An Analysis of Students' Perceptions of Electronic Note Taking

Honors Project

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By

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Abstract

In order to examine students' perceptions of electronic note taking devices, we administered a survey to the students of a medium-sized public university, focusing on laptops, tablets, and phones, and their usage as note taking devices. This paper analyzes the results of that survey and their implications for the adaptation of electronic interfaces into classroom note taking routines. We examined the survey with four specific research questions in mind: how students have adopted electronic interfaces into their note taking habits, whether students utilize symbols and diagrams in their notes and how, what environmental factors affect students' use of electronic interfaces, and how students feel about electronic note taking in general.

The results of this study show that students are currently wary of adapting electronic interfaces into their note taking habits, likely because of the change in note taking styles that may be required to use electronic interfaces effectively. The results also show that laptops are currently the most widely used of the electronic interfaces. In fact, laptops were the highest-rated electronic device in every category except when recipients were asked about the availability of desk space. However, it seems that the biggest obstacle for the adoption of electronic interfaces may be their potential for distracting students in the classroom.

Introduction

In the past few decades, technology has advanced by leaps and bounds and is being integrated into many fields, especially education. As electronic interfaces become more and more prevalent in classrooms, it becomes increasingly necessary to examine the perceptions of the students who use these interfaces. By examining the impressions electronic interfaces leave on students, educators can adapt technology to their students' interests, software developers can

create the most efficient and attractive electronic interfaces for students to use, and the students themselves can utilize this technology to improve their ability to learn. To study these opinions, we have developed a survey to administer to student volunteers. This survey questions participants about their use of electronic devices, the techniques they use while taking notes, the environmental factors that affect their usage, and their overall views about technology in the classroom. By examining these areas, we hope to form a general picture of students' perceptions about electronic note taking.

Literature Review

As technology becomes more advanced and its uses becomes more diverse, research has been conducted to discover its potential impacts on learning. Researchers have placed significant emphasis on the potential of technology to enhance the note taking strategies and abilities of students. Research has been conducted on the behaviors of both professors and students while using electronic interfaces, with mixed results.

In the classrooms of public schools and universities alike, some professors have taken the first steps to integrate technology into the classroom. In order to facilitate the addition of technology to the classroom setting, Abowd and his co-researchers at the Georgia Institute of Technology initiated the Classroom 2000 project. By combining an overhead display, audio recordings, and private interfaces for students, the project showed potential for improving note taking habits. However, while some students highly appreciated the technological improvements, many students involved in the study believed that the additional interfaces were no more effective than a whiteboard or chalkboard (Abowd et al., 1997). Another iteration of the project ran into some accessibility and exclusion issues, especially with students who preferred to not take notes (Truong, Abowd, & Brotherton, 1999).

Other researchers have also attempted to integrate entire classrooms with technology to promote note taking habits. One group of researchers developed Classroom Presenter, a similar system to Classroom 2000, and implemented it in twenty-five computer science courses. Student reactions to the system ranged from improved learning and engagement with material to no real change; a few students believed their learning was harmed by the technology (Anderson et al., 2004). In another study, the same system was used in an example-driven class and generated high amounts of class participation through the use of its anonymous submission system. Several students indicated that the extra interaction without the potential for embarrassment improved their desire to participate in discussions (Anderson et al., 2007).

The integration of technology into the classroom is not limited to professors of computer science; many non-computer science disciplines have introduced technology into their classrooms, as well. Professors from Washington College conducted an Organic Chemistry class that was nearly paperless, with students using tablets to take notes and complete assignments. Student feedback on the experience was highly positive, with "9-out-of-12 students preferring to use an iPad to take notes rather than the traditional paper and pencil method" (Amick & Cross, 2014).

While some professors choose to integrate technology in multiple aspects of the classroom, many prefer more subtle integrations, such as through the use of PowerPoint. Michael Wirth examined the practice of using handouts of PowerPoint slides to allow students to take notes in the margins; similar to some features offered by Classroom 2000 and Classroom Presenter, but without additional electronic interfaces. Wirth concludes that having access to these resources benefits students' learning and study habits (Wirth, 2003).

