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**A Survey of Personal Digital Assistants (PDAs) use in a Middle School Environment: Perceptions of Teachers, Parents and Students**

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**Abstract**

This study investigated how students in a middle school in Alberta, Canada along with their teachers and parents perceived the usefulness of PDAs for student use. Three group-specific questionnaires were employed to gather data. Students, parents, and teachers all strongly agreed that PDAs helped to enhance and support students in the areas of: a) collaboration, b) work effectiveness, and c) technology knowledge. Results of the study were inconclusive, however, and possible areas for improving the PDA program were suggested.

**Introduction and Framework**

The Alberta Department of Education, called Alberta Education, mandates the curriculum and framework for the education of K-12 students.<sup>1</sup> Recognizing the critical role of technology in today's society, technology learning is part of every student's basic education in Alberta. The Alberta Information and Communication Technology (ICT) program of studies is a prescribed curriculum for K-12 students that details the technical and communications knowledge and skills required of all Alberta students.<sup>2</sup> It is intended that students receive a wide range of technical concepts and activities designed to increase their technical competence, literacy, and understanding of the ways technology impacts them and society in general.

The curriculum is not stand-alone but is integrated within other curricula, especially the core subjects of English, mathematics, science, and social studies. Above all, the ICT curriculum emphasizes using technology as a tool for problem solving (Jonassen, 1996).

A number of school districts in Alberta have started technology projects in support of the ICT curriculum. One such project involved the use and integration of personal digital assistants (PDAs) into a middle school environment.<sup>3</sup> Two classes (one 7th grade and one 9th grade) of Alberta middle school students in a large urban area were involved in the study. Students in this study used PDAs throughout the school day and at home. Data could be stored on their PDAs directly, and stored or retrieved wirelessly from the school server.

The 26 students in 7th grade were nearing the end of their first year of study with the PDAs intervention, and the 25 students in ninth grade were nearing the end of their third year of using PDAs. Participants in this study were drawn from these classes as well as the students' parents and school staff and were comprised of: 24 of 51 students (47%), 14 of 24 families (58%), and 6 staff (100%).



## Literature Review

Many earlier technologies adapted to education, such as radio, filmstrips, tape recorders, and 16mm films were considered sufficiently important to be capable of changing educational methodology (Saettler, 1990). However, the projections and plans of technology advocates, promoters, and early adopters have not always resulted in the changes anticipated – or even in any change at all in educational practice. For example, the psychologist Gordon Allport, commenting on the slow deployment of educational radio stated, “Educators are confronted with a new medium for public instruction whose magnificent possibilities daze them, but whose technical and psychological peculiarities they do not yet fully understand” (Cantril & Allport, 1935, p. 248). Nonetheless, the ability of new and especially networked technologies and their capacity to extend and expand both communication and information processing continues to inspire and challenge educational leaders to consider such technologies to be at least a component part of education innovation.

One of the more recent technologies to extend and expand communication and

information processing is the personal digital assistant (PDA) or handheld. Particular to educational applications, PDAs afford a number of potentially useful activities and interventions. For instance, data are efficiently recorded and analyzed using PDAs as compared to using pen and paper. Portable and lightweight handhelds can be carried in pockets or purses into almost all environments of learning or research. In comparison to desktop computers, PDAs offer improved portability, accessibility (low cost), mobility, and adaptability (Ray, McFadden, Patterson, & Wright, 2001). One of the key reasons for using PDAs in the classroom is that every student can have immediate and personal access to computer technology, and this particular computer technology can also be taken home easily (Brown, 2001). In order to have true technological innovation in schools, computerized devices should be readily available (Buboltz, Young, Wilkinson, & Thomas, 2002; Ray, McFadden, Patterson, & Wright, 2001; *Education World e-Magazine*, 2001) preferably at a one-to-one ratio of student to device. Handhelds are an economical way to make technological innovation more available in schools, and the *Palm* web site offers successful accounts of handhelds being used in educational environments (Palm, Inc., 2006).

One challenge for PDA use in education is that designing instructional programs for PDAs is a relatively complex task for teachers. Nevertheless, Son, Kim, and Park (2004) point to eight positive characteristics of PDAs that outweigh the complexities and give credence and a rationale for the use of handhelds in educational domains. Their key point is that technology tools such as PDAs encourage and support students in changing their learning behavior.

