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

Seungoh Paek
Learning Design and Technology
speak@hawaii.edu

Lori Fulton
Institute for Teacher Education
fultonl@hawaii.edu

University of Hawai'i at Mānoa
Honolulu, HI
United States

Abstract: This study investigates the potential of a tablet-based note-taking application (TbNA) to act as a digital science notebook that supports elementary students' science practices. Eighteen grade 4-5 students, in an intensive six-week summer science class, participated in the study. During the program, students used a tablet-based note-taking application as a personal digital science notebook. Students' notebook entries and survey responses regarding their experience with the TbNA were collected. The study discusses how students made use of various features within the TbNA.

Introduction

The purpose of this project is to investigate how a tablet-based note-taking application (TbNA) might facilitate elementary students' science practices. More specifically, the study examines the potential of a TbNA to work as a digital science notebook, examining how students use functional tools of the TbNA such as handwriting, voice recording, picture taking, and file sharing, in relation to their science-related writing.

Background of Study

Writing in science has been an integral part of doing and learning inquiry-based science (Baker et al., 2008; Yore, Florence, Pearson, & Weaver, 2006). Evidence of this can be seen in *A Framework for K–12 Science Education* (NRC, 2012), which asserts that "from the very start of their education, students should be asked to engage in the communication of science [and] should write accounts of their work, using journals to record observations, thoughts, ideas, and models" (p.76).

At the elementary level, many teachers utilize science notebooks as a way to encourage students to write within science (Baxter, Bass, & Glasser, 2001; Fulton & Campbell,

2014; Fulwiler, 2007; Rivard, 1994). Research has demonstrated that when students incorporate the communication-related aspects of science, such as the development of explanations within their science notebooks, there is a strong, positive correlation between their performance and their understanding of the content (Aschbacher & Alonzo, 2006; Fulton, 2012; Ruiz-Primo, Li, Tsai, & Schneider, 2010).

It can be, however, a challenging and complex task for primary-aged students to write about their scientific practices, such as constructing explanations and obtaining, evaluating, and communicating information. Accordingly, teachers should scaffold their instruction (Ruiz-Primo, et al., 2010) by supporting students' use of scientific language with appropriate writing frames (Choi, Notebaert, Diaz, & Hand, 2010; Ruiz-Primo et al., 2010) and by delivering explicit instruction (Baxter, et al., 2001; Ruiz-Primo et al., 2010; Tucknott & Yore, 1999).

While teachers' explicit instruction and support mechanisms serve to scaffold the development of scientific writing, studies have demonstrated the potential benefits of using Information Communication Technology (ICT) for science learning. Some of the benefits include the encouragement of communication, collaboration in science research activities, collection of scientific information, and interaction with multimedia resources (see Bingimlas, 2009).

Given these developments, this project introduced a tablet-based note-taking application– an ICT—to elementary students in order to examine how using the application as a digital science notebook might facilitate science practice. More specifically, the study investigated how various functional capabilities such as handwriting recognition, voice recording, and picture taking assisted students in completing various science-related tasks, such as observing phenomena, taking notes, and collecting and organizing data.

Methods

The research was conducted at a university-sponsored summer program. Eighteen (N = 18) students in grades 4-5 participated in the study. Twelve tablet computers (i.e., iPads) with a TbNA (i.e. *Notability* by *Ginger Labs*) installed were available for students. All students had the opportunity during the six-week science course to use the tablet computers individually and in collaboration with a peer during class time. The teacher introduced the TbNA as a digital science notebook, had the class brainstorm how to use the science notebook in terms of how and what to record, and demonstrated how to use the TbNA. The introduction and demonstration took approximately one hour. At the end of six weeks, students completed a survey about their use of the TbNA. In addition, students' notebook entries were collected at the end of the semester. For students' survey responses, descriptive data analysis was conducted to examine the use of specific tools available in the TbNA. In addition, student writing was analyzed using content analysis methods described by Ruiz-Primo and Li (2004). While data analysis is ongoing, this paper reports preliminary findings. These findings highlight the various features and functions of the TbNA that students reported using as well as those tools that appeared in their notes.

