



**HANDHELD TECHNOLOGIES PROJECT
INTERIM REPORT**
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Executive Summary

There is an interest within the Calgary Board of Education (CBE) to investigate how new and emerging technologies can be used to address the diverse needs of unique learners within a large school system. Through the support of Innovative Learning Services (ILS), Information Technology Services (ITS) and a modified grant from the philanthropic division of HP Canada, three CBE schools are piloting handheld computers within the context of a systemic research initiative. These schools were selected to represent some of the diverse and unique learning situations within CBE schools with the intent of investigating how handheld technologies may impact the diverse needs of learners.

The purpose of this research initiative is to determine the extent to which handheld technology devices can enhance teaching and learning. This study is also intended to inform the CBE of the human and capital investment requirements of introducing handheld technologies into the teaching and learning environment.

The goals of the this pilot are to: i) identify relevant learning outcomes which are enhanced through the appropriate use of handhelds by teachers and learners; ii) gain further understanding of how students with diverse student learning needs use handheld technology to facilitate learning; iii) gain further understanding of how handheld technologies support teacher preparation and instructional planning; iv) gain an understanding of any technical issues that could arise in using handhelds within a teaching and learning environment; v) gain a better understanding of the role that handhelds can play in supporting teaching and learning; vi) inform the CBE and participating schools of the value and limitations of using this technology in instructional settings; vii) identify organizational and device management strategies for the incorporation of these handheld devices into schools; viii) identify professional development needs that could result from the inclusion of handheld technologies within teaching and learning environments; ix) identify how handheld technologies mesh with what is already in practice; and x) describe how the use of handheld technologies impact the use of time and space in schools.

This interim report is intended to provide baseline information to participants and stakeholders regarding benefits and drawbacks of handheld computer use in the classroom and to identify management, technical, professional development and communication strategies. Data collected from a teacher pre-survey, a student pre-survey, and focus group interviews and from classroom observations have informed this preliminary report.

Teacher pre-survey results demonstrated that there is a range in teacher comfort level and use of technology as well as teacher opinions regarding their expectations as to the use of handhelds for teaching and learning. Overall, teacher pre-survey results reveal that teachers anticipate that handhelds will impact their practice and that there will be positive benefits along with a number of challenges. Survey results from teachers also indicate that teachers see a use for handhelds in addressing the diverse needs of learners. In particular, teachers have identified that handhelds have the potential to support the diverse needs learners in terms of organization, motivation, higher level thinking, language development and access to technology. In terms of the potential benefit of using handheld technologies to meet the diverse needs of learners, 63% indicated that handheld use would be either valuable or highly valuable. 58% of survey participants either agreed or strongly agreed that handhelds would have an *impact on instructional planning*. 78% of teachers agreed or strongly agreed that handhelds would have an impact on managing *student assignments* and 94% thought that handhelds would have an impact on teachers' ability to *organize their own work and schedule*. Teachers indicated that they anticipate needing technical PD support for handheld technologies more frequently than needing ideas for designing learning experiences or *managing learning activities*. In terms of the potential *impact on student motivation for learning*, 79% agreed or strongly agreed that there would be a positive impact. Teachers were less decisive about the potential impact of handhelds on student learning. While 48% agreed or strongly agreed that students will be more successful in their learning, 53% indicated they could not estimate the potential impact on student learning. 42% agreed or

strongly disagreed that handheld use would help students *manage their schedules and assignments* but 37% were not able to predict.

At present the **student pre-survey** has been conducted only in the middle school and in the elementary school. The senior high student pre-survey will take place in mid February. Results will be incorporated in the final report of this project.

The student pre-survey provides baseline data which offers insight into these students' opinions of school, their reported attendance and work habits. In addition it provided data regarding student comfort level, use and experience with technology, including handhelds. The student pre-survey also provides data that demonstrates students' anticipated expectations around the use of handhelds. Student pre-survey results have indicated that students anticipate that handhelds will be useful in that they will allow increased access to resources and tools, are portable, will allow for more personalized learning, organization and communication and finally that they will make learning more fun.