Other authors have described strategies for successfully introducing and integrating PDAs into classrooms. Pownell and Bailey (2001) generated 13 themes for successful integration. A key theme was the ability of a leader to develop a vision for a successful handheld program. Too few school administrators at present seem capable of initiating and sustaining technology programs, suggesting a need for changes to administrative preparation and professional development (University of Minnesota, School Technology Leadership Initiative 2004). The Maryland Technology Academy, in collaboration with John Hopkins University, Towson University, and the Maryland State Department of Education, was established to develop recommendations and professional development programs for administrators who would be technological leaders in their schools (STLI, University of Minnesota's School Technology Leadership Initiative, 2004; Wizer and McPherson, 2005).

Many teachers still find computers to be difficult to integrate into their students' learning since computers are often isolated in computer labs or provided in classrooms in insufficient numbers for easy and sustained usage. The more accommodating PDAs are proving useful to language arts, science, and math. In

language arts a PDA can support the crucial writing process (Figg & Burson, 2002). While the desktop computer can be considered an instrument for producing the final versions of written assignments, PDAs are an excellent tool for the more preliminary work of the writing process, that of creative brainstorming, drafting, editing, and re-writing. Note taking during class can also be enhanced through collaborative consultation by means of shared text input applications. Students can participate to a greater degree though seeing their individual text entries merging into a collective text (Denoue, Sing, & Das, 2005).

PDAs are proving to be valuable tools in mathematics and science as well (Ostler, 2002). Software can provide for specialized mathematical programs. PDAs can be connected to peripheral tools and input devices. Examples of software include applications for graphing, simulation, animation, and mathematical games. Peripheral tools include temperature probes, digital cameras, GPS units, and robotic apparatus.



An example of appropriate use of a PDA in a science class is the use of an input probe to capture information such as temperature, humidity, and motion (Walthes, 2005). PDAs have also been shown to be effective and efficient tools for presenting quizzes. This use often results in reduced student time in taking a quiz, real-time scoring, and less time spent on grading (Segall & Doolen, 2005).

From an accountability standpoint, there are agencies that attribute increases in student achievement to student use of PDAs. The Consortium for School Networking (2004) conducted a study of the use of handhelds in K-12 schools focusing in part on the increasing numbers of schools that were turning to handheld computers so that every student had a PDA. The study found that PDA use was associated with improved student attention and increased achievement. Like other aspects of computer technology, the development of handheld computer technology continues to evolve rapidly. Such developments include increased capacity and connectivity with other computer devices (Krazit, 2004). New features of some PDAs rival the capabilities of desktop computers and include: email, text messaging, an organizer, web access, Bluetooth® communication technology, an MP3 player, and a digital camera (Palm Products, 2006; Blackberry, 2006). Further, new technical devices continue to enter the marketplace. The LeapFrog FLY™ Pentop computer has, “an optical scanner that sees everything you scan and write on special dot-matrix FLY paper” (LeapFrog, 2006). This device purports to have program applications to assist children in

learning. Berq (2005) believes that the FLY™ Pentop computer highlights the value of this new form of computing.

Clearly, while improvements in handheld technologies offer educators exciting possibilities there are also new instructional challenges to consider. For example, student cell phones ring during class, record photographs without individuals' knowledge, play MP3 music, and enable text messages. Such activities hardly seem educational, and may, in fact, be disruptive to the learning process. The evolution in handheld devices can add to the problem of finding an adequate supply of educational software applications appropriate for handhelds. Learner support resources are complex issues when considering alternative technical devices such as a handheld (Pasian, Barber, & Siedlaczek, 2002).

In spite of continually changing technology and the problems of implementing PDAs in classroom activities, the literature implies that the use of such handheld technologies will likely increase in the future. Rather than dwell on the disadvantages such technology brings to the classroom, Hirsch (2005) suggests proactive strategies such as using cell phone accessible sites such as [homeworknow.com](http://homeworknow.com), [winksite.com](http://winksite.com), or [rtestedu.com](http://rtestedu.com) to create cell phone-based learning activities. Hirsch also suggests using Apple iPods for educational audio podcasts, a practice begun in some post-secondary institutions.

## **Methodology**

For this study, group specific questionnaires were developed to identify perceptions of the use of PDAs by students, parents, and staff in a consistent manner. The questionnaires were developed in consideration of *Guidelines for Designing a Questionnaire* (Berdie, Anderson, & Niebuhr, 1986). In addition, the first author used her experience as a teacher to consider what questions would best elicit student, parent, and staff perceptions of PDA devices in the classroom. Topics considered for questionnaires included cost, technical requirements, participation expectations, usefulness, ease of use, comparability to other technologies, time constraints and expectations, and effect on student achievement.

