Exploring the Use of Tablet PCs in Veterinary Medical Education: Opportunity or Obstacle?

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ABSTRACT

A tablet PC is a laptop computer with a touch screen and a digital pen or stylus that can be used for handwritten notes and drawings. The use of tablet PCs has been investigated in many disciplines such as engineering, mathematics, science, and education. The purpose of this article is to explore student and faculty attitudes toward and experiences with tablet PCs 6 years after the implementation of a tablet PC program in the College of Veterinary Medicine (CVM) at Kansas State University (K-State). This study reports that the use of tablet PCs has enhanced students' learning experiences through learner-interface interaction, learner-content interaction, learner-instructor interaction, and learner-learner interaction. This study also identifies digital distraction as the major negative experience with tablet PCs during class time. The tablet PC program provides CVM faculty the potential to pursue technology integration strategies that support expected learning outcomes and provides students the potential to develop self-monitoring and self-discipline skills that support learning with digital technologies.

Key words: tablet PC, interaction, digital distraction, technology, veterinary medical education

INTRODUCTION

The Kansas State University (K-State) College of Veterinary Medicine (CVM) started a tablet PC initiative in 2007 to maximize veterinary students' learning experiences and prepare them for the medical and technological challenges they will face in their careers. Each first-year student enrolling at K-State CVM receives a new tablet PC upon arrival on campus. Students use the computer throughout the 4-year curriculum and have access to electronic versions of all curricular materials available via the CVM intranet or K-State Online, the course management system at K-State.

Each first-year veterinary student initially received a Toshiba and currently receives a Fujitsu Lifebook T902 tablet PC recommended by the college computing unit on the first day of orientation. Technology orientation sessions, including hardware and software training, are provided on the tablet PC distribution day. Select course lecture notes are preloaded in digital format. Students can print course materials in the Student Technology Room or the library at their own cost. One-on-one instruction and support is available to students until graduation, and a 4-year warranty is provided. Responsibilities for students include payment of a technology fee each semester (to cover hardware, software, digital notes, computer support, warranty, and hazard insurance costs), maintenance of software updates as directed by the computing unit, and understanding the college policies related to the tablet PC.

A tablet PC has a touch screen that allows the user to operate the computer with a stylus, digital pen, or fingertip instead of a keyboard or mouse.[1] The tablet PC is a conventional notebook with a keyboard for typing. It also has the option to rotate and fold the screen so that a stylus can be used for handwritten notes and drawings. This function makes tablet PCs more suitable than laptop computers in taking written notes, drawing sketches or diagrams, and solving problems with mathematical formulas.

The impact of tablet computers in teaching and learning has been investigated in many disciplines such as engineering,[2–5] mathematics,[6,7] science,[4,8–10] and education.[11–13] The frequency of student use of tablets is related to increased attention and increased engagement in engineering courses.[2,3] Enriquez[14] reported that the use of tablet PCs during lecture time enhanced students' note-taking ability, improved their ability to organize class materials, and allowed them to integrate handwritten notes and course materials. While research[11,15] demonstrated that tablet computers provided students individualized feedback and that such feedback was related to student engagement behavior, Fister and McCarthy[16] also provided evidence that tablet PCs enhanced the learning environment for many mathematics students and that the technology engaged students with different learning styles. Rogers and Cox[4] reported that the use of tablet PCs in science and engineering courses enhanced classroom dynamics, teaching effectiveness, and student learning. Eurell et al.[17] found that the tablet PC is an

Table 1: Student age range by class*

Students	Percentage of student respondents					
	18–20 years (%)	21–25 years (%)	26–30 years (%)	31–35 years (%)	36–40 years (%)	41–45 years (%)
Year 1	0	79	17	3	1	0
Year 2	1	69	18	7	3	2
Year 3	0	60	37	1.5	0	1.5

* Data were collected from 102 first-year, 109 second-year, and 68 third-year veterinary students.

effective tool for note-taking and information management for many veterinary students.

Moore[18] identified three types of interaction in terms of students' learning experiences: learner-content interaction, learner-instructor interaction, and learner-learner interaction. Hillman, Willis, and Gunawardena[19] added another type of interaction, learner-interface interaction, to the literature. Learner-interface interaction refers to "a process of manipulating tools to accomplish a task."[19(p.34)] Learner-content interaction refers to the process of "intellectually interacting with content"[18(p.2)] to bring about changes in the learner's understanding, perspective, or cognitive structure. Learner-instructor interaction attempts to motivate and stimulate the learner and allows for clarification of any misunderstanding by the learner regarding the content. Learner-learner interaction occurs "between one learner and another learner, alone or in group settings."[18(p.4)] The student learning experience with the tablet PC in this study is analyzed through the four types of interaction.

