

**Upper Peninsula Teaching and Learning Conference
“Toward Superior Teaching”**

Teaching and Learning Innovations:
A Demonstration of How a Smartpen Can Script Superior Teaching

Submitted to:

**The Center for Teaching and Learning
at Northern Michigan University
in Cooperation with Michigan Technological University**

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Abstract

A smartpen is an innovative, technology-enhanced learning device that can strengthen pedagogic effectiveness and improve student learning outcomes in virtually all academic disciplines and learning environments. Equipped with a computer, audio recorder, infrared camera, and internal memory, this instrument simultaneously records what the teacher writes and speaks. The audiovisual recording can be wirelessly transmitted and synchronized to a computer. The presentation will demonstrate a wide variety of strategic classroom applications of the smartpen to motivate auditory, visual, kinesthetic, and tactile learner engagement. The adoption of smartpen activities is examined through the lens of SAMR and TPACK student and teaching-centered theories.

Presentation Track

The proposal is submitted to the *Teaching and Learning Innovations* presentation track for consideration by the Upper Peninsula Teaching and Learning Conference selection committee.

Presentation Session Timetable

The proposed 25-minute presentation incorporates three sections: (a) a five minute introduction to the smartpen technology and a brief discussion of the theoretical framework that informs the systematic and judicious integration of technology in the learning environment including the Substitution, Augmentation, Modification, and Redefinition (SAMR) and Technological Pedagogical Content Knowledge (TPACK) models, (b) a fifteen-minute demonstration of the technology and its differentiated uses for teaching and learning, and (c) a five minute question and answer session designed for audience members to pose any unanswered questions, discuss the technology or any teaching concepts or theories explored throughout the presentation, or to express their opinions or share their thoughts and ideas with the group (Koehler, Punya, & Cain, 2013; Puentedura, 2013; Punya & Koehler, 2006). A tabletop projector will capture and display the demonstration to a wall screen.

The Smartpen Demonstration

The demonstration will begin with a walkthrough of smartpen features including the power button, the built-in microphone and speaker, the headset jack, OLED display, USB connector, infrared camera, rechargeable non-removable lithium battery, removable ink cartridge, and mobile charging cradle. The smartpen demonstration will be conducted using a special dot paper, required to record what is written, sketched, or illustrated. The interactive

presentation will showcase three didactic activities including how to: (a) record and share a pencast learning activity via EduCat, (b) prepare digital curriculum plans and record, store, and retrieve related teaching notes, and (c) use pencasts to facilitate a self-reflection of teaching performance and effectiveness. Optional mobile apps designed to transmit smartpen recordings using Bluetooth technology to smartphones and tablets will be discussed. Instructional design employing smartpen technology for accessibility is highlighted. Prior to the conclusion of the demonstration, a smartpen and dot paper notebook will be distributed through the audience for examination.

Targeted Audience

The presentation will target a diverse and comprehensive audience, encompassing faculty of all experience levels and position types teaching in any academic discipline or learning environment. The presentation focus extends beyond higher learning teaching to include faculty serving in all sectors of formal education. Although the demonstration is intended for educators, students and administrators may also benefit from the information presented at the session.

Audience Takeaways

Audience takeaways from the presentation include how to operate smartpen and smartpen related technology, design smartpen instructional activities, and integrate smartpen technology in a teaching and learning environment. A demonstration of several innovative smartpen activities that promote high-impact teaching practices and student engagement will be central to the presentation. Moreover, attendees will reinforce their scholarship of teaching and learning (SoTL) and pedagogical expertise vis-a-vis the alignment of multimedia activities to evidence-based methods to promote higher-level and multimodality learning.

Theoretical Framework

While the smartpen is an ink-filled writing instrument commonly used by students as a note-taking gadget, the embedded computer records each pen stroke along with audio that can be transferred to a computer, phone, or tablet in a file called a pencast. A pencast viewer can play, pause, stop, or replay a video, slow down or speed up the audio, or advance to various sections of the pencast file. Comparatively, screencasts are audio and video recordings of computer screen output with similar functionality. Research has been conducted to evaluate the use of screencasts in various educational settings, the indications of which evidence an improved student learning experience, increased student engagement, satisfaction, and motivation, a reduction of anxiety (Evans, 2008; Hew, 2009; McKinney, Dyck, & Luber, 2009; Morris & Chikwa, 2014).

Pencasts for Improved Learning Outcomes

Technology-enabled learning tools are argued to improve the student learning acquisition process (Petty, 2013). Students that utilize supplemental materials are more likely to earn a higher course grade (Pinder-Grover, Green, & Millunchick, 2011; Shaffer & Schweback, 2015). Morris and Chikwa (2014) discovered that students watching screencasts received higher course grades than their peers who did not interact with them. Pencasts are even linked to a deeper understanding of learning and can magnify the overall learning experience (Bovill, Cook-Sather, & Felten, 2011; Bronstein, 2009).

The Digital Pen as an Assistive Technology Tool

The digital pen can benefit students with learning challenges or disabilities. Smartpens have helped students with disabilities to improve mathematics skills and reading comprehension

(Bouck, Bassette, Touber-Doughty, & Flanagan, 2009). As an assistive instructional technology, smartpens can provide instructors with the ability to record and broadcast lectures, design activities, or create resources to support students with learning difficulties (Ok & Rao, 2017).

Learning Modalities and Smartpen Technology

Learning modalities are described as the senses that are incorporated during the learning process (Sprenger, 2003). These senses serve as learning gateways that enable students with the ability to process, retain, recollect, and transmit information (Silver, Strong, & Perini, 2007). The modalities most commonly observed in a classroom setting include kinesthetic, visual, auditory, and tactile. Researchers assert that student learning is amplified as more modalities are exercised in the learning process (Burden & Byrd, 2013, King & Alperstein, 2015).