Rather than researching the integration of electronic systems by professors in the classroom, some researchers chose to examine individual users of electronic notes. Dr. Lin and his colleagues examined integrating micro-notes, short notes and reminders that people often hurriedly jot down and need to refer to later, into electronic systems, believing they could be helpful for note takers. They found that the best micro-note system would combine several different aspects of both paper and digital note taking, but would need to be specially designed with its users in mind (Lin, Lutters, & Kim, 2004). C. C. Bates examined the use of a specific note taking program called Evernote by literacy coaches. After the examination, Bates concluded that users needed "professional development," like tutorials and instructional videos to effectively use such specialized programs (Bates & Martin, 2013). A separate study that involved using Evernote in the classroom showed a correlation between students' performance with the interface and their perceptions of using it; optimistic users performed well while skeptical users performed poorly (Palaigeorgiou, Despotakis, Demetriadis, & Tsoukalas, 2006). Other studies also show this correlation with electronic note taking in general, including one by Martin, McGill, and Sudweeks that analyzed why some students choose to use laptops for note taking purposes. Students cited easy mobility and communication with other students as significant motivations for using electronic notes (Martin, McGill, & Sudweeks, 2013).

Where some researchers focus on the implementation of electronic notes, others focus on the impact they have on the learning process. A study by Katayama, Shambaugh, and Doctor showed that students taking electronic notes are more likely to copy and paste information than type it out. This "shortcut" also seemed to lead to poorer performance on tests and activities than typing out the notes (Katayama, Shambaugh, & Doctor, 2005). A separate study, also performed by Katayama, showed that taking partial, paraphrased notes produced better results than taking

notes verbatim (Katayama & Crooks, 2003). Another study by Bauer and Koedinger showed that some features in note taking programs, such as copy and paste functionality, can have negative effects on note takers simply by being available (Bauer & Koedinger, 2006). Yet another study by Bui, Myerson, and Hale proposed that different electronic note taking strategies performed better in different situations: taking verbatim notes performed worse than summarized notes without any study time before the examination, but performed better with some time to study beforehand (Bui, Myerson, & Hale, 2013).

Even though many studies present the positive aspects of technological implementation in note taking, others exist that explore its negative effects. One group of researchers monitored a lecture hall where many students used laptops to take notes. While they did find that students spent more time taking notes than any other single activity, only one-third of the time was actually spent taking notes, with the remaining two-thirds spent on social media, games, and other off-task distractions (Ragan, Jennings, Massey, & Doolittle, 2014). Even when the option of participating in off-task activities was removed, another study found that students taking electronic notes still performed worse than students taking paper notes. The researchers believed the electronic interface made students feel more detached from the classroom and therefore were less likely to participate (Mueller & Oppenheimer, 2014). In a study that examined students' notes to see what functionalities of electronic interfaces, another group of researchers found that specialized electronic interfaces often contain extra features that were neither wanted nor used by participants (Kim, Turner, & Pérez-Quiñones, 2009).

Clearly, scattered research has been conducted about many aspects of electronic note taking. Full-classroom integration techniques seem to have the most positive impact, though the effects of personal use seems to fluctuate depending on the user's note taking techniques.

Interestingly, most research efforts have focused on the performance of students using electronic interfaces for taking notes, with less focusing on students' perceptions and beliefs about technology in the classroom. Therefore, we decided to examine these opinions to see how this rising note taking option is being received by students. Specifically, we chose to examine students' beliefs about the effectiveness of electronic interfaces as note taking devices, the support offered by the interfaces for creating diagrams and charts, the environmental factors that influence the effectiveness of the interfaces, and the steps students have taken to integrate electronic interfaces into their note taking habits.

Methodology

To conduct research on the electronic note taking habits of students, we constructed four research questions to focus on. Each question involves the connections between students and electronic devices that may be used for note taking and focuses on how the students perceive these interactions.

RQ1. How have electronic interfaces been adopted into students' note taking behaviors, and how has adopting these interfaces changed their note taking behaviors?

RQ2. How well do the interfaces support students' desired note taking behaviors?

RQ3. What environmental issues affect the usage and adoption of electronic interfaces as note taking devices?

RQ4. What are students' perceptions of the electronic interfaces that are often used for note taking?

With these questions in mind, we created a twenty-four question survey for our student volunteers to complete.

When constructing the survey, we first decided to define what electronic interfaces we were interested in researching. For the purposes of this research, we settled on three types: laptop, tablet, and phone. We also chose to question volunteers about their paper and pencil note taking habits, to serve as a baseline to compare to the electronic interfaces. Most questions were divided between these four categories, and participants rated their response to the questions for each one. Some questions compared typing to writing, especially when concerned with how natural the note taking style felt; for those questions, we combined writing with a stylus with pen and paper.

Throughout the survey, we examined several different facets of the students' note taking techniques. We initially asked about how easily and effectively the student could take notes using each of the four interfaces (RQ1). In addition, we specifically asked how easily students could create and use symbols with each interface, and whether the students wanted to be able to use symbols or not (RQ2). We also examined how natural and efficient the styles of writing notes felt to students (RQ4). We asked students about the environmental factors that could affect their ability to take notes with an electronic interface: interference from professors, desk space, and availability of power sources (RQ3). Finally, we asked how likely students believed they were to lose notes taken with each interface (RQ3).

