

## RESEARCH ARTICLES

### Schoolwide Implementation of Personal Digital Assistants (PDAs): A First-Year Report

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**Objectives.** The purpose of this paper is to describe the use of personal digital assistants (PDAs) in a pharmacy school during the first year in which the tool was provided to all students and faculty members.

**Methods.** A survey was developed and administered to students in each year of the curriculum and to full-time faculty members. Data were evaluated using descriptive statistics.

**Results.** After providing PDAs, we observed that use of the devices was high by students (95.2%) and faculty members (93.3%). For approximately one third of the survey responders, use of pharmacy-related applications accounted for over 50% of usage time, although use varied according to individual courses.

**Conclusions.** A high percentage of faculty members and students used the PDA provided to them by the school. Although PDA use across the curriculum has varied, the tool was viewed as having a positive impact on student learning.

**Keywords:** personal digital assistant, pharmacy education, technology, survey

## INTRODUCTION

With the explosion of new pharmaceutical products, complexity of medical conditions and therapies, and increased use of evidence-based medicine (EBM), healthcare professionals require new technologies to stay abreast of the continued infusion of changing information. Internet sites and medical databases are frequently accessed on desktop computers, laptop or notebook computers, or tablet-size personal computers (tablet PCs). However, these tools of technology are usually stationary or cumbersome to carry around. Personal digital assistants (PDAs) are being used increasingly by healthcare workers. The PDA is compact, lightweight, and convenient for bedside or point-of-care functions.

The combined advances in EBM and more portable computer technology have resulted in a field of study termed *informatics*. Medical informatics is described as "the field concerned with the cognitive, information processing, and communication tasks of medical practice, education, and research, including the information science

and technology to support these tasks."<sup>1</sup> Informatics as a field of study has expanded into the practice of numerous medical professions. Many medical and dental schools have incorporated informatics into the academic curriculum. The nursing profession has developed a nursing informatics specialty practice.<sup>2</sup> In contrast, pharmacy, a profession dependent on knowledge-intensive skills, has not yet addressed informatics systematically, as a necessity in either pharmacy practice or education.<sup>2</sup>

In 2002, a presentation at the American Association of Colleges of Pharmacy (AACP) Annual Meeting<sup>3</sup> assessed the use of laptops and PDAs in pharmacy programs listed in the 2001–2002 AACP Roster. Of 88 surveys mailed to schools and colleges of pharmacy, 40 (45%) responses were received. Of these 40 schools, only 6 had policies concerning PDA use by students. Some programs addressed PDA use in clerkships, small group activities, or laboratory exercises; none of the 6 programs allowed students to access their PDAs during examinations. Furthermore, no responding program reported current integration of PDAs into the curriculum. Moreover, 30% stated that no formal plans for PDA use were being considered; 30% described plans to integrate PDAs into the curriculum within the next 5 years; and 32% did not answer this question. The other programs

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indicated that PDA implementation might occur based on student interest, by individual preceptors in clerkships, or only on a limited trial basis.

Based on the information available from several published articles, PDAs are gaining utility within the clinical practice of pharmacy.<sup>4-10</sup> Pharmacists are using PDAs to document services and interventions, allowing for potential reimbursement and savings resulting from the service provided.<sup>4</sup> Interventions suggested by pharmacists and the specific responses by physicians have been documented using PDAs and used as a tool for the hospital administration to re-credential all medical staff.<sup>5</sup> The utility of a PDA as a documentation system, medication and formulary reference, disease management utility, clinical monitoring tool, and even mobile dictation system has also been reviewed.<sup>6</sup> While use of PDAs in pharmacy practice is growing, implementing a formal program of PDA use in the pharmacy curriculum has not been addressed in the literature. Preparing students to effectively use PDAs before graduation may increase their ability and confidence in discussing and recommending new or preferred evidence-based therapies for patients.