Smartpen technology promotes the simultaneous use of all learning modalities (Allison & Rehm, 2016). Auditory senses are triggered from the recordings of the voice of the instructor. Visual senses are cued by the video, graphics, or other representations captured as part of the pencast. Tactile modalities are stimulated as students work with the pencast recording itself and the keyboard, touch pad or screen, of their computer or other smart device. Kinesthetic senses are activated when students are encouraged to complete an activity or problem-based activity conveyed by a pencast.

The TPACK Model

The Technological Pedagogical Content Knowledge (TPACK) framework was developed to guide instructors in the strategic integration of emerging technology to leverage effective teaching (Koehler & Punya, 2006). The model, illustrated in Figure 1., consists of three

domains: pedagogic knowledge (PK) (how or the expert knowledge in the science of teaching), content knowledge (CK) (what, or the understanding, and expertise of the subject matter), and technological knowledge (TK), (knowledge about technological tools and how to integrate them in the classroom), the intersection of which fosters enhanced learning. Koehler and Punya (2006) proposed that pedagogy, content, and technology must be viewed holistically, and not in isolation, to deepen student learning. The overlapping intersection of all three learning domains in the context of learning is suggested to meaningfully enhance teaching and improve student understanding by means of technology. Integrating smartpen technology in the classroom can help instructors to reach the targeted amalgamation of pedagogical content knowledge (PCK), technological content knowledge (TCK), and technological pedagogical knowledge (TPK).

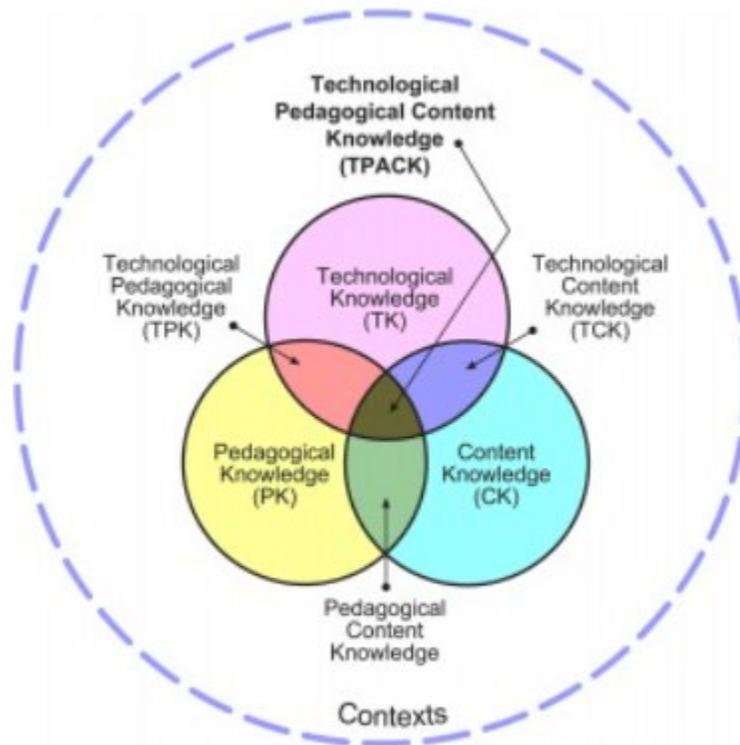


Figure 1. TPACK model. Source. <http://www.tpack.org/>

The SAMR Model

The Substitution, Augmentation, Modification, and Redefinition (SAMR) is a model to provide instructors with the means to design, develop, and integrate digital learning tasks to lead to high-level student learning outcomes (Puentedura, 2013). The SAMR model is a hierarchy, constructed similarly to Bloom's taxonomy in that cognitive learning is elevated as student learning progresses from the Substitution task (lowest level) to a Redefinition task (highest level) (Bloom, 1956; Puentedura, 2013). Pencasts redefine traditional ways of learning, not previously possible before the invention of the technology, enabling higher-order thinking and transformative learning.

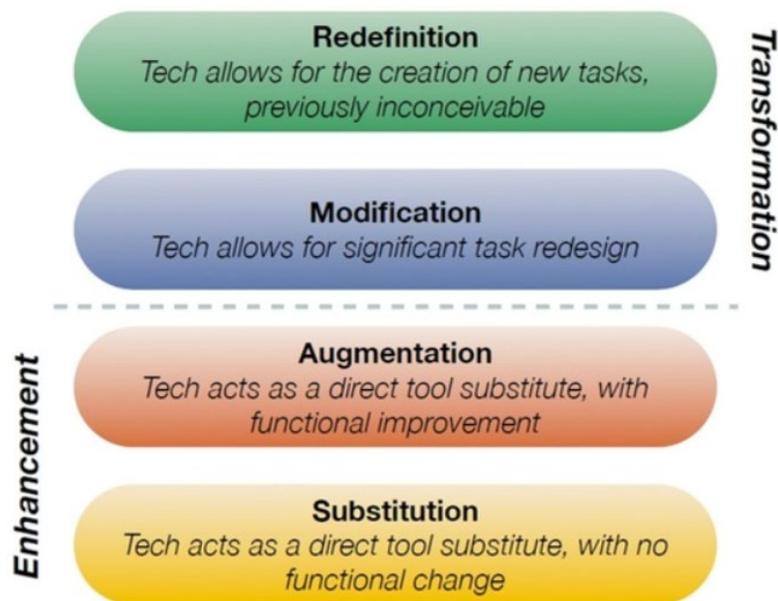


Figure 2. SAMR model. Source. <http://www.educatorstechnology.com>

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