Category	**Criteria**
By Device	Ease of Note Taking
	Effectiveness of Note Taking
	Use of Symbols in Note Taking
By Style	Naturalness of Note Taking
	Efficiency of Note Taking
Environmental Influence	Interference by Professors
	Available Desk Space
	Availability of Power Sources
	Likelihood to Lose Notes

Table 1. Survey Question Criteria

After the main body of the survey, we gathered demographic data from the volunteers to compare to the information we gathered. Each volunteer provided their sex, age, student classification, technology experience, and handedness. In particular, we were interested in gauging how right- or left-handedness seemed to affect the students' ability to take notes using the electronic interfaces. The surveys were provided via email to the entire student body of a medium-sized public university, and 214 were completed and analyzed for this study.

Results

Among the 214 volunteers who completed the survey, there existed a large amount of diversity. Approximately three-quarters of the respondents were female, with the remaining quarter made up of students who identified as male or preferred not to answer. In addition, the majority of volunteers were right-handed. Respondents were members of various age groups from 18 up to the early 50's, and were members of all student classifications.

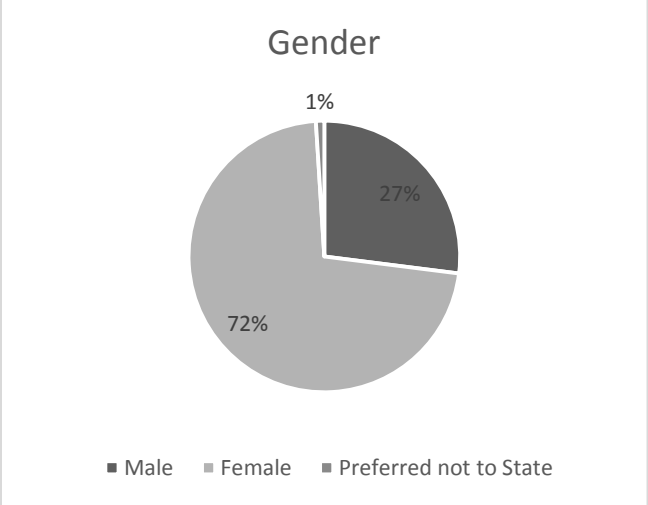

Figure 1. The Gender of Survey Participants

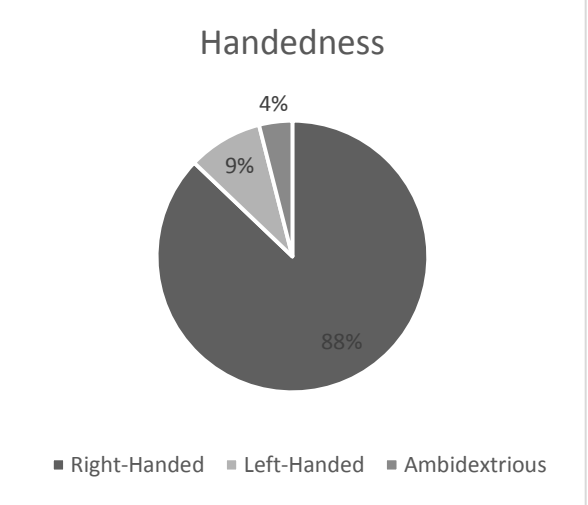

Figure 2. Handedness of Survey Participants

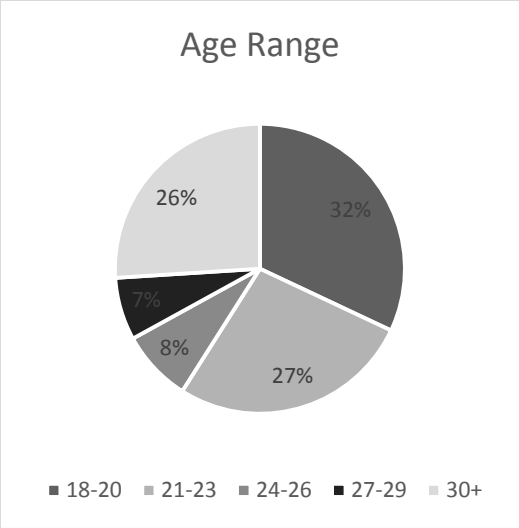

Figure 3. The Age Range of Survey Participants

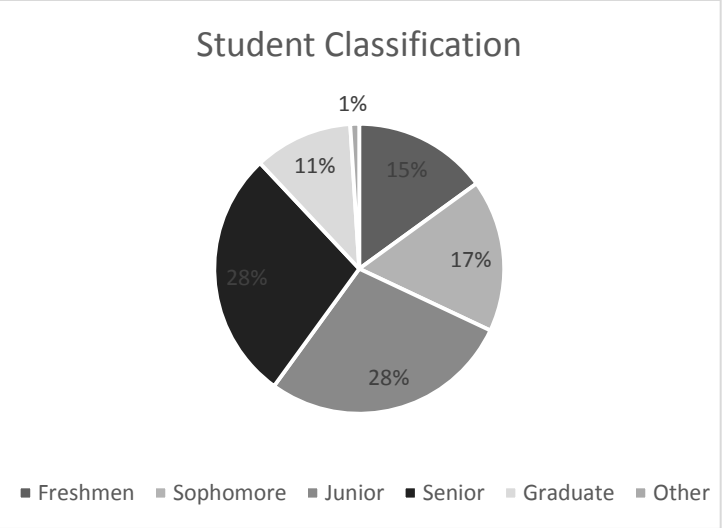

Figure 4. The Classification of Survey Participants