Results from the student survey from the two elementary schools indicate that the majority of students (87%) consider themselves to be either very good or good at using technology. Students indicated that they thought handhelds would be helpful or very helpful for *research from the internet* (87%), *taking notes during class* (78%) and *for creating presentations* (75%). 96% of students agreed or strongly agreed that *using handheld technologies would have a positive impact on their learning* and 80% strongly agreed or agreed that the devices would help them *get homework done*. All but one participant agreed or strongly agreed that handhelds would *make learning more fun*.

Students also provided opinions regarding potential drawbacks of using handheld devices. Drawbacks included a steep learning curve, issues related to inappropriate use and concerns about the fragile nature of the devices. Usability factors were also mentioned as potential drawbacks of using handhelds, including keyboard and screen size as well as memory limitations.

Focus group discussions identified that teachers see a number of management and technical issues that need to be addressed when introducing handhelds within the teaching and learning domain. Teachers identified issues and challenges in terms of using a device intended for one user with multiple users. They also expressed concerns over connecting to a local area network and described the impact of network security issues on planned learning experiences and portability. Teachers also indicated that they anticipated that these issues would lead to an increase in teacher work load. Focus group participants also provided data relating to decisions made regarding home use. Teachers expressed some concerns over how to strategize for limited battery life and memory. In addition they expressed a need for further technical support.

Focus group participants indicated that they anticipate that handhelds have greater potential when used with existing technologies and with those, such as wireless, emerging on the horizon. They also proposed a number of management strategies that may lead to successful implementation of the devices. These include such strategies as using student leaders as mentors.

Focus groups also revealed that teachers see a number of benefits that may result from the use of handhelds as well as drawbacks that may prove challenging. Teachers described that handhelds may offer an increased access to technology and that the portable nature of handhelds offers tools and resources when and where they are needed. The use of the handhelds for personalized learning was seen as an important benefit as was its use for organization, communication and motivation.

Finally, teachers have offered their opinions with regard to professional development strategies and challenges. Teachers expressed their concerns over limited time and resources for PD. They also indicated that PD opportunities needed to be appropriate to the needs of teachers and

the unique learning situations in which they teach. Teachers suggested that a combination of formal and informal PD is needed as well as a combination of face to face and online environments. In addition, teachers suggested that PD should offer opportunities for joint planning around curriculum topics as well as the integration of handhelds.

Classroom observations provided additional artifacts to inform this study and further illuminate findings to shape directions for this study. Observations have taken place in two of the selected schools to date. One follow-up student interview has been conducted to date.

This report concludes with several preliminary recommendations regarding this pilot study. Recommendations include strategies for professional development, technical support, network access and communication.

Introduction Background



As a service unit within School Support Services in the Calgary Board of Education (CBE), Innovative Learning Services (ILS) leads work in technology-enhanced learning options and opportunities. ILS includes an online Senior and Junior High school and home education program as well as a distributed professional development program and a three year Alberta Initiative for School Improvement (AIS) project that addresses technology enhanced, distributed learning opportunities and options. Within this context, ILS has an interest in optimizing learning potential through access to innovative learning technologies. ILS is currently involved in a

number of research initiatives to examine and identify the impact of new and emerging technologies on student learning and teacher professional development, while working closely with CBE's Information Technologies (IT) department, to examine technical, organizational, and management issues to inform current and future decisions regarding school and teacher support for new technologies within teaching and learning environments.

In April 2004, several CBE schools were invited, through ILS, by the philanthropic division of Hewlett-Packard (HP), to apply for HP's Technology for Teaching grant initiative. These yearly HP grants are designed to accelerate learning through the innovative use of technology and are each worth \$35,000 to each school; including HP wireless equipment, help desk support, and professional development. Proposals from three separate CBE schools were submitted: Nellie McLung Elementary, Dr. Oakley Centre, and James Fowler High School.