The purpose of this article is to explore student and faculty attitudes toward and experiences with the tablet PC. This study was approved by the K-State Committee for Research Involving Human Subjects.

METHODS

An online survey was conducted in April 2013. All preclinical veterinary students were invited to participate, including 109 first-year students (class of 2016), 120 second-year students (class of 2015), and 118 third-year students (class of 2014). Participation in the study was voluntary. The survey consisted of five types of response items: demographic information questions, multiple-choice questions, 7-point Likert-scale response items (1 = *strongly disagree*, 7 = *strongly agree*), fill-in-the-blank questions, and open-ended response items. An online survey was administered to the CVM teaching faculty in June 2013 to collect data regarding the use of tablet PCs from a faculty perspective. The faculty survey consisted of four types of response items, including demographic information questions, multiple-choice questions, 7-point Likert-scale response items (1 = *strongly disagree*, 7 = *strongly agree*), and open-ended response items.

The student survey and the faculty survey had different questions with a different focus. The student survey focused on students' experiences with using tablet PCs and their perspectives on how the use of tablet PCs affected their learning. The faculty survey focused on how faculty used technology tools and instructional strategies to accommodate the new learning environment in which each student has a computer. Both surveys were conducted using Qualtrics,[a] a professional and user-friendly survey tool through which all respondents took the survey without technical difficulty.

For the qualitative data collected in the open-ended questions from students and faculty, the researchers used Creswell's[20] "winnowing" approach to reducing data by developing codes and sorting text into categories. Two individuals analyzed the qualitative data with Miles and Huberman's[21] technique of "counting" data and determining the frequency of codes in the database. The first author coded and sorted data, and the other individual outside the CVM also sorted and counted the data for accuracy based on a comparison of the two versions completed by the two different individuals. For the quantitative data, statistical analysis was performed to determine the means and standard deviations of items related to learner-interface interaction, learner-content interaction, learner-instructor interaction, and learner-learner interaction, which are presented in the next section.

FINDINGS

Demographic Information

Of 347 veterinary students, 279 (80%) completed the online survey. Among the survey respondents, 78% were female and 22% were male. Most respondents were Caucasian (89%), and the remainder were Hispanic (4%), Asian American (3%), African American (1%), and Native American (1%). About 2% of students identified themselves as being mixed with parents from different ethnic backgrounds. Most of the students (70%) were 21–25 years of age. Approximately 24% were between 26–30 years of age, and few were between the ages of 31–35 (4%), 36–40 (1%), and 41–45 (1%) (Table 1).

The 108 CVM teaching faculty were invited to complete an online survey; 49 completed the survey for a response rate of 45%. Among survey respondents, 61% were male and 39% were female. Faculty respondents represented a wide age range with the following distribution: 51–55 years of age (20%), 41–45 (17%), 46–50 (17%), 31–35 (12%), 56–60 (10%), 36–40 (8%), 65–70 (8%), 61–65 (6%), and older than 70 (2%). Most faculty respondents were Caucasian (80%), and the rest were Asian American (14%), other backgrounds without specification (4%), and Hispanic (2%).