To analyze this data, we ran several ANOVAs comparing the devices and note taking style against the students' perceptions of taking notes using them. We then ran a post-hoc analysis on the significant results to discover where the differences occurred. In addition, we ran multiple correlations between different questions on the survey, but the results were uninteresting. This analysis will mainly focus on the results of the ANOVA and post-hoc results.

When analyzing the results of the survey, the most useful data appeared when comparing the student's beliefs about each interface's ease of use and effectiveness by device (RQ1). Analysis of the ease of use by device showed highly significant results, with the means for the devices placing paper and pencil ahead of laptop, followed by tablet, and phone. The same trend appeared for the effectiveness of the students' note taking by device. Here, the means appeared in the same order: paper and pencil, then laptop, then tablet, and finally phone. A significant relationship also appeared between the students' perceived ability to use symbols in their notes by device (RQ2). Paper and pencil achieved a significantly higher rating, while laptop, tablet, and phone were significantly lower. Finally, significance arose between the students' perceived

ability to express their thoughts by device, with mean values in the same order: paper and pencil, laptop, tablet, and finally phone (RQ1).

Criteria	ANOVA Results	Post Hoc Analysis Results
Ease of Use	$p = 0.000^{***}$ $F = 122.16$	$p < 0.001$ for all pairs of devices
Effectiveness	$p = 0.000^{***}$ $F = 146.68$	$p < 0.001$ for all pairs of devices
Use of Symbols	$p = 0.000^{***}$ $F = 202.72$	$p < 0.001$ for all pairs of devices
Ability to Express Thoughts	$p = 0.000^{***}$ $F = 35.86$	$p = 0.027$ for writing – laptop $p = 0.019$ for laptop – tablet $p < 0.001$ for all other pairs of devices

Table 2. ANOVA of Students' Perceptions by Device

*Significant at $p \leq 0.05$ ** Significant at $p \leq 0.01$ *** Significant at $p \leq 0.001$ † Not significant