To increase construct and face validity, the instruments were reviewed and formative feedback provided by three individuals: a practicing classroom teacher; a recent graduate of a master's program in instructional technology; and a professor with considerable expertise in educational technology. Given tradition and the desire to obtain the highest return rate possible, hard copies of the surveys were distributed by and completed surveys later collected by the school principal (see Appendixes A, B, and C).

## **See Appendix A - Questionnaire for School Staff**

[See Appendix B - Questionnaire for Parents](#)

[See Appendix C - Questionnaire for Students](#)

## **Participants and Setting**

Participation rates were as follows: six staff members (100%); 24 out of 51 total students (47%) from a 7th grade class of 26 students with almost a year of PDA experience and a 9th grade class of 25 students with almost three years of PDA experience; and 14 of 24 families (58%).

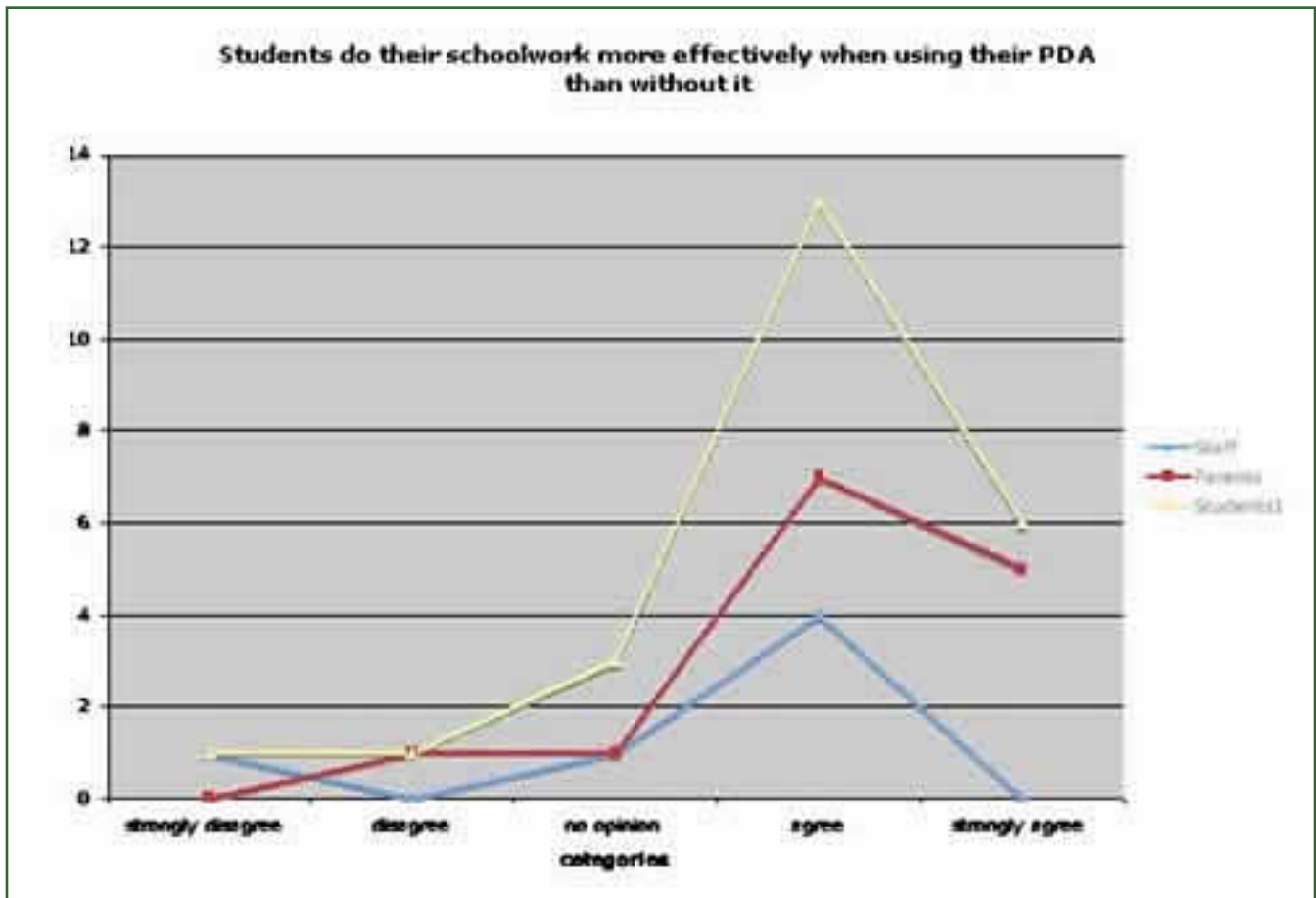
Students were encouraged but not required to purchase PDAs. Participation in the program progressed from partial involvement in 7th grade to complete participation by 9th grade. Ninth graders in the study had been initiated into the PDA program during their 7th grade year.

