857 Professional Development Proposal

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Needs Assessment

A needs assessment for this professional development project will encompass an assessment of the technology needs of the students, the learning needs of the teachers, and an inventory of available technology in the school.

The students' needs addressed by this PD are defined by the Virginia Computer Technology Standards of Learning (Board of Education, 2013) and include the following standards:

- C/T 9-12.1 A: Demonstrate the ability to perform a wide variety of complex tasks using technology, including creating and using models and simulations.

- C/T 9-12.4 B: Develop and apply strategies to evaluate new and emerging technologies as potential tools for learning.

- C/T 9-12.14 Use models and simulations to understand complex systems and processes

- C/T 9-12.16 Apply knowledge and skills to generate innovative ideas, products, processes, and solutions.

Teachers' needs are defined by The Virginia Administrative Code (Technology Standards for Instructional Personnel of 1998):

A. Instructional personnel shall be able to demonstrate effective use of a computer system and utilize computer software.

B. Instructional personnel shall be able to apply knowledge of terms associated with educational computing and technology.

C. Instructional personnel shall be able to apply computer productivity tools for professional use.

D. Instructional personnel shall be able to use electronic technologies to access and exchange information.

E. Instructional personnel shall be able to identify, locate, evaluate, and use appropriate instructional hardware and software to support Virginia's Standards of Learning and other instructional objectives.

F. Instructional personnel shall be able to use educational technologies for data collection, information management, problem solving, decision making, communication, and presentation within the curriculum.

G. Instructional personnel shall be able to plan and implement lessons and strategies that integrate technology to meet the diverse needs of learners in a variety of educational settings.

A survey instrument will be used to gather information on the teachers' perceptions on student technology skill levels and technology use. The survey will also gather information on teachers' initial perception of their use of technology as defined by the Technology Standards for Instructional Personnel. Additionally, information will be gathered on teacher attitudes and beliefs about the integration of technology in their teaching (Mishra & Koehler, 2006) and their confidence in their ability to use computer skills to execute a task (Wu, Chang, & Guo, 2008).

In addition to the pre-session survey, teachers will be asked to complete an inventory of hardware and software that is available in their classrooms and in their schools. They will

also be asked to provide information on the quantity and type of personal devices their students bring into the classroom.

Research Base

This project will focus on the use of a freely available online graphing calculator Desmos to support mathematics learning in high school mathematics classroom. The professional development will enable the high school mathematics teachers to integrate the software into the existing curriculum to support mathematics learning, to raise technology literacy. This professional development will train faculty participating in this project to effectively use the Desmos graphing calculator to support learning in all levels of high school mathematics, and to measure the impact of the training and use of the resource on teacher practice and student achievement. All curriculum materials created will be in alignment with the standards set by Virginia DOE.

The importance of the effective use of technology in the mathematics classroom has been firmly established ("Principles to Action", 2014; NCTM, 2011). The National Council of Teachers of Mathematics position on the role of technology in the teaching and learning of mathematics posted to the NCTM website states:

> "It is essential that teachers and students have regular access to technologies that support and advance mathematical sense making, reasoning, problem solving, and communication. Effective teachers optimize the potential of technology to develop students' understanding, stimulate their interest, and increase their proficiency in mathematics. When teachers use technology strategically, they can provide greater access to mathematics for all students" (NCTM, 2011).

But teachers face challenges when trying to integrate technology into their classrooms. In spite of overall improved access to computer technology in schools, teacher surveys show that use and integration of computer technology in classrooms is actually in decline (Wachira & Keengwe, 2011).

To meet student need, and for their own professional development teachers need to become proficient at using available technology. Multiple barriers exist including lack of resources, teacher beliefs and attitudes about using technology in teaching, lack of openness to change, and lack of training (Koehler & Mishra, 2009). The result is environments where many teachers are fearful of technology or do not have the time to integrate its use into their classrooms (Mishra & Koehler, 2006). But fear of technology may not be a salient driver of technology use. Wu, Chang, and Guo (2008) found that ease-of-use was not a predictor of teachers' use of technology in their classrooms. Instead, perceptions of usefulness for improvement of teachers' performance and student learning, and strong computer self-efficacy were found to significantly increase the probability of technology integration (Wu, Chang, & Guo, 2008).

The perception of the usefulness of a technology tool is bound by a teacher's ability to integrate the tool as only one of many means to present concepts and applications. The interaction between technology and content both affords and constrains the types of ideas that can be taught (Koehler & Mishra, 2009). An understanding of these affordances and constraints can only empower a teacher who has well developed content knowledge and pedagogical knowledge. This a professional development program is designed to introduce a tool to the teachers, not as an end, but as a means that can be adapted to the teachers' and the students' needs over time (Koehler & Mishra, 2009).

Desmos, an online graphing calculator, has been selected as the tool to be introduced to the teacher participants in this professional development program. It has been selected because of its stability over multiple delivery devices, including computers, tablets, and mobile phones. The Desmos graphing calculator's UX interface is intuitive and easily manipulated by a new user. In addition, the representations of the software are mathematically accurate and can be manipulated easily by students and teachers allowing for user agency (Zbiek, Heid, & Blume, 2007), immediate feedback, and mathematical consequences of user actions: properties necessary for deepening understanding and insight into mathematical concepts (Van Wert, 1998; Kaput, 1992).

