Elementary Students' Tablet-Based Note taking Application Use for Writing in Science

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BACKGROUND

Scientific Inquiry

Definition

The diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work.

(National Science Education Standards, 1996, p.23)

Practices for Inquiry

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

A Framework for K-12 Science Education (NRC, 2012, P.20)

Inquiry-Based Science

As scientists engage in reading, writing, and talking as part of their scientific practice, ***educators*** should consider language and writing as an integral part of doing and learning inquiry-based science.

(Baker et al., 2008; Howes, Lim and Campos, 2009; Yore, Florence, Pearson, and Weaver, 2006)

Science & Writing

- Writing promotes critical-thinking skills and the construction of vital scientific concepts in order to challenge ingrained misconceptions (Baker et al., 2008).
- The writing process is an integral part of science and is an extension of the inquiry and interpretation processes (Yore, Florence, Pearson, and Weaver, 2006).
- Literacy practices should be central to science teaching; reading, writing, and speaking are foundational to the work of professional scientists, as well as to the comprehension of ideas by nonscientists (Howes, Lim and Campos, 2009).

Science Notebooks

Many teachers at the elementary level incorporate writing in science through the use of science notebooks

(Baxter, Bass, & Glasser, 2001; Fulton & Campbell, 2014; Fulwiler, 2007; Gilbert & Kotleman, 2005; Shepardson & Britsch, 2004; Worth, Winokur, Crissman, Heller-Winokur, & Davis, 2009).

Paper-based vs. Digital-based

- Traditionally, science notebooks have been introduced via paper-based notebooks.

- Studies have suggested the potential benefits of integrating Information Communication Technology (ICT) into science learning. Some of the benefits include:
  - the encouragement of communication,
  - collaboration in science research activities
  - collection of scientific information
  - interaction with multimedia resources

(see Bingimlas, 2009).

Tablet-Based Note-Taking Applications (TbNA)

DIGITAL SCIENCE NOTEBOOKS

Rationale

Digital science notebooks can include the core functionality of paper-based notebooks while adding the additional benefit of familiarizing students with a digital system.

Arnstein, Hung, Franza, Zhou, Borriello, Consolvo, & Su, 2002; Giles, 2012; Schraefel et al., 2004

A TABLET-BASED NOTE TAKING APPLICATION (TbNA)

Handwriting

- Handwriting is a “natural” and fluid mode of text entry for elementary-aged children.
- Writing on a tablet was as efficient as, and produced comparable writing to, pencil and paper.

(Longcamp, Zerbato-Poudou & Velay, 2005)

Audio Recording

- When ELLs used iPods to record their thinking prior to writing, they used the devices as a means to rehearse what they wanted to say.
- They would listen back to their statement, modify their thinking, and repeat the process until they were satisfied with their answer.

(Fulton, 2012)

Tables for Data Organization

- Being able to create a table and enter values is a common scientific practice.
- Students need opportunities to organize their information and observations in a way that makes sense to them (Rider-Bertrand, 2012).

Cloud-Based File Sharing

- Researchers and educators have emphasized the importance of formative assessment for guiding students toward learning and academic achievement (Hwang & Chang, 2011).
- Cloud-based features that facilitate communication of ideas between teacher and student, and between peers, is deemed an essential feature of a developmentally appropriate note taking application.

Notability

Features:

- Handwriting/Drawing
- Audio Recording
- Cloud-based File Sharing
- ~~Creating Tables~~
- Low cost ($2.99)

CURRENT STUDY

Setting & Participants

Setting

- Six-week Elementary science course at a university-sponsored summer program
- Twelve tablet computers (i.e., iPads) with a TbNA (i.e. *Notability* by *Ginger Labs*)

Participants

- Eighteen (N = 18) students in grades 4-5
  - All students used the tablet computers individually and in collaboration with a peer during class time.

RESULTS

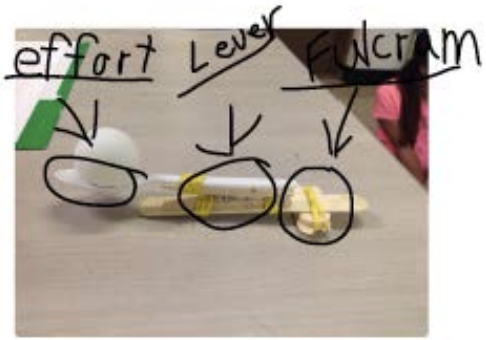
Features Used

Tools	Number of Responses	% of Responses
Taking a photo	17	89%
Drawing/Coloring	17	89%
Erasing	16	84%
Handwriting	16	84%
Typing	15	79%
Cutting/Pasting	15	79%
Highlighting	14	74%
Zooming (Magnifying glass)	14	74%
• • •		
Inserting web clip	4	21%
Inserting figures	3	16%
Adding stickies	3	16%
Audio recording	2	11%
Palm resting	0	0%

Examples

10

Catapult day two



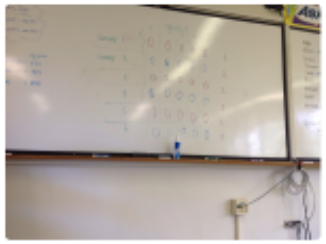
Today we can buy more materials so we got two rubber bands to hold the broken Popsicle sticks witch act as fulcrum.