## **Results**

Results were grouped into the following major themes:

*Themes strongly agreed upon by students, parents, and staff.* It was strongly agreed that PDAs enabled students to work more effectively (see Figure 1), improved student collaboration, and helped students learn more about computer technology.

*Themes moderately agreed upon by students, parents, and staff.* It was moderately agreed that PDAs provided digital communication between students and the Internet; PDA screen size was adequate; student writing on a PDA was free of spelling errors; and the PDA program could be considered successful because students wanted to continue using PDAs and wanted other schools to follow their lead. On the contrary, participants did not support statements suggesting that PDAs could have best been used in mathematics or language arts.



**Figure 1:** Agreement by staff, parents, and students that PDAs enable students to work more effectively.

*Themes weakly agreed upon by all participants:* There was only weak agreement that PDAs: enabled students to be better organized; assisted students in problem solving; were useful devices at a minimal cost; or were useful for word processing.

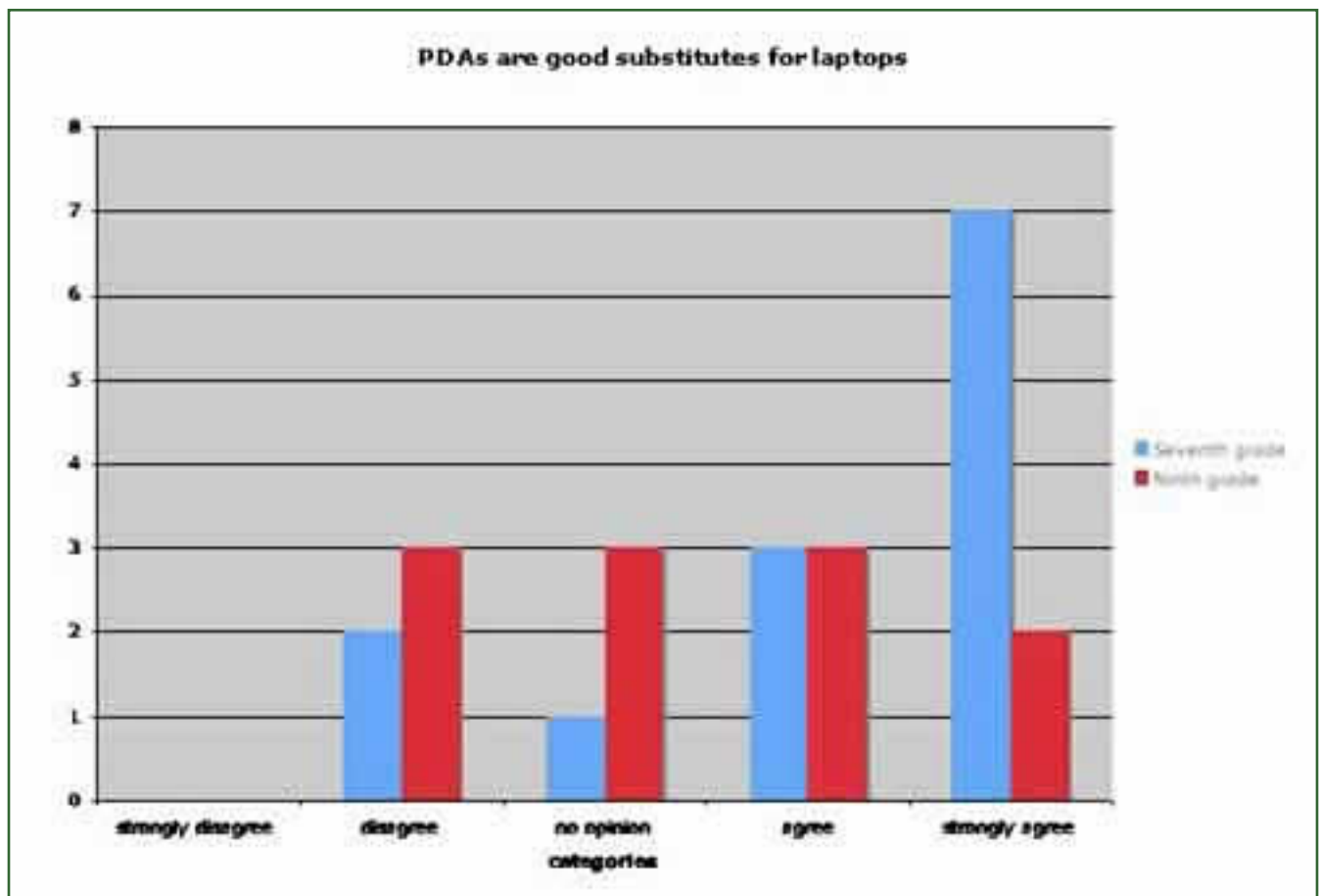
*Themes staff members strongly agreed on:* Staff members felt that students: did their schoolwork more effectively when using PDAs; collaborated through PDA use; were comfortable working with their PDAs; and were more fortunate than their parents in having computer technology to assist them in their education.