Since the report of Smith et al in 2002, the McWhorter School of Pharmacy (MSOP) at Samford University has implemented school-wide provision of PDAs (either *Palm* m500 or m515) for all enrolled students and faculty and staff members. These PDAs are provided free to students (upon enrollment in the MSOP) and faculty and staff members, with required software (*Lexi-Comp* and *HandBase* products) to be purchased by the students. Personal digital assistants were selected over pocket PCs because at the time of original selection more medical software was available for PDAs. Prior use by our Dean and other select faculty members identified the *Palm* m500 as appropriate because of its compact, lightweight size and rechargeable battery. This *Palm* model also had a memory expansion slot that used a readily available nonproprietary expansion card, while others (such as devices by Handspring) required the use of a proprietary expansion chip. Soon after distributing the PDAs to faculty members, a change was made to provide the *Palm* m515, which had a color screen with adequate backlighting. This allowed for better use in a darkened classroom environment. The *Palm* m515 is still in use at our institution. However, since this model is no longer manufactured, the *Palm Tungsten-e* was provided to entering students beginning in fall 2004.

No tuition dollars or separate fees paid by students are used to fund PDA use at the MSOP. The school's Dean maintains a strong liaison with alumni. This has

allowed for continued monetary support of PDAs, which continue to be purchased for each entering class using grant funds from a private individual. Students pay a one-time fee for a required set of software and are responsible for any maintenance or repairs to the PDA. Students get to keep the PDA upon graduation. This report outlines our PDA experiences during the first year of their schoolwide use.

## **METHODS**

A survey instrument concerning PDA use by the faculty members and students of the MSOP at Samford University was developed and pilot tested by the researchers (questionnaire available upon request from the author). All enrolled students and full-time faculty members at the time of the survey were eligible to participate. During the fall 2002 semester, the survey instrument was distributed to first-, second-, and third-year (P1, P2, and P3, respectively) students and to all faculty members. The survey instrument was administered to fourth-year (P4) students during a class meeting in the spring 2003 semester. The survey instrument inquired about PDA use in each required and elective course offered during the fall 2002 semester. Answers and free-form comments were documented and descriptive statistics were compiled. For questions not answered by every respondent, the data reported are adjusted to reflect answers based on the actual number of responders. This summary reports patterns of use in the first year of school-wide PDA availability.

## **RESULTS**

A total of 350 of 475 survey instruments were completed, resulting in an overall response rate of 74%. The response rate for the P1 group was 65.9% (83/126); for P2, 70.3% (83/118); for P3, 79.6% (86/108); for P4, 75.6% (68/90); and for the faculty group, 90.3% (30/33). Sample demographics are reported in Tables 1 and 2. The majority of student responders were female, white, and between the ages of 18 and 29 years of age, which is representative of total MSOP student body statistics. Faculty responders were fairly evenly split between gender and departmental affiliation, and were typically between 30 and 50 years of age (Table 2).

More faculty members (33%) than students (12.7%) reported having a PDA prior to the school's provision of the device; however, after provision, PDA use was high among both faculty members (93.3%) and students (95.2%). General trends in PDA use, including type of use and perceptions of impact on student learning are discussed in more detail below.

Table 1. Demographic Data of Student Responders

Characteristic	P1 (%)	P2 (%)	P3 (%)	P4 (%)
<b>Gender</b>				
Female	61.4	74.7	65.1	67.6
Male	38.6	25.3	34.9	32.4
<b>Race</b>				
White	90.4	84.3	84.3	77.6
Asian	6.0	7.2	9.6	6.0
Black	2.4	3.6	4.8	13.4
Other	1.2	4.8	1.2	3.0
<b>Age (in years)</b>				
18-23	77.1	63.4	42.2	11.9
24-29	14.5	25.6	50.6	73.1
30-35	6.0	8.5	7.2	11.9
36+	2.4	2.4	0	3.0
Prior PDA ownership	8.4	12.0	12.0	19.1

P1 = first-year pharmacy student; P2 = second-year pharmacy student; P3 = third-year pharmacy student; P4 = fourth-year pharmacy student; PDA = personal digital assistant

Table 2. Demographic Data of Faculty Responders

Characteristic	Faculty (%)
<b>Gender</b>	
Female	43.3
Male	56.7
<b>Department affiliation</b>	
Pharmacy Practice	60.0
Pharmaceutical Sciences	40.0
<b>Age</b>	
20-29	23.3
30-39	40.0
40-49	26.7
50-59	10.0
60+	0
Prior PDA ownership	33.3

**General PDA Use Trends**

Most of the 317 student responders (87.4%) indicated they had not owned a PDA prior to the provision of one by the MSOP. The majority of faculty members (66.7%) also indicated they had not owned a PDA prior to the school providing one. Among students, prior ownership of a PDA was highest among those in the P4 class (19.1%) and lowest among those in the P1 class (8.4%).