Although CBE schools were not successful recipients of the Technology for Teaching grants, discussions between ILS and the philanthropic division of HP Canada, resulted in each of the proposals receiving modified grants for each respective school. These grants included fifteen HP 4350 iPaq's for each school. To meet the needs of unique learning goals and action research initiatives within the schools, two of the three schools determined to purchase additional iPaq's and peripherals. In addition, ILS purchased one HP camera and one GPS device that any of the three participating schools could borrow from ILS. ILS also purchased HP keyboards for each iPaq included in the grant as well as those purchased by the schools.

Innovative Learning Services is providing research direction and support for the Handheld HP iPaq Project with the intention of determining the extent to which handheld technology devices can enhance teaching and learning. Within the context of the system research initiative, each school has developed their own research initiative that incorporates the use of handhelds and each school's unique needs.

Within selected classrooms during identified blocks throughout the year, Dr. Oakley is conducting action research to “critically examine the role that iPacs can play in facilitating the teaching and learning of middle school aged children who have learning disabilities and to share these findings with system personnel.” Specifically they are seeking to: further understanding of how middle school students with learning disabilities use handheld technology to facilitate learning; improve the understanding of the role that handhelds can play in supporting the instructional needs of teachers who must individualize programs for students with learning disabilities; and inform logistical, professional and technical support issues related to portable technologies. (Appendix A).

Nellie McLung School is investigating the extent to which handheld technology devices can enhance teaching and learning of students within an elementary gifted and talented educational (GATE) setting. In particular, they are investigating how the use of handheld technologies impacts the process and outcomes of authentic research, including how handheld use impacts teacher practice and how the use of handhelds impacts meaning created and negotiated by unique learners (gifted and talented) within specific curricula. (Appendix B).

James Fowler High School is pursuing research around the question, “Can miniaturized, portable technology enhance teaching and learning of students enrolled in Social Studies in a high needs learning community?” Through the goals of their action research project, teachers and administrators at James Fowler seek to address the following goals: i) increasing student motivation and engagement; ii) giving students the opportunity to interact with technology in meaningful and relevant ways; iii) utilizing technology as a means of bringing greater relevance to course content objectives, and iv) addressing issues of socio-economic inequities around technology access. (Appendix C).

A steering committee composed of 3 ILS Specialists and an IT Specialist is managing issues and directions for this pilot. This committee meets regularly with project participants and liaises with IT personnel, to inform security and network planning. Through ILS, HP 4350s were delivered to schools in October, 2004. By November, 2004, keyboards were delivered to schools. Other peripherals were available from ILS. Students in Dr. Oakley and Nellie McLung schools began using these technologies in November. Through support from ILS and from the participating teacher at Nellie McLung, professional development is being provided. This included training on the use of iPacs, which began in November, 2004 for teachers from all three schools. This support continues on an ‘as needs’ basis through discussions with ILS. Because high school students are on a semester system, teachers and administrators at James Fowler High School have been engaged in PD to date, while students will be incorporating the use of handhelds into their second semester. PD sessions have included training sessions from a participating teacher at Nellie McLung and additional sessions offered by ILS specialist regarding how handheld technology can potentially be used to address the unique needs of learners.

Purpose

As a system pilot, this initiative is intended determine the extent to which handheld technology devices can enhance teaching and learning. This project is also intended to inform the CBE of the human and capital investment requirements of introducing handheld technologies into the teaching and learning environment.

The following goals have been identified in relation to this purpose:

- To identify relevant learning outcomes which are enhanced through the appropriate use of handhelds by teachers and learners
- To gain further understanding of how students with diverse student learning needs use handheld technology to facilitate learning
- To gain further understanding of how handheld technologies support teacher preparation and instructional planning

- To gain an understanding of any technical issues that could arise in using handhelds within a teaching and learning environment
- To gain a better understanding of the role that handhelds can play in supporting teaching and learning
- To inform the CBE and participating schools of the value and limitations of using this technology in instructional settings
- To identify organizational and device management strategies for the incorporation of these handheld devices into schools
- To identify professional development needs that could result from the inclusion of handheld technologies within teaching and learning environments
- To identify how handheld technologies mesh with what is already in practice
- To describe how the use of handheld technologies impact the use of time and space in schools.