*Themes parents strongly agreed on:* Parents felt that students: could readily access the Internet with their PDAs; were happy to be part of the PDA program; and were comfortable using PDAs. Parents did not strongly support any statements suggesting PDA use in specific subject areas. Rather, they appeared to focus on functions of PDAs, such as the supposed improvement in spelling through a PDA spell-check function. Parents had more faith than students or staff members that Internet information was readily accessible. Parents even expressed the belief that students solved problems more easily when using their PDAs.

*Themes students strongly agreed on:* Students were glad to be a part of the PDA program; knew more about technology because of PDA use; preferred to continue using PDAs; and would be pleased if other schools followed their lead.

*Themes divided on the basis of student gender:* Females were more likely to use their PDAs to communicate with each other. Ninth grade females did not believe that it was easy to access the Internet with PDAs. Seventh grade females didn't think that PDA calendars and organizers would be of much assistance to them. Males strongly agreed they could create tables, charts, and graphs when using their PDAs, while females disagreed. Males had a stronger belief in the technical functions of a PDA, and were more comfortable using PDAs than females.

*Themes that were noticeably divergent between the grades (See Figure 2):* Ninth grade students were split in beliefs that PDAs were preferable to laptops. Seventh grade students held a strong belief that PDAs were preferable to laptops.