Table 2: Student report on items related to learner-interface interaction*

Item	Students	Percentage of student respondents							Mean (*SD*)
		Strongly disagree (%)	Disagree (%)	Somewhat disagree (%)	Neutral (%)	Somewhat agree (%)	Agree (%)	Strongly agree (%)	
Frequent use of a tablet PC as a primary device for study	Year 1	2	0	1	0	4	18	75	6.59 (1.02)
	Year 2	1	1	1	2	5	21	69	6.46 (1.07)
	Year 3	1	1	1	1	3	30	63	6.31 (1.15)
	Total								6.45 (1.08)
Familiarity with support contact to fix the computer	Year 1	1	1	9	5	17	37	30	5.68 (1.34)
	Year 2	1	2	3	5	11	30	48	6.03 (1.34)
	Year 3	1	0	1	0	9	43	46	6.27 (1.00)
	Total								6.0 (1.23)
Helpfulness of first-week technology support in class	Year 1	1	1	4	9	15	42	28	5.75 (1.23)
	Year 2	2	0	1	16	19	28	34	5.68 (1.36)
	Year 3	1	0	1	10	12	48	28	5.82 (1.14)
	Total								5.75 (1.24)
Helpfulness of first-year orientation on using a tablet PC	Year 1	5	6	6	7	14	29	33	5.40 (1.77)
	Year 2	1	3	3	12	13	24	44	5.83 (1.40)
	Year 3	2	1	4	10	14	25	44	5.72 (1.51)
	Total								5.65 (1.56)
Helpfulness of first-year orientation on software usage	Year 1	5	6	4	10	20	25	30	5.31 (1.73)
	Year 2	1	2	1	16	16	27	37	5.73 (1.32)
	Year 3	1	1	4	10	14	32	38	5.69 (1.37)
	Total								5.58 (1.47)
Familiarity with support contact for software usage	Year 1	1	3	17	9	19	29	22	5.15 (1.55)
	Year 2	3	4	7	7	19	26	34	5.49 (1.60)
	Year 3	3	0	10	3	25	35	24	5.52 (1.42)
	Total								5.38 (1.52)

* Data were collected from 102 first-year, 109 second-year, and 68 third-year veterinary students.

Positive Impact on Learning

The learner-interface interaction can be seen through students' frequent use of tablet PCs as well as the training and support designed to help them master the interface of the technology. The survey data (Table 2) suggest that students' frequent use of tablet PCs and ongoing support contribute to the continued use of the technology. The data support a positive experience in the learner-interface interaction.

Students reported the benefits of using a tablet PC to help them learn course content, which is reflected in four aspects of learning including accessing course materials via K-State Online, accessing course materials via Microsoft OneNote, facilitating note-taking, and facilitating online test taking. Accessing course materials through K-State Online ($M = 6.47$, $SD = 1.01$) and OneNote ($M = 6.12$, $SD = 1.25$) have greater mean values than in-class note-taking ($M = 5.94$, $SD = 1.28$) and online testing ($M = 5.02$, $SD = 1.71$). The survey data (Table 3) provide evidence for students' positive experiences in their interaction with course content, and such learner-content interaction has facilitated and enhanced learning.

The learner-instructor interaction is reflected both in and outside of class. The data (Table 4) demonstrate that students used the tablet PC to communicate with their instructors outside of class. The tablet PC also helped students interact with the instructor during class activity time, such as through TurningPoint[b] polling.

In a similar manner, students also used the tablet computer to communicate with their peers ($M = 6.02$, $SD = 1.34$) and collaborate with their classmates in learning ($M = 5.39$, $SD = 1.28$). Tables 4 and 5 provide evidence for positive interaction among students and between students and instructors. Such interpersonal interaction has facilitated social connection among students and enabled interactive and collaborative learning.

The top 10 ways students used tablet PCs correspond with the four types of interaction that enhanced the learning experience (see Table 6). Based on a selected list with an option for students to share their alternative answers, the survey reported that students took notes with the stylus (100%), marked lecture slides with the stylus (87%), searched the Web for learning purposes (82%), reviewed homework or projects with the stylus (75%), imported Web-based information into notes (72%), and created diagrams with the stylus (60%). Searching the Web and using the stylus for different learning tasks reflect a positive learner-content interaction using the

Table 3: Student report on items related to learner-content interaction*

Item	Students	Percentage of student respondents							Mean (*SD*)
		Strongly disagree (%)	Disagree (%)	Somewhat disagree (%)	Neutral (%)	Somewhat agree (%)	Agree (%)	Strongly agree (%)	
Using a tablet PC to access course materials on K-State Online helped me learn.	Year 1	0.5	0	0.5	0	3	23	73	6.62 (0.85)
	Year 2	2.5	0	1.5	2	4	17	73	6.47 (1.20)
	Year 3	1.5	0	0	3.5	7	38	50	6.32 (0.99)
	Total								6.47 (1.01)
Accessing lecture notes via OneNote enhanced my learning.	Year 1	1	0	5	2	7	29	56	6.26 (1.16)
	Year 2	1.5	1.5	3	6	11	21	56	6.08 (1.38)
	Year 3	1	0	4.5	4.5	12	34	44	6.01 (1.23)
	Total								6.12 (1.25)
Using a tablet PC in class facilitated my note-taking.	Year 1	0	4	3	5	12	33	43	5.97 (1.29)
	Year 2	1	4	3	4	13	31	44	5.96 (1.35)
	Year 3	3	0	0	4	15	40	38	5.90 (1.21)
	Total								5.94 (1.28)
Using a tablet PC in class made it easy for me to take online tests.	Year 1	4	10.5	7	7.5	17	29	25	5.08 (1.81)
	Year 2	2	5	5.5	9.5	23	28	27	5.39 (1.50)
	Year 3	12	6	7	9	28	29	9	4.58 (1.82)
	Total								5.02 (1.71)