When asked how frequently they had used their PDA since receiving it, most students (66.8%) and faculty members (83.4%) indicated they used their PDA at least once daily. Over 66% of faculty members and over 42% of students reported they used their PDA multiple times each day. Interestingly, daily or greater frequency

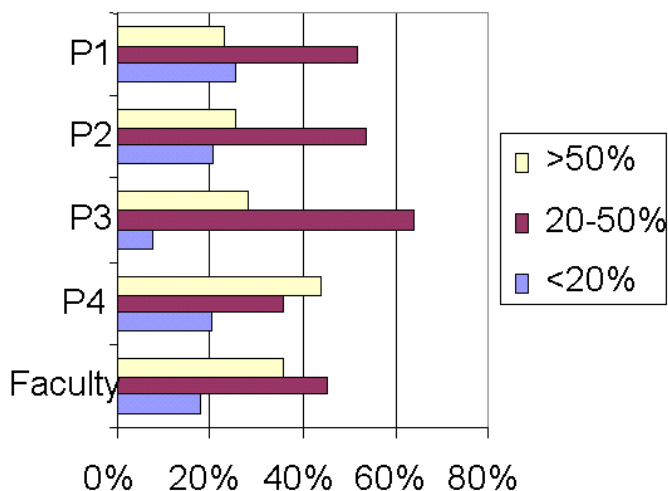


Figure 1. Percent of PDA time on pharmacy-specific functions. P1 = first-year pharmacy student; P2 = second-year pharmacy student; P3 = third-year pharmacy student; P4 = fourth-year pharmacy student; PDA = personal digital assistant.

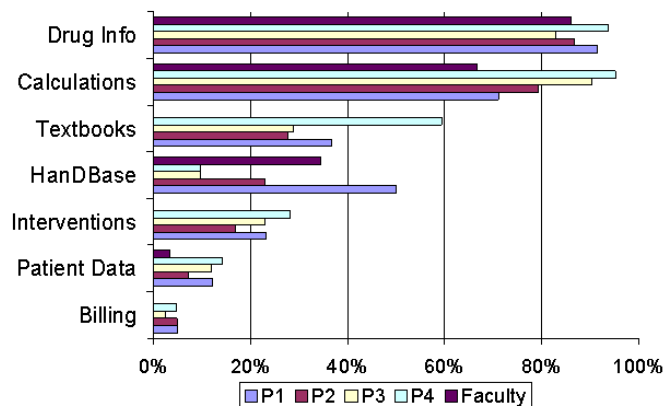


Figure 2. Frequency of use of pharmacy-specific PDA functions. P1 = first-year pharmacy student; P2 = second-year pharmacy student; P3 = third-year pharmacy student; P4 = fourth-year pharmacy student; PDA = personal digital assistant.

of PDA use among students was highest among the P3 class (74.7%) and the P2 class (74.7%), followed by the P4 class (67.2%), and the P1 class (50.6%). About 7% of students and about 7% of faculty members reported using their PDA less than once a week. Less than 5 students in each class reported using a PDA other than the one provided by the school at the time of survey administration.