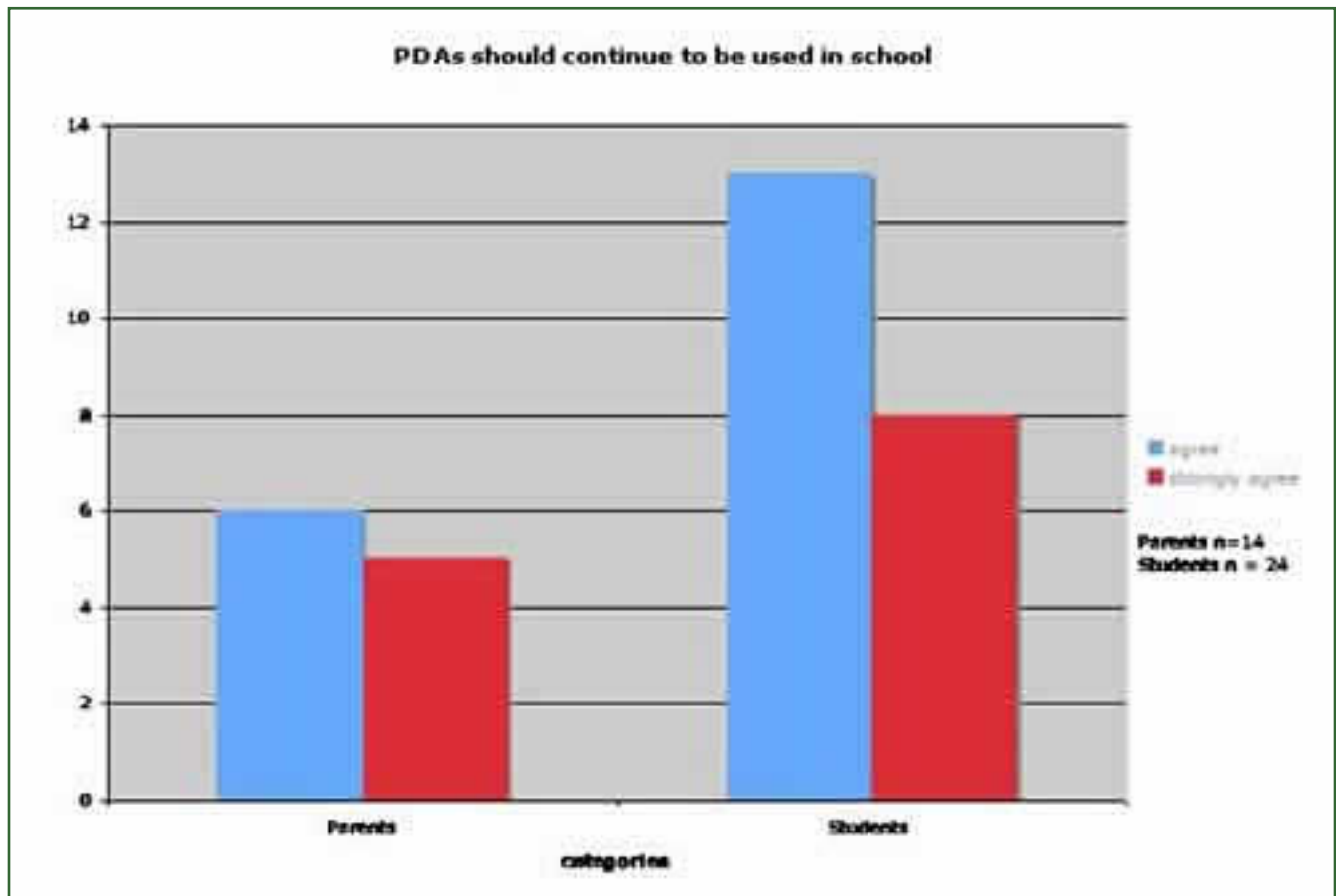


**Figure 2:** Seventh grade students had a preference for PDAs over laptops

*Themes staff members showed strong perceptual differences to:* (Staff were grouped by ten-year intervals of teaching experience.) There was strong

divergence of beliefs between staff members of varying years of experience. Staff members held strong perceptual differences on approximately 50% of the questionnaire statements. Although there were only six staff members, the strong divergence of perceptions suggested possible concern for the PDA program. For example, when asked to rate the item “students are better problem solvers when using their PDA”, there was equal rating between disagree, no opinion, and agree.

*Other perceptual comparisons of interest:* Overall there was sufficient support by students and parents for continuation of the PDA program (see Figure 3). At the same time, a strange twist was noticed when perceptions were gathered on whether or not other schools should follow the lead of this school. Although parents seemed to be in agreement with the PDA program, in that they purchased a PDA for their child, they showed some concern that other schools might follow their lead. Further study of this dichotomy of parental beliefs might reveal some interesting hopes and misgivings they may have for the program.



**Figure 3:** Parents and students agree that PDAs should continue to be used in school

Staff members had the most divergent perceptions and thus it was often difficult to measure their support for continuing the program: Highly divergent perceptions

on 15 of 27 statements (56%); a moderate amount of divergent perceptions on 7 of 27 statements (26%); agreement of perceptions on 5 of 27 statements (19%).

It may be that PDAs are not being used as effectively as they could be, or that there are other factors that influence the perceptions of relative advantage of the tool by individual teachers. It may be useful to seek out available educational PDA applications and match applications with curricular areas.

### **Changes to improve the questionnaire**

Participants were asked if PDAs were best used for such purposes as word processing or mathematics. Rather than the stated “best use of PDAs”, a gentler “suitable use of PDAs” may have elicited more support from participants. Additional changes to questionnaire statements could be:

- Should more software applications have been used?
- (For parents) Should the school have purchased PDAs for student use?
- (For staff) Should staff have been trained on a wider scope of PDA use, such as in science or mathematics?
- (For staff) Would increased staff involvement in the planning of a PDA program improve staff attitudes towards the use of PDAs in school?
- (For students) An open ended question may have been useful in asking students what additional uses in school PDAs might have

**Conclusion** The current computer technology of choice in most K-12 school districts is the desktop computer. However they are expensive and not portable. While laptop computers are portable, they are often more costly than desktop computers, and are considerably more fragile. Thus, one middle school in Western Canada initiated a PDA program. A group-specific questionnaire was developed in order to gain student, parent, and staff perceptions of the value and function of the PDA program.

The results indicate possible areas for improving the PDA program, specifically in the area of PDA curriculum integration into certain subject areas. It also appears that by using a wider variety of PDA software applications, the PDA program could be strengthened. Analysis of the questionnaires shows that there were possible problems with the wording of some of the questionnaire statements. It is believed that the altering and addition of different questionnaire statements, plus employing a larger sample, might yield more significant survey results.

Generally, students, parents and teachers felt that using PDAs was an important addition to their educational experience. It is important to emphasize that

students, parents and teachers all strongly agreed that PDAs helped to enhance and support students in the areas of: a) collaboration; b) work effectiveness; and c) their technology knowledge.