K-State = Kansas State University

* Data were collected from 102 first-year, 109 second-year, and 68 third-year veterinary students.

Table 4: Student report on items related to learner-instructor interaction*

Item	Students	Percentage of student respondents							Mean (*SD*)
		Strongly disagree (%)	Disagree (%)	Somewhat disagree (%)	Neutral (%)	Somewhat agree (%)	Agree (%)	Strongly agree (%)	
I used my tablet PC to communicate with my instructors outside the class.	Year 1	1	0	2	7	9	38	43	6.10 (1.11)
	Year 2	2	1	1	7	12	30	47	6.05 (1.26)
	Year 3	1	0	1	6	18	44	30	5.93 (1.10)
	Total								6.03 (1.16)
Using my tablet PC in class enabled me to interact easily with the instructors through TurningPoint polling.	Year 1	0	5	1	11.5	16.5	46	20	5.56 (1.24)
	Year 2	1	3	4	14	22	31	25	5.48 (1.34)
	Year 3	1	1	6	9	22	37	24	5.46 (1.32)
	Total								5.50 (1.30)

* Data were collected from 102 first-year, 109 second-year, and 68 third-year veterinary students.

tablet PC. The survey data demonstrate that the tablet PC serves as a tool to facilitate student learning processes and help them learn the content. Positive use of the tablet PC in learner-instructor interaction is reflected in 96% of students responding to instructors for class interactive activities and 89% of students communicating directly with instructors. Learner-learner interaction is reflected by 92% of students using the tablet PC to communicate with classmates and 91% of students sharing notes with other students. The many uses of the tablet PC for content learning, interaction with instructors, and interaction with classmates illustrate that students have a good mastery of the technology interface. The survey data provide evidence that students consider the use of the tablet PC as positive to their learning experience in terms of four types of interaction.

Qualitative data from open-ended questions were coded to identify emergent themes. To avoid bias in the data analysis process, two individuals (one from a different college) sorted and counted qualitative data. Themes emerged from qualitative analysis regarding facilitation and enhancement of student learning, which is consistent with quantitative data centered on learner-content interaction.

Table 5: Student report on items related to learner-learner interaction*

Item	Students	Percentage of student respondents							Mean (*SD*)
		Strongly disagree (%)	Disagree (%)	Somewhat disagree (%)	Neutral (%)	Somewhat agree (%)	Agree (%)	Strongly agree (%)	
I used the tablet PC to connect with my friends outside class.	Year 1	3	1	4	3	14	40	35	5.85 (1.37)
	Year 2	5	1	1	6	10	25	52	6.01 (1.50)
	Year 3	3	0	0	1	7	43	46	6.20 (1.14)
	Total								6.02 (1.34)
Using the tablet PC in class enabled me to easily collaborate with my classmates on group projects.	Year 1	0	6	3.5	13.5	24	36	17	5.30 (1.34)
	Year 2	0	4	2	9	14	39	32	5.80 (1.25)
	Year 3	1	0	6.5	26	24.5	29	13	5.07 (1.25)
	Total								5.39 (1.28)

* Data were collected from 102 first-year, 109 second-year, and 68 third-year veterinary students.