Method

With the intent of capturing a thorough understanding of the use of handhelds within this pilot study, multiple data collection methods are being used to contribute to a more thorough understanding of the project. The following research techniques have been employed to date or are planned during the course of this study: i) on-line surveys; ii) focus group interviews; iii) classroom observations; iv) follow up student and teacher interviews; v) online logs within a learning management system.

Survey questionnaires are being used within this research initiative to gather quantifiable, standardized information from teachers and students participating in this pilot. Focus group interviews are included with the intent of providing rich, detailed responses and insights from the perspectives of participants. Classroom observations are being incorporated in order to provide opportunities for the researchers to shape the direction of further research and to further illuminate findings from survey and focus group interviews. Selected follow-up teacher and student interviews are planned as a result of classroom observations and are intended to provide detailed data to inform this research. Planning is underway for administrators, teachers, an IT Specialist and 3 ILS Specialists to participate in documenting technical and management issues via a learning management system.

Participant Selection

Schools

As the second largest school district in Canada, CBE serves a diverse student population. The following three programs and schools selected for this pilot were identified to represent some of the unique learning environments within our system and to investigate how handheld technologies may impact the diverse needs of learners.

- Nellie McLung Elementary campus houses both a K-6 regular program for students in the community as well as a gifted and talented (G.A.T.E.) program for higher ability learners focusing on higher level thinking and concept development.
- Dr. Oakley School provides intervention for learners who have difficulties in reading, writing, oral language and organizational skills. The school provides a congregated setting and focuses on literacy development for complex learners between 7 and 15 years of age.
- The handheld project is also being piloted in the Social Studies program at James Fowler High School, which serves a socio-economically high needs learning community.



Teachers and students

Teachers and classes of students were identified for participation in this project through discussions which took place at the school level. Teacher participants indicated a willingness to engage in action research and to participate in system research components. Nellie McLung identified 5 teacher participants and 2 administrators, Dr. Oakley identified 6 teachers and one administrator James Fowler identified 10 teachers and one administrator.

Procedures

To date, teacher and student pre-surveys have been conducted as well as teacher focus group interviews and classroom observations.

Teacher Pre-Survey

A [pre-survey](#) was conducted between November 7 and 15 to collect teacher perceptions about student and teacher use of handheld technologies prior to the implementation of the project. All participating teachers and administrators were invited provide data via this pre-survey. Table 1 indicates participation from each school for an overall response rate of 76%.

Table 1: Teacher Pre-survey response

School	Participating teachers	Responses
James Fowler High	11	9
Dr. Oakley	7	4
Nellie McClung Elementary	7	6
Total	25	19

Student Pre-Survey

A [student pre-survey](#) was also conducted in two of three schools to date. The survey was comprised of 16 items, which included items with forced choice and open ended responses. James Fowler students will respond to this same survey when their project is implemented in February 2005. Because of the nature of how students are organized for this project in each of the schools, there is a diverse response rate in each of the settings. Of the 54 students who have responded to date, 46 students were from Nellie McClung, six students from Dr. Oakley and 0 from James Fowler.

The following provides an explanation for the diverse response rate. Student use of handhelds is incorporated into each school as follows. The project at Nellie McLung is on a three week rotation period so that each class of students can use the handheld devices for a week at a time. Dr. Oakley students are involved in this project one class at a time throughout blocks of time during the year. Therefore at present, one class has had the opportunity to work with the handheld devices. James Fowler students are on a semester system. Therefore students will be incorporating the handhelds into the second semester of the school year, beginning in February.

Focus groups

Participating teachers from each identified school were invited to take part in a focus group interview, which was moderated by Dr. Edit Petrovic at each school. Table 2 indicates the number of teachers who took part in each of the focus groups, which occurred between December 6 and 14 in each of the three participating schools. A series of seven questions guided each focus group discussion. (Appendix D).