**Type of PDA Use**

Respondents were asked about the ways in which they used their PDAs, including both pharmacy and non-pharmacy applications (Figures 1, 2, 3, and 4). Roughly one third of faculty members (35.7%) and one third of students (29.4%) reported that their use of pharmacy-related applications accounted for over 50% of time

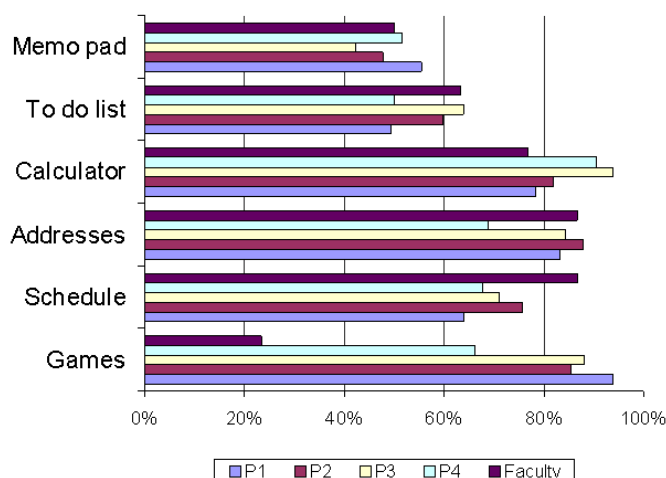


Figure 3. Frequency of use of nonpharmacy PDA functions. P1 = first-year pharmacy student; P2 = second-year pharmacy student; P3 = third-year pharmacy student; P4 = fourth-year pharmacy student; PDA = personal digital assistant.

spent on the PDA (Figure 1). Across all respondent categories, pharmacy calculation and drug information programs were reported as the most-used pharmacy applications (Figure 2). The most-used drug information applications were *Lexi-Comp* products (52.7% of students and 36.7% of faculty members) and *ePocrates* (38% of students and 33.3% of faculty members). Both students and faculty members reported that the least-used pharmacy applications on the PDA were ones that allowed for the tracking of patient data or billing of services.

Faculty members and students differed in the non-pharmacy uses of their PDAs (see Figure 3). For example, students reported using the PDA's calculator function (85.9%), games (84.4%), and address book (81.7%) the most, while faculty members reported using the PDA's address book (86.7%), scheduling function (86.7%), and calculator function (76.7%) the most.

Faculty members and students again differed when asked if students had used their PDAs in/for specific coursework (Figure 4). The percentage of students using their PDAs for a particular course ranged from 6.1% of students enrolled in a P2 year course to 97.6% of students enrolled in a P1 year course. About 50% of faculty members (50.8%) reported using their PDA in the classroom, with use in the fourth professional year being the highest. Faculty member reports of requiring students to use PDAs for class assignments varied widely, from a low of 33.3% in one course to a high of 71.4% in another.

### Perceptions of the Impact of PDA Use on Student Learning

The majority of students (79.2%) and faculty members (56.7%) believed that PDA use had a positive

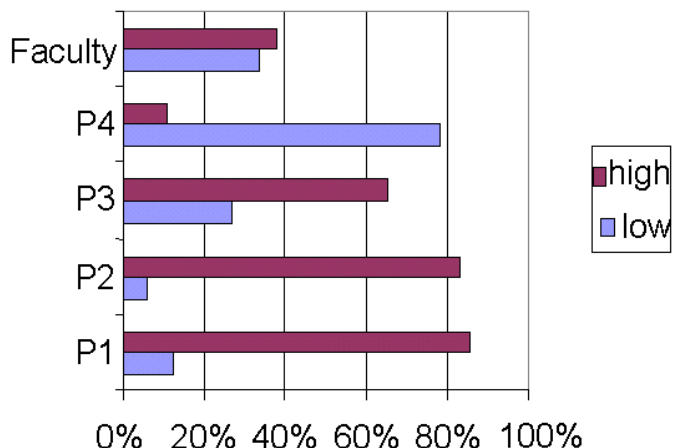


Figure 4. Range of use in individual coursework. P1 = first-year pharmacy student; P2 = second-year pharmacy student; P3 = third-year pharmacy student; P4 = fourth-year pharmacy student.