Table 6: Students' top 10 ways of using the tablet PC

Item	Student response rate (%) ($n = 279$)
Used stylus to take notes with OneNote during class	100
Responded to the instructor for class activities such as TurningPoint polling	96
Communicated with classmates	92
Shared notes or slides with other students	91
Communicated with instructors	89
Used stylus to mark lecture slides provided by the instructor	87
Searched the Web for supporting evidence for what I've learned	82
Used stylus to review homework/projects	75
Imported Web-based information into notes	72
Used stylus to create diagrams in learning	60

The most-cited uses of the tablet PC to facilitate and enhance student learning included note-taking (38%), easy access to course materials (34%), and note/information organization (29%). Representative student comments appear below:

- "It has made it a lot easier to take notes. I learn well when I color code things, and I'm quickly able to switch colors during lecture."
- "The OneNote program has been crucial to my success in school. It is a great way to have all of my notes in one convenient and organized place. Also, the ability to use the stylus to write extra notes or draw diagrams next to my notes is helpful."
- "Having all the materials in a uniform format and being able to easily communicate with other students and professors has enhanced the learning experience."

In addition to comments on the positive learning experience with use of a tablet PC, students also shared their positive thoughts about the CVM tablet PC program. Positive comments included those about OneNote (20%), consistency across computers used by students (18%), note/information organization (13%), and technology support (10%). Some students noted the convenience of using a tablet PC (9%), easy access to information (9%), and the college vision of embracing technology for students' future careers (3%). Some student comments include the following:

- "I really like OneNote. I think it is a great tool for lectures and note-taking."
- "Everyone has the same software so there is never an issue about not being compatible with sending or receiving something."
- "I like that we are able to organize everything from our courses on one device, especially when we have multiple sources of information for each class."
- "Staff is very helpful in general, especially when we receive our tablets during the first year."
- "I like that we are embracing the rising of technology in our society and using our knowledge to better our education."
- "I think it was a necessary change to keep us up to date with other universities and I'm proud of our college for trying to stay up to date and to be willing to make changes for our students."

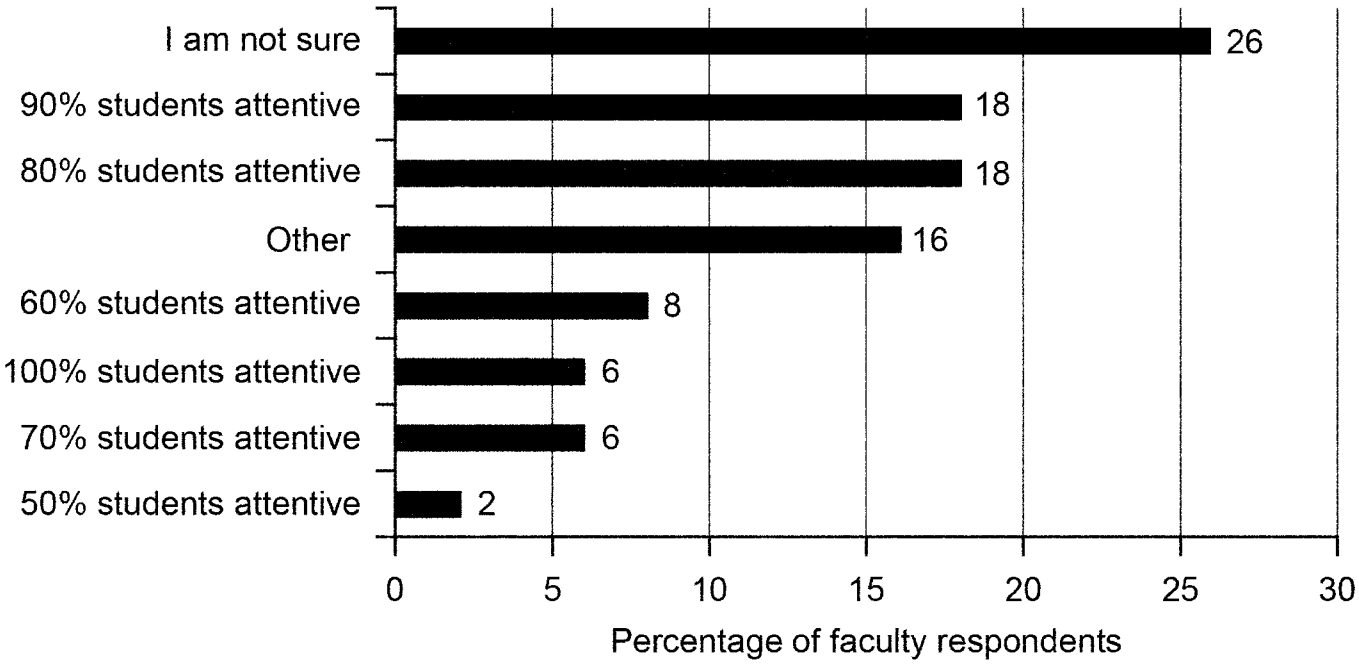

Figure 1: Percentage of students attentive in class as believed by faculty respondents