This is us testing the catapult but it never reached the target but after putting extra Popsicle sticks it increased the power and accuracy.

This is our fulcrum it is made of broken down sticks

We added another rubber band because the spoon kept

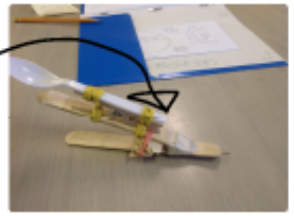
Trys	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
color	out	out	out	out	green	out	out	out	blue	blue	out	out	out	out	out



This was everybody's score we were very lucky.This was a very close score. Everybody's catapult was different they were very simple to very complicated.

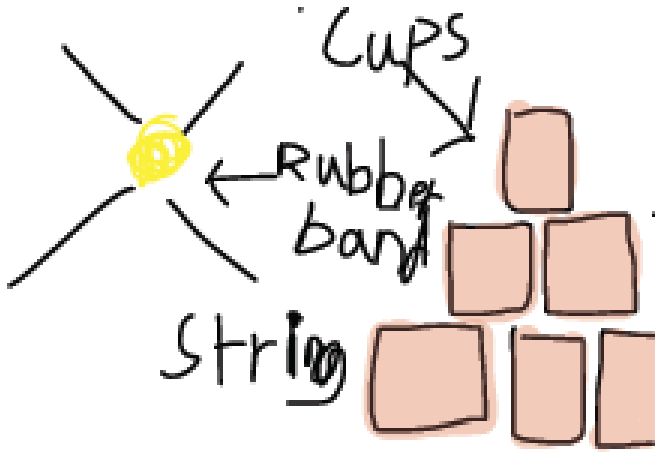
day three

This is our catapult we added the tape so it is more stable.



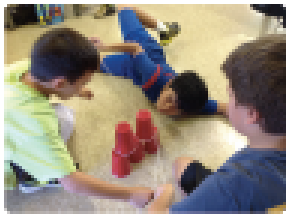
Then we added more Popsicle sticks so it's stronger and can shoot farther.

Examples



We are trying to stack the cups without touching the cups

Our strategy was blowing the cups



It did not really work

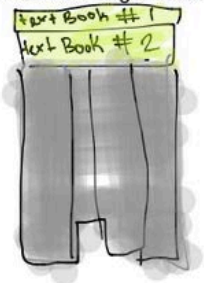
We messed up a few times. By that I mean a lot.

They were all annoyed, but we did it.

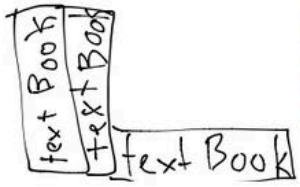
Our shape the circle was the strongest shape so far.
Our shape could hold 2 heavy text books.

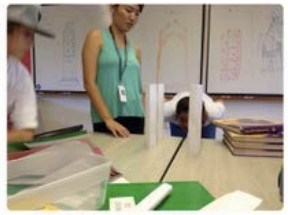
We used 2 of the text books.

The least strongest shape I think was the triangle because they tried to put 1 text book on but it fell.



This time the triangle shape could hold 2 text books.





Ms.Okada and Ms.Taoka tried the shape triangle.

Favorite Feature

Six students (33%) chose the drawing tool as their favorite tool.

- It let me write and draw with the same icon.
- Because you can write and draw with it
- cuz we could Draw what ever we want and then erase it.
- Because I can show people my work and more diagrams.

Favorite Feature

Another six students (33%) chose the typing tool as their favorite.

- because its fast
- your hands could fly across the keyboard
- because the keys are easy to press.
- because you get to change the font.

Least Favorite Feature

Six students (33%) chose the erasing tool as their least favorite.

- Because it erased your drawing.
- It erased to much at once.
- Because sometimes it erases everything
- Because it can erase the things that you do not want to erase.

Most Helpful

Ten students (56%) chose the typing tool as the most helpful tool for recording data.

- The typing tool was most helpful because it made it easier to write.
- Because you could type really quickly.
- You can type anything.
- It's easy to write fast.
- It's fast.

Paper-based vs. Digital Based

- Thirteen students (72%) chose the DSNs and the other three students (17%) chose paper-based notebooks.
- Those who chose paper-based notebooks explained that they liked paper-based notebooks because it was easier to write and draw.
- Those who chose paper-based notebooks explained that they liked DSNs because the technology-enabled device was easier and faster to use, had more tools to use, and was also more fun to work with.

Discussion

- It's encouraging that elementary-aged children were comfortable using all of the features of the note-taking application.
- The majority of students seemed to recognize some of the value associated with the digital science notebook over a more traditional composition notebook.
- Overall, the elementary-aged children seemed to have a positive experience using the TbNAs as their digital science notebook.

Limitations & Future Work

- What was reported might not directly reflect what students actually did with and how they actually feel about the TbNA.
- The next steps of data analysis include examining how these tools have been used in students' entries to facilitate student writing and how this led to students' understanding of the content.
- Future investigation is needed to examine how students use a TbNA in various scientific practices including organizing, analyzing, and interpreting data, as well as constructing explanations and engaging in evidence-based argument.

Questions?

Mahalo Nui Loa!

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