Table 2: Focus group participants

School	Number of participants
Dr. Oakley	8
Nellie McLung	4
James Fowler	8
Total	20

Classroom observations

Classroom observations by ILS specialists have contributed to the research data and have taken place in two of the three schools. In December, 2004, observations of a Language Arts class in Dr. Oakley School were made by an ILS specialist. On January 27, 2005, two ILS specialists made further observations in a grade six GATE class at Nellie McLung Elementary School. Video and digital images were collected in both settings to provide additional artifacts to inform this study. Because student use of handhelds at James Fowler High School will not take place until the second semester, classroom observations by ILS Specialists or educational researchers have not yet occurred in this location.



Follow up interviews

Resulting from the need for more time to fully explore issues or promising practices that emerge during initial classroom observations and focus group interviews, additional in-depth interviews will be conducted with students, teachers and parents in selected locations. At the time of this writing, one follow-up student interview has taken place. Additional students, teachers and parents will be selected for these interviews have been or will be selected through discussions with ILS specialists, teachers and administration.

Online Logs

The steering committee is in the process of designing a community of practice within a learning management system for teachers to discuss and identify issues related to handheld use and management. This has evolved as a result of meetings with project participants and through email correspondence with teachers and support staff, who are responsible for management and set up. In addition to supporting a community of practice, this format will be used during the remaining months of this project to collect data regarding:

- Setup and sync issues
- Wireless issues
- Logging in issues (i.e. passwords, multiple users, etc.)
- Maintenance (storage, recharging, carrying case, file clean up, restoring)
- Other specific teacher issues
- Other specific student issues

Results

This interim report has been informed by results from data collected from the following: i) teacher pre-survey; ii) student pre-survey; iii) focus group interviews; iv) classroom observations; and v) online logs.

Teacher Pre-Survey Results

The teacher [pre-survey](#) provided information about participating teachers' abilities and use of technology, as well as their opinions regarding their ability to use technology in general. In addition, the survey provided baseline data regarding teacher expectations regarding the use of handhelds for teaching and learning.

Technology abilities

Figure 1 demonstrates that teachers were fairly evenly split in their descriptions of their ability to use technology, with a small majority (53%) of teachers indicating they are either highly or somewhat skilled and a large minority indicating they were not skilled at all or somewhat unskilled (47%).

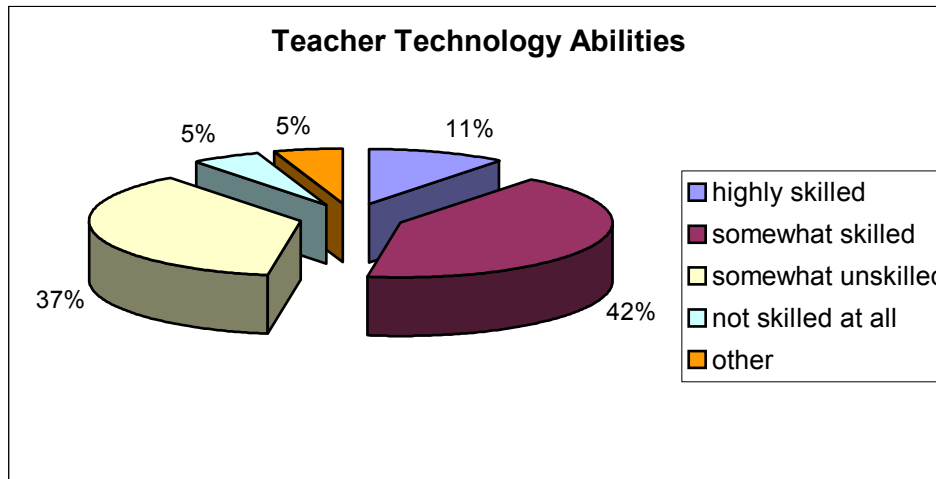


Figure 1: Teacher technology abilities

One individual described that while s/he might, “use (the handheld) every day as a resource for myself...I don’t use it as a means to help teach my classes.” She described that s/he does “use it to produce word documents, and to do some research on the internet.”