Negative Impact on Learning

Digital distraction (39%) is the most cited negative aspect of using a tablet PC in class. Students reported their own distraction and distractions by neighboring students. Technical difficulties, including slow computer speed, freezing, and crashing, were reported by 18% of students, although students also commented that support services were efficient and effective. The number of times students reported access to non-lecture-related Internet sources, on average, was seven per lecture hour. The number of times students reported access to lecture-related Internet sources per lecture hour was six. Representative student comments appear below:

- "I would actually like teachers to employ shutting down the system because I have a hard time staying on task during lecture sometimes."
- "It offers too many distractions. I, like many other students, am not disciplined enough to not access E-mail or the Internet during class."
- "I find the ability to browse the Web, Facebook, and E-mail access distracting to learning. I don't have the will power to not surf the Web especially during a boring class."
- "The access to the Internet and E-mail is very distracting to not only me but from my classmates around who are on the Internet as well. You'd think simply self-discipline would be able to control this but having the Internet so readily available is too tempting."

While most students were positive about tablet PCs in learning, some shared their concerns regarding digital distraction (39%), technical difficulties (18%), and relatively high costs of the computer (15%) in the comment section.

Faculty Perspective and Experience

Many benefits of tablet PCs for student learning as viewed by faculty were similar to the student perspective. The three most cited benefits were easy access to course materials and related sources (28%), the search function across course notes and the Internet (18%), and ease of note-taking (13%). Some faculty comments include:

- "It is certainly helpful in providing them [students] rapid access to the course information, syllabus and PowerPoint. Tablets also allow for searching of information."
- "Rapid access to disparate resources. Expandable graphics for optimal viewing."
- "The ability to integrate and search across topics, as well as the reduction of the amount of materials students must carry to class are huge benefits."
- "They have the ability to easily search for the definition of words with which they are unfamiliar and to get further clarification on information."
- "Easy, cost-free delivery of high-quality notes. Note-taking directly into digital notes during class."

The top two things that faculty respondents liked about the CVM tablet PC program are being paperless or saving paper (21%) and the consistency of computers used among students (11%). One faculty member commented, "I no longer have to have all my lectures ready to print before the semester starts." Another faculty member noted, "I like the fact that all students have access to the same technological equipment, to help them in their studies." And another listed a benefit of the tablet PC program as "the uniformity of the platform—everyone, including me, uses the same machine."

However, student attention was the primary focus of faculty comments and concerns about the use of tablet