Action Research on Learning is the framework used in this PD that provides the teachers, through reflection, the time and space to explore possibilities was essential to their learning process (Loucks-Horsley, Stiles, Mundry, & Love, 2010). Its form is a "collective self-reflective enquiry undertaken by participants," (Kemmis & McTaggart 1988, p. Bv 5). The form allows teachers to investigate their professional practice by using reflection on experiences to developing a plan for action or change. The components are a recursive cycle of planning, action, observation, reflection used to improve practice and knowledge. The aim of action research is to increase understanding of practices, innovation and the development of social practice (Gogus, 2012). The primary purpose of action research is to develop a community of inquiry within a community of practice (Reason, 2001).

Description of Program Goals, Activities and Timeline

The goal of this professional development program is to empower teachers to use technology tools to support student learning by effectively integrating the tool into a lesson

plan that allows students to explore the affordances of the tool to illustrate and demonstrate mathematical concepts.

- Participation in the PD will help the participant teachers achieve the following goals:
    - Understand the challenges and opportunities that technology tools bring to the classroom
    - Become proficient at navigating the Desmos.com website to access resources to develop course materials.
    - Develop and implement a lesson that integrates content developed on Desmos.com using the Desmos graphing calculator.
    - Share and critique developed activities and lesson plans with other PD participants.
    - Reflect on lessons successes and challenges in order to strengthen skills integrating content knowledge, pedagogical knowledge, and technology use.
- The following activities are designed to support the learning goals of the PD:
    - Pre- and post-surveys to gather information on teachers' experiences, available technology tools, and attitudes and beliefs regarding technology use in classroom. Questions will allow for open reflection by the teachers of how and why they do or do not implement technology based experiences in their classrooms and the impact (or lack of impact) of the PD on their practice following the training.
    - A preliminary discussion of the use of technology in mathematics classrooms including:
        - affordances and constraints of technology use,

- positive and negative experiences of the participants,

- and the perspective of the larger community of educators and education researchers (supporting literature will be provided)

o Training in the use of the Desmos graphing calculator, the resources on the Desmos.com site, and shared user content.

o Lesson planning using tools and content from Desmos.com

o Delivery of the lesson. Observation by other participants of the lesson can take place either in person or by review of gathered data from the lesson including video, photographs, and student-created artifacts (including student created content on the Desmos site).

o Written reflection by the teacher of the successes and challenges of the delivered lesson.

o Discussion among participants of strengths and challenges of the lesson could be strengthened. This will take place as in small (3-4 participants) focus groups either face-to-face or online depending upon the available resources of the school and the teachers.

o Teacher will either redesign of the original lesson or create a new lesson incorporating both their personal reflections and any insight that resulted from the group discussion.

- Proposed Timeline:

o The pre-survey will take place online before the first meeting

o A day-long seminar will include the preliminary discussion and Desmos tool training.

o Initial lesson development, delivery, reflection and discussion should occur within a 2 week timeframe.

o An additional week will allow time for the participants to either redevelop the initial lesson or create a new lesson.

Evaluation and Accountability Plan

Evidence of student achievement as measured by the Technology SOL will consist of student created content that demonstrates an understanding of how the tool can be used to illustrate mathematical concepts. Student developed simulations and demonstrated use of the tool will be captured via video, photographs, and student saved graphs on the Desmos site.

Teacher skills defined by the Virginia Technology Standards for Instructional Personnel will be assessed by analysis of data captured in the pre- and post-surveys. Effective integration of technology into practice will be demonstrated by the development and implementation of the lessons associated with the PD. Evidence of the teachers' ability to use technology to access and share information, collect data, and problem solve will be provided by successful implementation of a lesson that leverages the affordances of the technology, by participation in both reflection and discussion of the process, and by reimplementation of the use of technology in following lessons.

References

Board of Education (2013). *Computer technology standards of learning for Virginia's public schools grades 9-12*. Commonwealth of Virginia.

Gogus, A. (2012). Action research on learning. In N. M. Steel (Ed.), *Encyclopedia of the sciences of learning*. (pp. 69-72). New York: Springer

Kemmis, S., and McTaggart, R. (1988). *The action research planner* (3rd ed). Geelong: Deakin University.

Loucks-Horsley, S. Love, N, Stiles, K., Mundry, S., & Hewson, P.W. (2008). *Designing*

professional development for teachers of science and mathematics. Thousand Oaks, CA: Corwin Press, Inc.

NCTM (October, 2011). *Position*. Retreived from http://www.nctm.org/Standards-and-Positions

Principles to actions: Ensuring mathematical success for all. (2014). Reston, VA: National Council of Teachers of Mathematics,

Reason, P. (2001). Learning and change through action research. In J. Henry (Ed.), *Creative management*. London: Sage.

Technology Standards of Instructional Personnel, 8VAC20-25-30 (1998).

Van Weert, T. J. (1998). The impact of informatics on the teaching of mathematics. In D. Tinsley & D. Johnson (Eds.), Information and communications Educational Technologies and Mathematics 39 technologies in school mathematics (pp. 7–18). London, England: Chapman & Hall.

Wachira, P. and Keengwe, J. (2011). Technology integration barriers: Urban school mathematics teachers perspectives. *Journal of science education and technology*, *20*(1), 17-25.

Zbiek, R. M., Heid, K. M., and Blume, G. W. (2007). Research on technology in mathematics education. In F. K. Lester, Jr. (Ed.), *Second handbook of research on mathematics teaching and learning* (pp. 1169-1207). Charlotte, NC: Information Age Publishers and National Council of Teachers of Mathematics.