This was followed by a discussion centered on strategies that could serve to improve the lessons for future lesson development. Next, teachers analyzed student survey data and discussed a plan to continue professional development that involved more technology integration. Teachers also took the post-survey to evaluate their beliefs, attitudes, confidence and experience after participating in the professional learning.

**Results**

To evaluate the potential impact of the professional development on students and teachers, an evaluation plan was created before the start of the sessions. Both qualitative and quantitative data were collected throughout the implementation of this project. The data collected measured three things: the impact that professional development has on student achievement, the attitudes and engagement of students when using certain technologies and authentic tasks to learn, and the beliefs, attitudes, confidence and overall experience of teachers after participating in the professional learning opportunity.

Throughout the implementation of the lessons, teachers were tasked with assessing their students using the assessment tools in the Nearpod application. There are many different question types that can be used to assess students including: multiple choice, short answer, discussion, and drawings. The table below details student performance from classroom-to-classroom based on the assessments given in Nearpod. Teachers on the same grade-level taught the same lessons and gave the same assessments using the application. The results report the use of the application in a math lesson as compared to using the application in conjunction with an authentic task or project.

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| --- | --- | --- |
|  | **Student achievement results when using Nearpod solely.** | **Student achievement results when using Nearpod and other web 2.0 tools in conjunction with an authentic task or project.** |
| Grade Level | Assessment 1 | Assessment 2 | Assessment 3 | Assessment 1 | Assessment 2 | Assessment 3 |
| Grade 3 Classroom | 80% | 85% | 83% | 90% | 88% | 90% |
| Grade 3 Classroom | 85% | 87% | 85% | 92% | 88% | 95% |
| Grade 4 Classroom | 75% | 78% | 77% | 87% | 89% | 87% |
| Grade 4 Classroom | 70% | 68% | 75% | 85% | 87% | 87% |
| Grade 5 Classroom | 73% | 76% | 78% | 78% | 82% | 80% |
| Grade 5 Classroom | 70% | 75% | 76% | 85% | 87% | 85% |

When comparing the results of solely using Nearpod to using the application and other tools in conjunction with an authentic task or project, results indicate that introducing additional web 2.0 tools and an authentic task or project into a lesson increases student achievement levels. Overall, classroom mean scores increased when the additional web tools and tasks were introduced. This is perhaps due to the many different learning styles that students have. Offering the material in a variety of formats facilitates a wider variety of learning.

 A survey was also given to students throughout the implementation of the lessons that assessed their level of engagement and attitudes towards the Nearpod application and the authentic task or project. The survey was given at two points during implementation, after using Nearpod for instruction and after using Nearpod in conjunction with additional web 2.0 tools and the authentic task or project. Eight questions were given on a scale from one to five with the overall mean score being collected and is detailed in the table below.

|  |  |  |
| --- | --- | --- |
|  | **Student survey results when using Web 2.0 tools solely.** | **Student survey results when using web 2.0 tools in conjunction with an authentic task or project.** |
| Student engagement | 4.7 | 4.9 |
| Student Attitude | 4.1 | 4.7 |

 Student survey results indicate that a high level of engagement comes from using the Nearpod application in both methods. However, there is a slight increase in the level of engagement when compared to the introduction of a task or project. Students also show a positive attitude to using the application indicating that most students prefer to use the application over traditional methods. There was also a slight increase of student attitude with the introduction of the authentic task or project indicating that most students prefer to learn with that method. Overall, both methods of using the application are effective in engaging students in the ways they prefer to learn.

 Lastly, the beliefs, attitudes, confidence, and overall experience of teachers after participating in the professional learning opportunity were assessed through the use of a pre and post survey. Teachers were asked about their beliefs about the effectiveness that technology can have on student engagement and achievement. They were also questioned about their willingness to try new technologies and different methods regarding instructing with technology. Moreover, teacher confidence in using new methods of instruction and the overall experience of the professional learning opportunity were assessed. Teachers were asked twenty-eight questions and were instructed to rate themselves on the different areas using a scale from one to five. The mean was taken from each set of questions. The table below reports the results from the survey.

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| --- | --- | --- |
|  | **Pre Survey** | **Post Survey** |
| Belief | 3.4 | 5.0 |
| Attitude | 3.5 | 4.8 |
| Confidence | 2.4 | 4.7 |
| Overall Experience | 0 | 5.0 |

 The results indicate that there was a major increase in all areas regarding the professional development that was provided to teachers.

**Deviation**

Initial plans were more focused on the effect web 2.0 tools has on math achievement, and although the experience addresses the relationship between web 2.0 tools and math achievement, it deviated to focusing more on integrating authentic tasks or projects in conjunction with web 2.0 tools to improve student achievement. This resulted in focusing more on the professional learning of teachers and careful planning of professional development sessions. The original plan also opened the professional learning opportunity for kindergarten through fifth grade teachers, but due to feedback from administration, the development was only available for teachers grades third, fourth, and fifth.

**Reflection**

Throughout the duration of completing this project I was presented with many different learning experiences. Creating effective professional learning opportunities for teachers has many obstacles and can be a difficult task. However, by learning how to strategically plan I can better contribute to school improvement by facilitating technology and taking on a leadership role. By completing the capstone project I have learned how to successfully create a new initiative from planning and research to implementation.

 Crafting a purposeful professional learning opportunity for teachers was my main goal when planning this project, which took several hours to do. I had to conduct a needs assessment in order to determine the strengths and weaknesses to inform the content and delivery of the professional development. Since the professional development sessions took place over several weeks I knew I wanted to create meaningful and productive professional developments that would require me work closely with teachers. This would require me to have the ability to work with others and gain their trust. I believe that having a smaller group of teachers participate helped me facilitate their needs and reach a better outcome. I was able to work one on one with teachers and help them create effective learning experiences that integrated technology and research based strategies for their students. Though working with a small group was not part of the plan, I believe it worked out in my favor because personal relationships were able to form. Developing relationships is key in creating effective professional learning opportunities and encourages teachers to engage in future professional developments.

 I believe that I facilitated the effective use of technology to promote the shared vision from completing this project. I was able to collaboratively plan with and assist other educators in utilizing technology to improve teaching, learning, and assessment. I was able to evaluate the effectiveness of the professional learning in order to deepen teacher content knowledge and improve student achievement. Developing these skills is what is required of a technology facilitator and leader to help aid in the school change and improvement process.

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