Table 3. Most Common Survey Feedback From Students

Software is too expensive
PDA is of great benefit
Software selection should be up to student, not mandated
Desire to see PDA used more in class
More training needed
Problems with download programs
Use should be implemented later in the curriculum

impact on pharmacy student learning. Of the remaining students, 12.8% of students were unsure of the overall impact and 8% believed that PDA use had a negative impact on student learning. While 56.7% of faculty members believed PDA use had a positive impact on learning, 33.3% were unsure about the overall impact, and 10% believed their use had a negative impact on student learning. In addition, 80.6% of students (250/310) and 56.7% of faculty members (17/30) reported that they would recommend that other pharmacy schools incorporate the use of PDA in their curricula. Table 3 outlines the student comments most frequently received on the survey instrument. Need for additional training, expense of the software, and the mandatory nature of the school's selected software programs were mentioned most frequently as student concerns.

### DISCUSSION

The percentage of faculty members (33%) that reported using a PDA prior to the school providing one was almost 3 times the percentage of students (12.7%) that reported prior use. While this difference may reflect variations in financial resources between the 2 groups, another cause could be a greater awareness of or exposure to the device by faculty members (eg, seeing the device demonstrated at a national meeting or used in their prac-

tice sites, etc). General use of the device for both pharmacy and nonpharmacy functions was similar between the 2 groups, although rankings differed relative to the most frequently used functions.

Interestingly, students reported greater variation in the degree of PDA use on an individual course-by-course basis than did faculty members. Some students appear to have used the device for learning more often than faculty members had expected based on course design. Of concern, however, is that some courses had no more than 6.1% of students reporting regular PDA use for assignments. One reason for lower usage in some courses may have been a need for additional training on the PDA (basic functions and uses) by faculty members and/or students, lack of understanding by faculty members of how specific PDA functions could be incorporated into a particular subject area, or lack of interest in using the PDA. In addition, while all faculty members were encouraged by the School's administration to integrate the PDA within the structure of each course, there was no programmatic requirement for its use by either faculty members or students. Finally, some courses (such as human resources management) simply may not lend themselves to PDA use as much as others.

As might have been expected, P4 students reported the highest overall usage of the PDA with at least 78% of the P4 class indicating they used their PDAs on their advanced practice rotations. Still, the question remains why the minimum number of students using the PDA on rotations was not higher. Possible reasons why usage was not higher may be differences in preceptor exposure, the need for additional training of external preceptors, no requirement that the device be used by practitioners at the practice site, lack of awareness by practitioners of specific ways in which the PDA could be incorporated into practice, or lack of applicability of PDA functions to a specific practice site. In addition, if PDAs were not provided to preceptors by the practice site, their adoption by individuals might have been inhibited by personal lack of interest in the PDA or financial concerns regarding cost of the device and needed software programs.

There were several limitations to this study. Regarding survey design, specific questions were not asked about how each PDA program was used or why it was or was not helpful to either students or faculty members. This information might have been useful for determining the best software package to offer to students and faculty members in the future. In addition, students were not asked to quantify their PDA usage within each course taken during the academic year in which the study was conducted; instead, they were simply asked to indicate

whether they used the PDA in each course. This information would have been helpful for identifying the specific courses in which the PDA was used the most as well as those courses in which the PDA was rarely used. While both faculty members and students were asked to report their perception of PDA use on student learning, the survey simply asked whether PDAs had a "positive effect" on learning and did not allow respondents to quantify their answers. Finally, the study's aim was to gather basic descriptive data regarding how PDAs were being used and thus did not attempt to correlate PDA usage with outcomes of student learning.

Regarding survey administration, no attempt was made to collect additional responses from either students or faculty members who were not present when the original survey was distributed. In addition, P4 students took the survey later in the academic year than other students and faculty members, which might account for the higher reported usage by this class. Finally, because PDAs were provided free of charge, both students and faculty members may have felt pressure to report greater usage of the PDAs and more positive outcomes than actually occurred. Still, when provided with a PDA, students and faculty members used this new technology both for learning and the provision of pharmaceutical care.