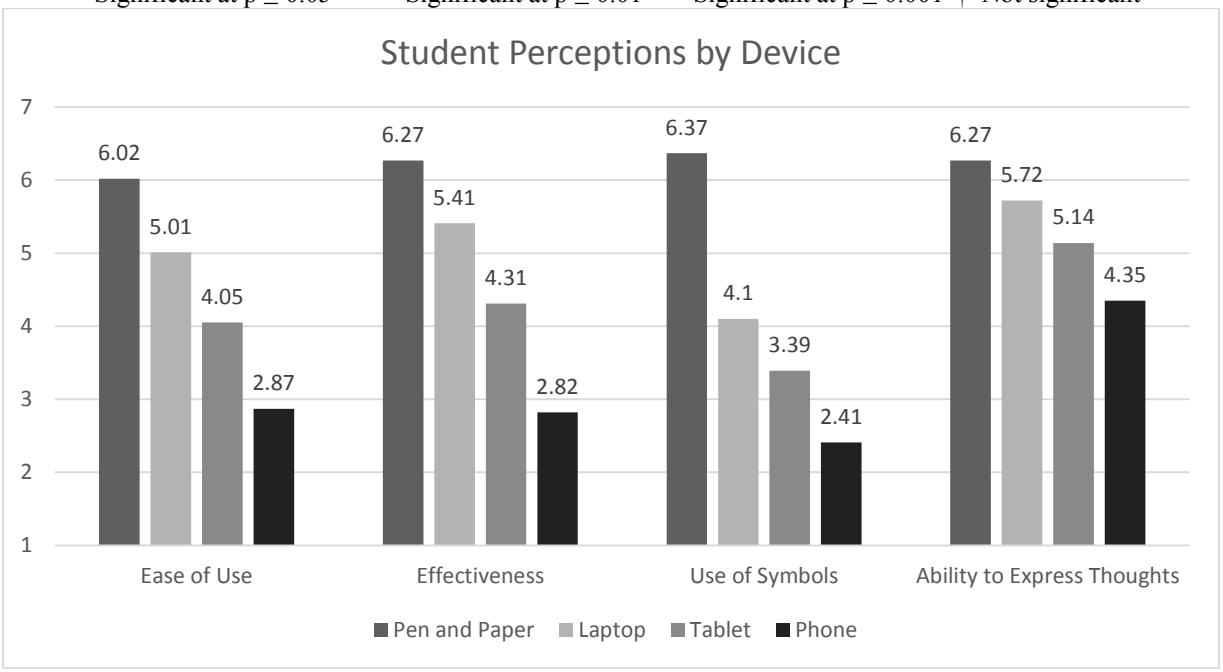

Figure 5: Students perceptions of each device's ease of use, effectiveness for note taking, easiness of symbol use, and ability to express thoughts.

Significance also appeared when analyzing the students' thoughts about the environment in relation to the note taking devices. When compared with how often professors interfere with the use of electronic note taking devices in class, significance appeared by device, with laptops slightly outperforming tablets, and trailed by phones. Significance also appeared in how often students had enough desk space by device. This analysis showed phones required the least amount of desk space, followed by tablets and laptops. Finally, when comparing how likely

students believed they were to lose their notes on each device, a significant relationship occurred. Students seemed slightly more inclined to believe that they could lose notes taken on paper and on their phones, and believed laptop- and tablet-based notes were less likely to be lost. However, all of the average values of the four devices were relatively low on the scale, meaning users of most of the devices did not believe they would lose their notes.

Criteria	ANOVA Results	Post Hoc Analysis Results
Professor Interference	$p < 0.000^{***}$ $F = 60.52$	$p = 0.233$ for laptop – tablet $p < 0.001$ for all pairs of devices
Desk Space	$p = 0.000^{***}$ $F = 63.65$	$p = 0.001$ for tablet – phone $p < 0.001$ for all pairs of devices
Power Issues	$p = 0.506^{***}$ $F = 0.68$	Not significant
Loss of Notes	$p = 0.000^{***}$ $F = 7.57$	$p = 1.000$ for writing – phone $p = 0.629$ for laptop – tablet $p = 0.279$ for writing – tablet $p = 0.049$ for tablet – phone $p < 0.003$ for all other pairs of devices

Table 3. ANOVA of Environmental Influences by Device
*Significant at $p \leq 0.05$ ** Significant at $p \leq 0.01$ *** Significant at $p \leq 0.001$ † Not significant

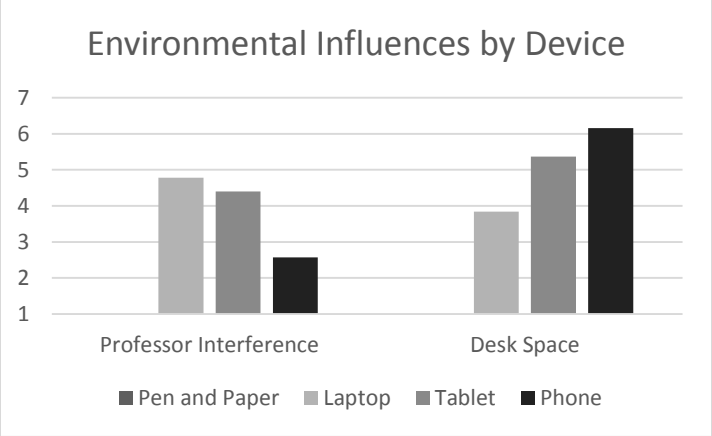

Figure 6: Interference from professors and desk space by device

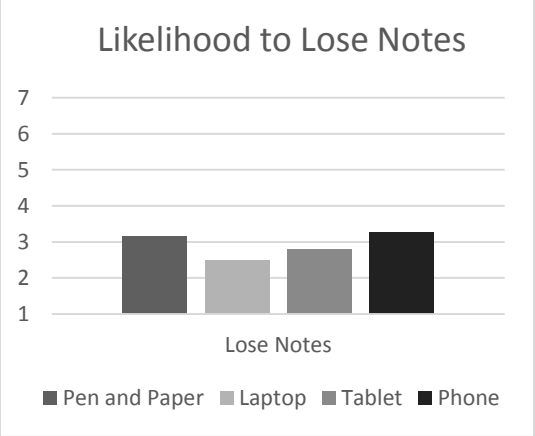

Figure 7: Likelihood of losing notes by device

Many examinations of data between survey questions and various demographic groups did not yield valuable information, but a few showed significant results. An analysis of students' perceptions of being able to effectively take notes by handedness produced significant results, with means of 4.63 for right-handed note takers, meaning neither effectively nor ineffectively, and 5.43 for left handed note takers, meaning relatively effectively. Another analysis of the

availability of desk space for note taking with electronic interfaces by gender also produced significant results, with means of 5.59 for male students and 4.96 for female students, meaning male students has fewer problems with desk space.