Results

A total of seven questions, including one multiple-choice question and six open-ended questions, were given to students. The first question was a multiple choice question asking the students which tools available in the TbNA they used while recording their work in their digital notebooks. All of the possible tools in the application were listed as options, and students were asked to check all of the tools they used. Table 1 presents the frequency of students' responses.

Table 1. Students' Use of Note Taking Application Tools.

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%
Changing paper	10	53%
Sharing (Google Drive)	8	42%
Inserting web clip	4	21%
Inserting figures	3	16%
Adding stickies	3	16%
Audio recording	2	11%
Palm resting	0	0%

As shown in Table 1, more than 70% of students reported taking a photo, drawing/coloring, erasing, handwriting, typing, cutting/pasting, and highlighting. On the other hand, only a few students reported using figures, web clips, and audio recording. Along with students' self-reports, their notebook entries from the 12 tablet computers

were collected to determine the tools actually used. For example, how many students' notes contained photos taken using the TbNA? The results indicated that students used typing, picture taking, drawing/diagraming, and handwriting while composing their notebook entries. Examining the students' notes also revealed that students used different colored pens and graphic organizers, such as tables and charts, as they worked to document and communicate information scientifically (see Figure 1). These results reflect the students' responses on the survey about their own tool use.

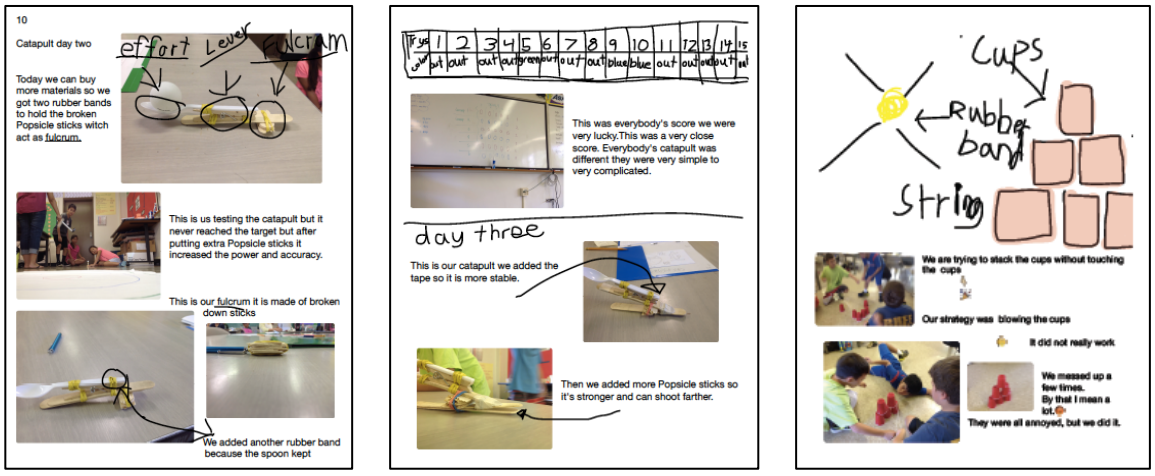

Figure 1. Samples of students' science-related writing in a tablet-based note-taking application (TbNA).

Further, six students chose the drawing tool as their favorite tool. They explained that they liked drawing because "It let me write and draw with the same icon," "because you got to use tools and colors," and "because you got to use tools and colors." Another six students chose the typing tool as their favorite. These students noted that they liked the typing functionality because it was "fast" and "the keys are easy to press" which allowed one student to "type instead of write."

In terms of the least favorite tool, six students chose the eraser explaining that "it erased to[o] much at once." Other students noted that the eraser "sometimes it erases everything" and can "erase the things that you don't want." These responses revealed that these students may not have known that they could have changed the size of the eraser to have more control over how much was erased at a time.