Because this is the first published report of a school-wide implementation of PDA use, we would like to share some of the lessons that we have learned with others who may be considering such a program. First, the importance of user training cannot be emphasized enough. All first-time users need a workshop or extended hands-on training session, as well as ongoing support. While learning the mechanics of PDA use is not particularly difficult for those with prior experience with computers and other electronic devices, some students and faculty members are likely to have trouble using even the most basic functions. To successfully deal with all of these problems it is essential to have one or more persons on site who students and faculty members can use as resources when they encounter problems with either hardware or software, including basic questions such as, "What program can I use to do X and how do I load it?"

Second, whether it be determining the best use of an available program in a certain course or the development of a new program that meets the documentation needs for a specific clinical rotation, implementing use of the PDA throughout the curriculum can result in a steep learning curve for some users. In addition, some users are likely to be resistant to learning to use a new electronic device, especially if they feel that they have no need for it. The use of PDA "experts" can help in this

area, both to convince potential users of the relevant advantages of the device (in the classroom, on clinical rotations, in personal life) and to help users brainstorm about innovative ways to use PDAs for teaching and learning.

Finally, the cost of providing PDA technology and its associated training and support to students and faculty members may be prohibitive for some organizations. While no cost-benefit studies of PDA use have been reported in the literature yet, Gonyeau and DiVall found that use of PDAs by doctor of pharmacy students to document clinical interventions yielded a substantial costs savings (\$107,561 over 35 weeks, based on 1533 pharmacy interventions) to 2 urban teaching hospitals.<sup>11</sup> This information could help support the cost justification of such a technology investment in the future.

## CONCLUSIONS

Over 90% of faculty members and students use PDAs at the McWhorter School of Pharmacy to assist with student learning. While the adoption of this technology across the curriculum has been inconsistent thus far, faculty members and students agreed that PDAs have a positive impact on learning, especially during clinical practice experiences, and would recommend their use to other schools.

Little information is currently available in the literature regarding implementation and use of the PDA within schools of pharmacy. It is hoped that these results will assist others in incorporating the use of PDA technology within their own curricula.

## REFERENCES

1. Greenes RA, Shortcliffe EH. Medical informatics: an emerging academic discipline and institutional priority. *JAMA*. 1990;263:1114-1120.
2. Balen RM, Miller P, Malyuk DL. Medical informatics: pharmacists' needs and applications in clinical practice. *J Inform Pharmacother*. 2000;2:306-318.
3. Smith KM, Romanelli F, Cain J, Stinchcomb A, Foster TS, Anderson-Harper H. Personal digital assistants (PDAs) and computer use: The status at North American schools and colleges of pharmacy. *Am J Pharm Educ*. 2002;66:82Abstract.
4. Silva MA, Tataronis GR, Maas B. Using personal digital assistants to document pharmacist cognitive services and estimate potential reimbursement. *Am J Health-Syst Pharm*. 2003;60:911-915.
5. Lynx DH, Brockmiller HR, Connelly RT, Crawford SY. Use of a PDA-based pharmacist intervention system. *Am J Health-Syst Pharm*. 2003;60:2341-2344.
6. Emerging technology at the point of care. *J Am Pharm Assoc*. 2003;43:S50-1.
7. Lau A, Balen RM, Lam R. Using a personal digital assistant to document clinical pharmacy services in an intensive care unit. *Am J Health-Syst Pharm*. 2001;58:1520-1522.
8. Reilly JC, Wallace M, Campbell MM. Tracking pharmacists' interventions with a hand-held computer. *Am J Health-Syst Pharm*. 2001;58:158-161.
9. McCreddie SR, Stevenson JG, Sweet BV. Using personal digital assistants to access drug information. *Am J Health-Syst Pharm*. 2002;59:1340-1343.
10. Clark JS, Klauck JA. Recording pharmacists' interventions with a personal digital assistant. *Am J Health-Syst Pharm*. 2003;60:1772-1774.
11. Gonyeau MJ, DiVall MV. Evolution of doctor of pharmacy students' clinical interventions during APPE [abstract]. *Am J Pharm Ed* [serial online] 2003, [cited 2004 Feb 13]; 67: Article 100. Available from URL <http://www.ajpe.org/view.asp?art=aj6703100&pdf=yes>.