Criteria	ANOVA Results	Post Hoc Analysis Results
Natural	$p < 0.000^{***}$ $F = 126.40$	$p < 0.001$ for both styles
Efficient	$p = 0.000^{***}$ $F = 29.51$	$p < 0.001$ for both styles

Table 4. ANOVA of Note Taking Feel by Style

*Significant at $p \leq 0.05$ ** Significant at $p \leq 0.01$ *** Significant at $p \leq 0.001$ † Not significant

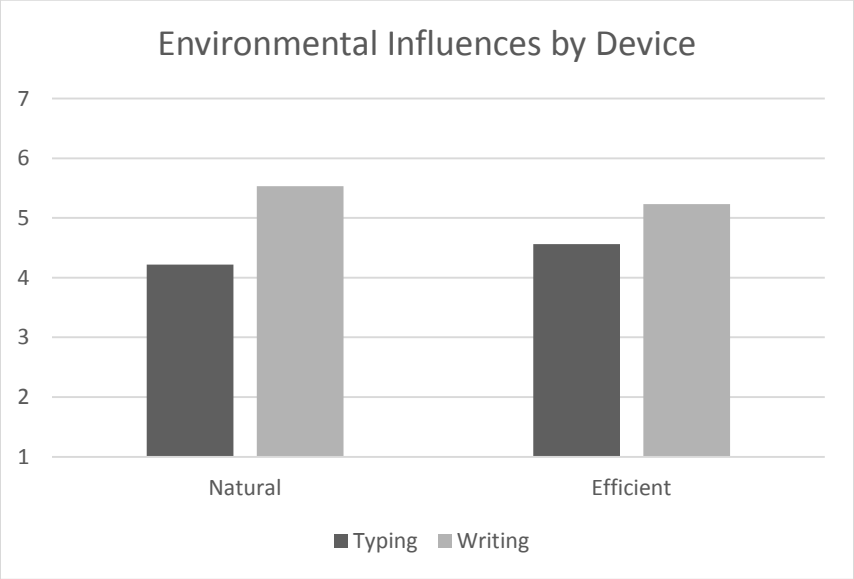

Figure 8: Naturalness and efficiency of note taking by style

Finally, there was significance found when comparing preferred styles of note taking: writing and typing. A significant relationship appeared with how natural taking notes with each device felt revealed, with slightly higher means for writing than typing, where a 1 corresponded to "Very Unnatural" while a 7 corresponded to "Very Natural." A similar result occurred with how efficient taking notes with each device, with writing scoring slightly higher than typing on a similar scale.

Conclusions

After examining the data provided by the survey, we applied our findings to our research questions. The data corresponding to RQ1, "How have electronic interfaces been adopted into

students' note taking behaviors, and how has adopting these interfaces changed their note taking behaviors," revealed that the majority of students prefer to write out their notes, with three quarters of respondents preferring writing over typing, and on average, writing was believed to be the most effective method. Electronics are slowly being adapted, as 41% of participants reported that they used some type of electronic interface to take notes, with laptops being the most common device, but many participants still prefer paper and pen.

Interestingly, many participants indicated that they preferred one style over another because it was faster: those who prefer paper and pencil believed writing was faster, while those who prefer a laptop believed typing was faster. This suggests that the preferred note taking interface is based more on familiarity than inherent functionality. One student echoed this sentiment when asked why writing is preferable to typing:

> "When I was in public school we never used computers to take notes and we never used computers in class unless it meant a trip to the computer lab. So I am just used to writing my notes out and I usually remember things better after I actually write them [d]own."

Other students noted the potential for distraction by electronic interfaces. Many pointed to the potential for software errors and social media as major distractions, while others believed the excess noise created by typing was distracting for both the note taker and other students. This is similar to the results of the study that examined electronic note taking in a lecture hall, which found that two-thirds of the time spent on electronic interfaces was used for non-note taking activities (Amick & Cross, 2014).