It is interesting to note the differences between ninth grade and seventh grade students regarding their opinion on whether PDAs or laptops were preferable. The ninth grade students were divided. On the other hand, seventh grade students had a preference for PDAs. Ninth grade students had three years experience with PDAs in contrast with seventh grade students who only had one year of PDA experience. The differences between ninth grade and seventh grade students could be attributed to a variety of explanations:

- Novelty for seventh grade students who only used PDAs for less than one year Frustration with small screen size for ninth grade students who used PDAs for almost three years
- Laptops currently having more capacity and capabilities than the PDAs in use

Staff members showed a great deal of diversity in their perceptions of the PDA program. It might be possible to improve staff attitudes through professional development initiatives that are tailored to support curricular integration of PDAs.

It appears that parents have a somewhat idealistic view of the impact of PDA technology on student learning. It might be possible that parents perceived their children as special because they were selected for inclusion in the PDA program. Overall, this study provides some insight into the use of PDAs in specific context in seventh and ninth grade. However, it raises many questions as well. Further research is needed to measure the effect of PDA use on a variety of results including course completion, learning outcomes, and development of social skills. More work needs to be done to identify critical areas where PDAs or other handheld technology devices can enhance and support student learning.

## Footnotes

<sup>1</sup>Alberta Education provides illustrative examples to clarify the intent of the curriculum (<http://www.education.gov.ab.ca/ict/ie.asp>). A classroom assessment toolkit is also available to assist teachers with student assessment. Kits are available for grades K-12 from ([http://www.education.gov.ab.ca/k\\_12/curriculum/bySubject/ict](http://www.education.gov.ab.ca/k_12/curriculum/bySubject/ict)).

<sup>2</sup>In support of the ICT curriculum and the use of technology as a tool for problem solving, the Government of Alberta has initiated a number of exploratory projects,

such as LearnAlberta.ca and digital video teleconferencing initiatives. Alberta SuperNet (<http://www.albertasupernet.ca>) (Restructuring and Government Efficiency) is now operational throughout the province. SuperNet comprises a high-capacity wide area network, connecting schools, hospitals, libraries, and government offices. LearnAlberta.ca (<http://www.learnalberta.ca/login.aspx>) also provides resources for teachers, students, and parents, for kindergarten to grade 12.

<sup>3</sup>A PDA is a small hand-held processor-based device that replicates many of the functions of a desktop computer. A key value of a PDA is that it can be carried in a pocket or purse because of its small size and lightweight construction. Even though PDAs have a small viewing screen, they are viable alternatives to laptop computers because of greater mobility and a lower purchase price. The cost of a PDA varies according to functionality, memory size, and accessory features, but is usually less expensive than desktop and laptop computers. Files created with PDA applications such as word processing, spreadsheets, slide shows, and personal organizers can be synced with computer versions of the same applications. For improved data entry, light-weight, folding keyboards are available. Various software applications can create new functions for the PDA. For example, mathematical applications can be used to create visual representations of mathematical concepts, aiding in student understanding.

## About the Authors



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## Appendix A

### Questionnaire for School Staff

1. How long have you been teaching? 0 – 10 years, 11 – 20 years, 21 – 30 years, more than 30 years
2. Our students do their schoolwork more effectively when using their PDAs than without them.
3. Our students find their PDA preferable to laptop/notebook computers because PDAs have more portability.
4. Our students digitally communicate with other students using their PDAs.
5. Our students collaborate with other students while using their PDAs.
6. Our students find PDA screens sufficiently large for doing schoolwork.
7. Our students are better problem solvers when using their PDA than without them.
8. Our students access information from the Internet with their PDAs.
9. Our students make multimedia presentations on their PDAs. (Multimedia - using pictures, and/or animations, and/or sound, and/or music, etc)
10. Our students keep written assignments free of spelling errors by using their PDAs.
11. Our students use their PDAs to send files to other PDAs or computers.
12. Our students make a table, chart, or graph with their PDAs.
13. Our students use a spreadsheet program to enter and manipulate data on their PDAs.
14. Our students are better organized because of the calendar/organizer on their PDAs.
15. Our students are glad to be part of the PDA program.
16. Our students believe that PDAs are more useful with a wireless network.

17. Our students consider PDAs to be small computers.
18. Our students know more about computer technology because of using PDAs.
19. The parents of our students think PDAs are quite useful for the money they cost.
20. I think other schools should use PDAs in their classrooms.
21. PDAs are the only kind of computer technology some of our students have at home.
22. Our students have occasionally lost work because of a low battery or a technical problem on their PDAs.
23. Our students believe that the best use of a PDA is for word processing.
24. Our students are comfortable working with PDAs.
25. If our students could make a technological recommendation to their teacher/principal, it would be that PDAs continue to be used in our school.
26. Our students believe that PDAs are most useful for their calculating ability.
27. Our students enjoy reading for enjoyment on their PDAs.
28. Our students are more fortunate than their parents in that they have computer technology to assist them in their education.
29. Our students believe that the best use of a PDA is for research.