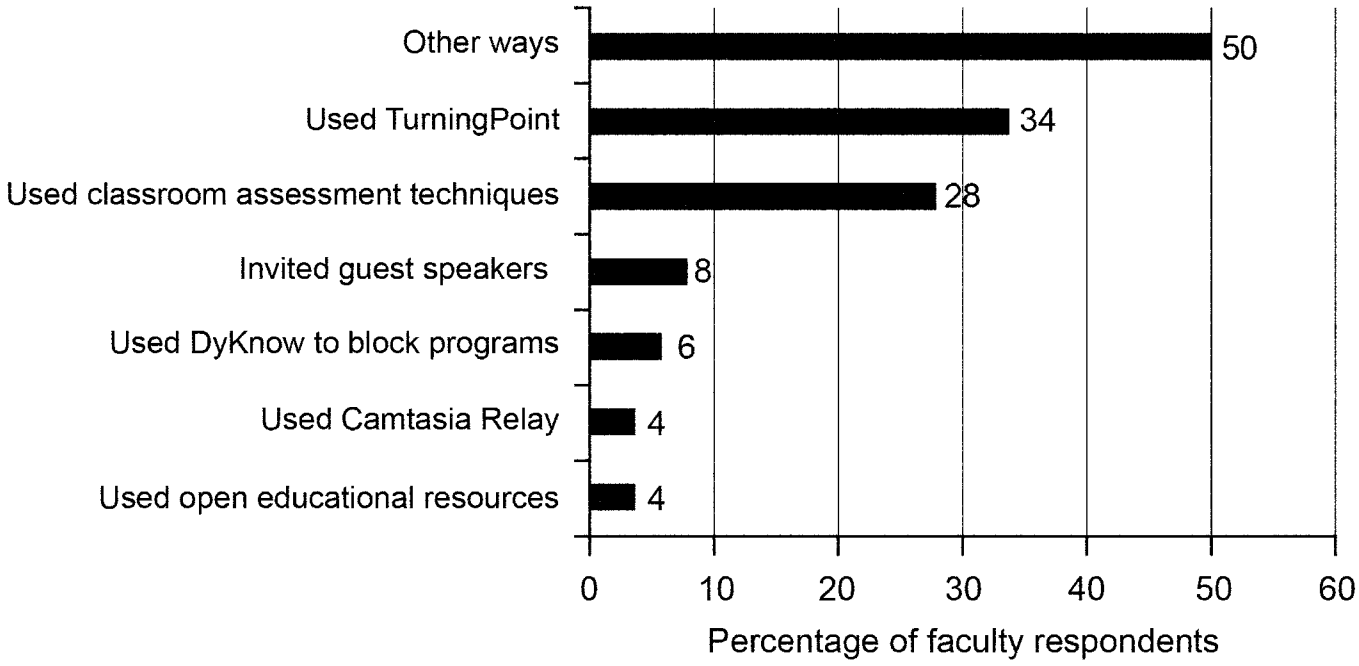

Figure 2: Faculty respondents' strategies for preventing digital distraction in class

PCs. Only 6% of faculty ($n = 49$) believed that 100% of students were attentive during class. The most common response regarding student attentiveness was "I am not sure" (26%). Eighteen percent of faculty respondents thought that 80% of students were attentive during class time while another 18% thought that 90% of students were attentive (Figure 1).

Faculty reported different strategies to prevent digital distraction during class time (Figure 2). Faculty respondents used TurningPoint questions to get students to pay attention to the lectures (34%) and classroom assessment techniques to engage students (28%). Additional strategies to engage students in the classroom included inviting guest speakers to the classroom in person or via Adobe Connect[c] (8%), using DyKnow[d] to block applications on students' computers (6%), using Camtasia Relay[e] to record lectures for flipped classroom strategies (4%), and using open educational resources to gain students' attention in class (4%). Other strategies (50%) included making only lecture outlines available as digital notes and providing problem-solving activities, interactive discussion approaches, and outdoor teaching. The CVM support staff provide training and individual help to faculty adopting new instructional strategies or using new technology tools such as TurningPoint, Adobe Connect, DyKnow, and Camtasia Relay.

The survey demonstrated that faculty have concerns ($M = 5.21$, $SD = 1.85$) about digital distraction when each student has a computer during class time. Quantitative data are consistent with the dominant theme that emerged from the open-ended question regarding what is least liked about tablet PCs. Faculty respondents reported that digital distraction (39%) was what they liked least about tablet PCs used in the classroom. Some sample faculty comments include:

- "Many students do not seem to have the discipline to keep focused during class and spend time doing E-mails or surfing the Web. This is a distraction from their learning and also can distract students that have direct sight-line with their computer screens. Basic sight-line distraction."
- "The ability for the students to be on the Internet during class time—not only is that student not paying attention to the lecture material but is also distracting for students around them."
- "It does have the potential for abuse and ready distraction at times when they [students] should be paying closer attention."

Some faculty (10%) also listed the high cost of tablet PCs as what they disliked about the tablet PC program. On average, faculty respondents held a relatively neutral opinion toward the helpfulness of providing each student a computer for their study during class time ($M = 4.87$, $SD = 1.70$).

DISCUSSION

This study did not intend to quantify the learning effectiveness of using tablet PCs in student learning. Instead, the study intends to explore student and faculty attitudes toward and experiences with tablet PCs. Student responses demonstrated a generally positive learning experience with the use of tablet PCs in the classroom. Educational strategies supported by tablet PCs include four types of interaction: learner-interface interaction, learner-content interaction, learner-instructor interaction, and learner-learner interaction. Opportunities to help students master the interface of the technology are provided at different points of time, including the first-year technology orientation, the first-week technology support in the classroom, and ongoing support for hardware and software from the

college support units throughout the 4-year veterinary curriculum. After each new veterinary student receives a new tablet PC, training sessions and individual help are available for students to learn the operation of a tablet PC and its related software.