To determine how electronic interfaces affected their note taking skills, participants were asked whether they believed they would have to change note taking styles in order to effectively use an electronic interface. The majority of the respondents believed that, no, it would not

require a change of style to use electronic interfaces. However, when examining only students that actively use electronic interfaces, an overwhelming majority indicated that they did have to change their note taking styles to effectively use electronics for note taking. This suggests that perhaps some of the resistance to electronic note taking is a refusal to adapt to the electronic interfaces. A study of the Evernote note taking software revealed similar trends, where the students who were willing to adapt to the interface performed the best with it (Palaigeorgiou et al., 2006).

RQ2, "How well do the interfaces support students' desired note taking behaviors," revolves mainly around the use of symbols and diagrams in their notes. When asked about using symbols and diagrams in their notes, 85% responded that they used them often. Interestingly enough, when asked to rate how well each interface allows for the use of symbols and diagrams, respondents reported that writing on paper was the easiest, followed by using a laptop, then a tablet, and finally a phone. This was especially interesting because it would appear that being able to write on a tablet would make it easier to create symbols than a laptop, but that does not appear to be the common belief among students. However, even though the laptop was the second-best interface for symbols, writing was clear and away the most effective method. It seems that many students do not believe current electronic devices properly support the use of symbols and diagrams. This supports the findings of an experiment with Classroom Presenter by Anderson which expressed that specific goals (like effective use of symbols) have to be kept in mind when designing note taking interfaces (Anderson et al., 2007).

RQ3, "What environmental issues affect the usage and adoption of electronic interfaces as note taking devices," focused on professor interference, desk space, power availability, and likelihood of losing notes. When examining how often professors interfered with electronic note

taking interfaces, laptops and tablets had middle-range numbers, suggesting that students believe about 50% of professors would not allow them to use these interfaces in a classroom. Phones, however, had an average of 2.57, suggesting that professors are often strict about phone usage in class, likely because of their association with instant messaging and social media.

When examining desk space, participants reported that laptops were the most likely to require more space, as they are the largest of the electronic interfaces. Following laptops were tablets, then phones, which makes sense as smaller devices would require less space. Interestingly, female participants were overwhelmingly more likely to have a problem with desk space than male participants by a difference of almost a full point on the 7-point scale. These findings insinuate a potential relationship between female students and desk space, but more research would be needed to fully draw a conclusion.

While useful data turned up for professor interference and desk space, there were no conclusive trends among the responses pertaining to students having difficulties powering their devices. In the open-ended section, some students did mention having problems with battery life on their laptops, but these responses were in the minority. When examining how likely students believed they would lose their notes, laptop and tablet users seemed to be slightly more likely than phone or paper users to keep up with their notes, but all four categories were on the lower end of the scale, indicating that students believed it would be unlikely for them to lose their notes in any form.

Our final question, RQ4, “What are students’ perceptions of the electronic interfaces that are often used for note taking,” was answered in part by the open-ended response and the device preferences. Across nearly every category, except for desk space, laptops are viewed as superior to tablets, and tablets are viewed as superior to phones. Although there is no definitive data

among the survey responses that explains why this trend exists, it could potentially stem from a lack of familiarity: laptops have been available longer than tablets have, and phones are not often thought of as note taking devices. Interestingly, a larger percentage of left-handed participants were more open to electronic interfaces than right-handed participants were, though the difference is small: approximately 0.8 difference in averages on the 7-point scale. Further research would be necessary to see if these results persists.

Overall, our research revealed that students are currently not adopting electronic interfaces into their note taking habits. In addition, students seem to be wary of the use of technology in note taking. We hypothesize a lack of experience with the interfaces, or a lack of interest in them, may explain the lower usage of electronic interfaces and the general preference for pencil and paper. The common belief that electronic interfaces are a distraction could also be preventing students from taking steps towards electronic note taking. Future research could be directed at the reasons behind these perceptions.

Future Research

Though the results suggest laptops are viewed as strictly better than tablets and phones for note taking, further research could be conducted to see specifically why this is true, especially in the case of using symbols and diagrams. Research could also be conducted that focuses on the contexts surrounding electronic note taking; our research focused specifically on classroom note taking, but certain interfaces may be more effective for taking notes outside of the classroom. Potential research for this area could focus on taking notes outside of the classroom, perhaps when conducting research for essays or studying for exams. Electronic note taking could also have potential beyond education, and research could be focused on the use of electronic interfaces to take notes by doctors or therapists.

In addition, an entirely separate study could also be conducted to find clearer reasons for why paper and pencil is used so much more often than electronic interfaces. This research could examine how long students had been using paper and pencil to take notes or when they first tried to take notes using an electronic interface. Other research efforts could focus on the class-based context of the students, how access to sufficient technology varies by economic status, and whether that factors into note taking preferences.