## **Appendix B**

### Questionnaire for Parents

1. My son/daughter does his/her schoolwork more effectively when using his/her PDA than without it.
2. My son/daughter finds his/her PDA preferable to a laptop/notebook computer because it has more portability.
3. My son/daughter digitally communicates with other people using his/her PDA.
4. My son/daughter collaborates with other students using his/her PDA.
5. My son/daughter finds the PDA screens sufficiently large for doing his/her schoolwork.
6. My son/daughter is a better problem solver when using his/her PDA.
7. My son/daughter easily access information from the Internet with his/her PDA.
8. My son/daughter makes multimedia presentations on his/her PDA. (Multimedia - using pictures, and/or animations, and/or sound, and/or music, etc)
9. My son/daughter keeps written assignments free of spelling errors by using his/her PDA.
10. My son/daughter uses his/her PDA to send files to other PDAs or computers.

11. My son/daughter makes a table, chart, or graph on his/her PDA.
12. My son/daughter works with a spreadsheet program to enter and manipulate data on his/her PDA.
13. My son/daughter is better organized because of using the calendar/organizer on his/her PDA.
14. My son/daughter is glad to be part of the PDA program.
15. My son/daughter believes that a PDA is more useful with a wireless network.
16. My son/daughter considers a PDA to be a small computer.
17. My son/daughter knows more about computer technology because of using a PDA.
18. My son/daughter is less concerned about computer viruses or hackers when using a PDA as compared to when using desktop computers.
19. My son/daughter thinks a PDA is quite useful for the money it costs.
20. My son/daughter thinks other schools should use PDAs in their classrooms.
21. My son/daughter's PDA is the only type of computer technology we have at home.
22. My son/daughter has lost work because of a low battery or a technical problem with his/her PDA.
23. My son/daughter believes that the best use of a PDA is for word processing.
24. My son/daughter is comfortable working with a PDA.
25. If my son/daughter could make a technological recommendation to his/her teacher/principal, it would be that PDAs continue to be used in his/her school.
26. My son/daughter believes that PDAs are most useful for their calculating ability.
27. My son/daughter read books for enjoyment on his/her PDA.
28. My son/daughter is more fortunate than I was in that he/she has computer technology to assist him/her in his/her education.
29. My son/daughter is able to sync data between his/her PDA and a desktop computer.

## **Appendix C**

### Questionnaire for Students

1. Please check the appropriate box. I am male or female.
2. I can do my schoolwork more effectively when using my PDA than without it.
3. My PDA is preferable to a laptop/notebook computer because it has more portability.
4. I digitally communicate with other students using my PDA.

5. I collaborate with other students while using my PDA.
  6. Even though my PDA screen is small, it is sufficiently large for doing my schoolwork.
  7. I am a better problem solver using my PDA than without it.
  8. I easily access information from the Internet with my PDA.
  9. I make multimedia presentations on my PDA. (Multimedia - using pictures, and/or animations, and/or sound, and/or music, etc)
  10. I keep written assignments free of spelling errors by using my PDA.
  11. I use my PDA to send files to other PDAs or computers, and to teachers and other students.
  12. I make a table, chart, or graph on my PDA.
  13. I use a spreadsheet program to enter and manipulate data on my PDA.
  14. I am better organized because of the calendar/organizer on my PDA.
  15. I am glad to be part of the PDA program.
  16. PDAs are good substitutes for laptops/notebooks.
  17. My PDA is more useful with a wireless network.
  18. PDAs have helped me learn about computer technology.
  19. I am not as concerned about computer viruses or hackers when I use a PDA as compared to when I use a desktop computer.
  20. I believe that my parents think PDAs are quite useful for the money they cost.
  21. I think other schools should use PDAs in their classrooms.
  22. My PDA is the only kind of computer technology I have at home.
  23. I have lost work because of a low battery or a technical problem with my PDA.
  24. The best use of a PDA is for word processing.
  25. I am comfortable working with a PDA.
  26. If I could make a technological recommendation to my principal, it would be that PDAs continue to be used in our school.
  27. My PDA is most useful for its calculating ability.
  28. I read books for enjoyment on my PDA.
  29. We are more fortunate than our parents in that we have computer technology to assist us in our education.
  30. My PDA is preferable to a laptop/notebook computer because I seldom have to charge it during the school day.
  31. I have more frequent access to Internet research because of my PDA.
  32. I became very confident in using my PDA within two months of receiving it.
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