Students reported that the use of a tablet PC facilitated note-taking, organization of notes and slides, access to course materials, and communication with instructors and peer learners. These findings are consistent with previous reports[4,14,17] on students' enhanced learning experience with tablet PCs. In addition, student comments support Backon's[22] argument regarding the value of pen computing to empower student understanding. Microsoft OneNote allows a combination of typed and handwritten notes, graphic images, Web pages, and multimedia in blocks that can be manipulated with a stylus in a manner that is most meaningful to the individual learner. In addition, all content is searchable, enhancing the value of the notes.

Despite the positive elements, this study also identified digital distraction as the major negative element. Some students admitted they lack self-discipline, leading to E-mail, Facebook, and other non-course-related activities during class time. The self-reported frequency of non-course-related Internet access (seven times per lecture hour) is higher than course-related Internet access (six times per lecture hour). Students reported E-mailing, going on Facebook, and surfing the Web during lecture time in the survey. Faculty reported digital distraction as a negative consequence of the tablet PC program, and they also reported adaptive strategies to combat digital distraction. Despite use of interactive polling with TurningPoint, locking applications with DyKnow, and classroom assessment techniques, students are still engaged in non-course-related uses of technology during lecture time.

Survey data from students and faculty have raised concerns about non-course-related use of technology during class time. Information and instructional technology has become increasingly important in higher education teaching and learning. A recent survey of higher education chief technology officers reports that 87% and 82% of college classrooms have wired Internet and wireless Internet access, respectively.[23] K-State CVM has wired and wireless Internet access in all three of its buildings. While computers, tablet PCs, electronic communication tools, and social media are becoming commonplace in many instructional settings, they also provide opportunities for misuse of digital technologies. Some non-course-related uses of technology in the instructional context such as E-mailing, messaging, shopping, and gaming result in classroom distraction and negatively affect teaching and learning.[24] Researchers[25–27] demonstrate that if students multitask on laptop computers during class time, they have impaired comprehension of course material and poorer overall course performance.

Haughton et al.[28] define digital distraction as "occurring when technology gadgets are involved in a multitasking behavior that prevents the primary task from being performed to its potential."[28(p.4)] When multitasking, students need additional cognitive load to switch between primary and non-primary tasks. Several studies[25,29–32] find that multitasking negatively impacts performance of primary tasks because non-primary tasks reduce attention to the primary tasks. A recent study by Sana, Weston, and Cepeda[33] reports that multitasking on a laptop causes a significant distraction to not only users but also fellow students and can be detrimental to comprehension of lecture content. Research[34] suggests that human beings have limited resources available to process, encode, and store information for later retrieval. When focusing on a single primary task, our attention is well directed and uninterrupted, and information is adequately processed, encoded, and stored.[35] When a secondary task is added, attention is divided, and the encoding of information is disrupted, which negatively affects the quantity and quality of information that is stored.[36] With ubiquitous computing, there is a need to explore strategies to reduce or prevent digital distraction in teaching and learning in the future. One strategy the faculty teaching third-year students adopted in Fall 2013 is using DyKnow to block non-educational resources in class, which only allows students to access resources needed for learning during class time, such as OneNote, Word, PowerPoint, Excel, Adobe Reader, dictionary sites, the course management system, and the PubMed site. Faculty hope to reduce digital distraction by allowing students to use the beneficial aspects of their tablet computers without access to non-educational materials during class time.

Providing each student a computer and access to the Internet in class may result in unintended consequences of off-task behaviors and distractions, and some faculty may favor banning computer use in the large classroom setting. While it is possible to employ policies controlling how technology is used during lecture time, banning the use of technologies in higher education learning settings may not be appropriate.[37] Such a policy may not even be feasible due to the expectations of the twenty-first-century student core learning outcomes,[28,37] which include information, media, and technology skills for the twenty-first-century students who live in a technology- and media-driven society. As this study reports, tablet PCs provide a generally positive learning experience for most veterinary students. The use of tablet PCs has enhanced students' learning experience through learner-interface interaction, learner-content interaction, learner-instructor interaction, and learner-learner interaction, although it has provided the possibility of digital distraction in class, a major negative experience reported in the study. The tablet PC program allows CVM faculty to pursue technology integration strategies supporting expected learning outcomes as well as students to develop self-monitoring and self-discipline skills supporting learning with digital technologies. With faculty's continued efforts and students' increased self-discipline, tablet PCs can be used to empower students to meet the learning outcomes expected of twenty-first-century competent veterinarians.

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NOTES

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