Finally, as this research focuses on students' perceptions of electronic note taking, a separate study could examine students' actual note taking practices, to see how well they line up with their statements. For example, how do the students' note taking styles change over time? If the same student uses multiple interfaces to take notes, how do the styles of these notes vary? Do students who indicated that they frequently use symbols actually use them, and what do they use them for? Examining the physical notes of students could yield valuable information about the nature of note taking and what is necessary to allow electronic interfaces to adapt to students' note taking habits.

References

References

Abowd, G. D., Atkeson, C. G., Feinstein, A., Hmelo, C., Kooper, R., Long, S., … Tani, M. (1997). Teaching and learning as multimedia authoring: the classroom 2000 project. In *Proceedings of the fourth ACM international conference on Multimedia* (pp. 187–198). ACM. Retrieved from http://dl.acm.org/citation.cfm?id=244191

Amick, A. W., & Cross, N. (2014). An Almost Paperless Organic Chemistry Course with the Use of iPads. *Journal of Chemical Education*, *91*(5), 753–756. http://doi.org/10.1021/ed400245h

Anderson, R., Anderson, R., Davis, K. M., Linnell, N., Prince, C., & Razmov, V. (2007). Supporting active learning and example based instruction with classroom technology. *ACM SIGCSE Bulletin*, *39*(1), 69–73.

Anderson, R., Anderson, R., Simon, B., Wolfman, S. A., VanDeGrift, T., & Yasuhara, K. (2004). Experiences with a tablet PC based lecture presentation system in computer science courses. *ACM SIGCSE Bulletin*, *36*(1), 56–60.

Bates, C. C., & Martin, A. (2013). Using Mobile Technology to Support Literacy Coaching Practices. *Journal of Digital Learning in Teacher Education*, *30*(2), 60–66.

Bauer, A., & Koedinger, K. (2006). Evaluating the effect of technology on note-taking and learning. In *CHI'06 Extended Abstracts on Human Factors in Computing Systems* (pp. 520–525). ACM. Retrieved from http://dl.acm.org/citation.cfm?id=1125563

Bui, D. C., Myerson, J., & Hale, S. (2013). Note-taking with computers: Exploring alternative strategies for improved recall. *Journal of Educational Psychology*, *105*(2), 299–309. http://doi.org/10.1037/a0030367

Katayama, A. D., & Crooks, S. M. (2003). Online Notes: Differential Effects of Studying Complete or Partial Graphically Organized Notes. *The Journal of Experimental Education*, *71*(4), 293–312. http://doi.org/10.1080/00220970309602067

Katayama, A. D., Shambaugh, R. N., & Doctor, T. (2005). Promoting knowledge transfer with electronic note taking. *Teaching of Psychology*, *32*(2), 129–131.

Kim, K., Turner, S. A., & Pérez-Quiñones, M. A. (2009). Requirements for electronic note taking systems: A field study of note taking in university classrooms. *Education and Information Technologies*, *14*(3), 255–283. http://doi.org/10.1007/s10639-009-9086-z

Lin, M., Lutters, W. G., & Kim, T. S. (2004). Understanding the micronote lifecycle: improving mobile support for informal note taking. In *Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 687–694). ACM. Retrieved from http://dl.acm.org/citation.cfm?id=985779

Martin, R., McGill, T., & Sudweeks, F. (2013). Learning anywhere, anytime: student motivators for m-learning. *Journal of Information Technology Education: Research*, *12*(1), 51–67.

Mueller, P. A., & Oppenheimer, D. M. (2014). The Pen Is Mightier Than the Keyboard: Advantages of Longhand Over Laptop Note Taking. *Psychological Science*, *25*(6), 1159–1168. http://doi.org/10.1177/0956797614524581

Palaigeorgiou, G. E., Despotakis, T. D., Demetriadis, S., & Tsoukalas, I. A. (2006). Synergies and barriers with electronic verbatim notes (eVerNotes): note taking and report writing with eVerNotes. *Journal of Computer Assisted Learning*, *22*(1), 74–85.

Ragan, E. D., Jennings, S. R., Massey, J. D., & Doolittle, P. E. (2014). Unregulated use of laptops over time in large lecture classes. *Computers & Education*, *78*, 78–86. http://doi.org/10.1016/j.compedu.2014.05.002

Truong, K. N., Abowd, G. D., & Brotherton, J. A. (1999). Personalizing the capture of public experiences. In *Proceedings of the 12th annual ACM symposium on User interface software and technology* (pp. 121–130). ACM. Retrieved from http://dl.acm.org/citation.cfm?id=322593

Wirth, M. A. (2003). E-notes: Using electronic lecture notes to support active learning in computer science. *ACM SIGCSE Bulletin*, *35*(2), 57–60.