A final question asked students which notebook they liked better: a traditional composition book or a digital notebook. Thirteen students chose digital notebooks, and three students chose composition books. The three students who chose the composition book stated that they liked this book better because it was easier to write and draw. In contrast, the students who chose the digital notebook felt the technology-enabled device was easier and faster to use. Additionally, some students mentioned that the digital notebook had more tools to use and was also more fun to work with.

Implications or Discussion

This study aimed to investigate how a tablet-based note-taking application might facilitate students' writing in a science class. The study started by examining how students used various features of a TbNA. The results suggest that most students used a variety of tools without much difficulty. Students' self-reports combined with the actual notebook entries showed that the most commonly used tools included: typing, drawing, taking and inserting photos, and highlighting text. There were, however, a few tools such as audio recording and inserting web clips and figures that were less popular. In addition, the majority of students seemed to recognize some of the value associated with the digital science notebook over a more traditional composition notebook.

Taken together, the results reported here are encouraging in that they show how easy it is for elementary-aged children to use a TbNA in the context of their science lessons. Furthermore, the results also demonstrate the potential of a TbNA to be used as a digital science notebook in applied settings. 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.

References

Aschbacher, P., & Alonzo, A. (2006). Examining the utility of elementary science notebooks for formative assessment purposes. *Educational Assessment*, *11*(3-4), 179-203.

Baker, W. P., Barstack, R., Clark, D., Hull, E., Goodman, B. Kook, J., …Lang, M. (2008). Writing-to-learn in the inquiry-science classroom: Effective strategies from middle school science and writing teachers. *The Clearing House, 81*(3), 105-108.

Baxter, G. P., Bass, K. M., & Glaser, R. (2001). Notebook writing in three fifth-grade science classrooms. *The Elementary School Journal, 102*(2), 123-140.

Bingimlas, K. A. (2009). Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. *Eurasia Journal of Mathematics, Science & Technology Education*, *5*(3), 235-245.

Choi, A., Notebaert, A., Diaz, J., & Hand, B. (2010). Examining arguments generated by year 5, 7, and 10 students in science classrooms. *Research in Science Education, 40*(2), 149-169. doi: 10.1007/s11165-008-9105-x

Fulton, L. A. (2012). *Writing in science: Influences of professional development on a teachers' beliefs, practices, and student performance* (Doctoral Dissertation). Retrieved from ProQuest Dissertations and Theses. (1038158599)

Fulton, L. A. & Campbell, B. (2014). *Science notebooks: Writing about inquiry*. Portsmouth, NH: Heinemann.

Fulwiler, B. R. (2007). *Writing in science: How to scaffold instruction to support learning.* Portsmouth, NH: Heinemann.

National Research Council (NRC). (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas.* Washington, DC: National Academies Press.

Rivard, L. P. (1994). A review of writing to learn in science: Implications for practice and research. *Journal of Research in Science Teaching, 31*(9), 969-983.

Ruiz-Primo, M. A., & Li, M. (2004). On the use of students' science notebooks as an assessment tool. Studies in Educational Evaluation, 30(1), 61-85. doi: 10.1016/j.stueduc.2004.03.004

Ruiz-Primo, M. A., Li, M., Tsai, S. P., & Schneider, J. (2010). Testing one premise of scientific inquiry in science classrooms: Examining students' scientific explanations and student learning. *Journal of Research in Science Teaching, 47*(5), 583-608. doi: 10.1002/tea.20356

Tucknott, J. M., & Yore, L. D. (1999, March). *The effects of writing activities on grade 4 children's understanding of simple machines, inventions, and inventors*. Paper presented at the Annual Meeting of the National Association of Research in Science Teaching, Boston, MA.

Yore, L. D., Florence, M. K., Pearson, T. W., & Weaver, A. J. (2006). Written discourse in scientific communities: A conversation with two scientists about their views of science, use of language, role of writing in doing science, and compatibility between their epistemic views and language. *International Journal of Science Education, 28*(2-3), 109-141.