Frequency of technology use

Slightly over half the respondents indicated that they use technology daily (52%). 48% use technology only a few times a week (11%) or a few times a month (37%) (Figure 2).

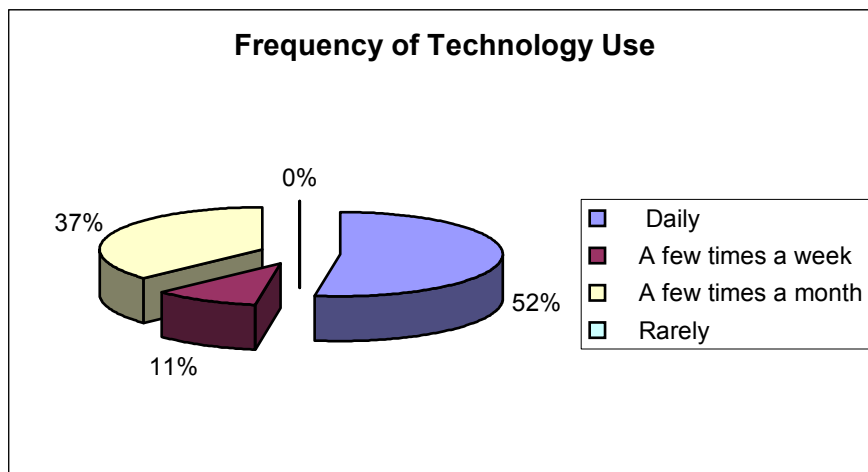


Figure 2: Frequency of teacher technology use

Comfort level with handheld technologies

The reported confidence level of respondents indicates that only 16% are confident or very confident users of technology while 52% indicated they were only somewhat confident and 32%

indicated they were not confident in using handheld technologies (Figure 3). Two individuals indicated that with practice, they were gaining more confidence.

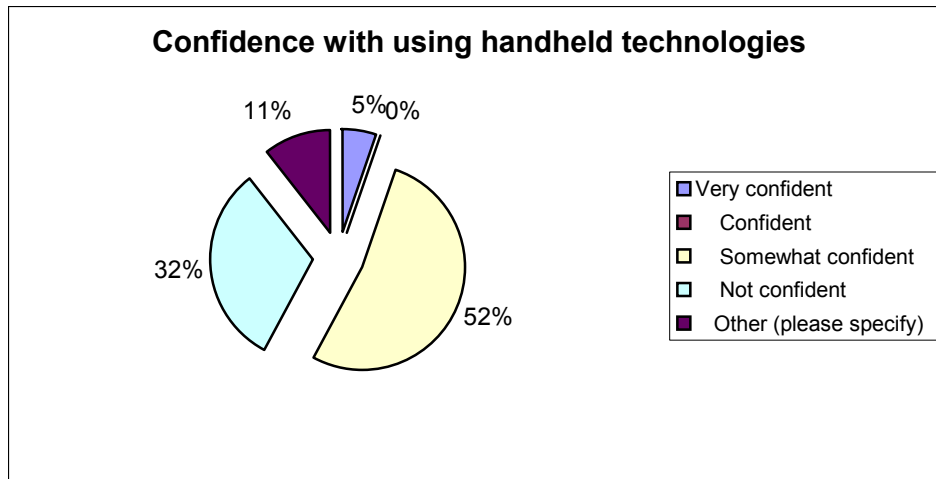


Figure 3: Confidence with using handheld technologies

Professional development needs

The teacher pre-survey provided additional information with regard to teachers' perceptions of their need for professional development (PD). When asked to rate how much PD support they anticipated needing around handheld technology use for this project, most (63%) of the 19 respondents indicated that they anticipated needing frequent help with the technical aspects of using iPads. Occasional support was also indicated as a need regarding ideas for designing (63%) and managing (68%) learning experiences. (Table 3).

Table 3: Anticipated PD Support Needed

	Frequent	Occasional	Little or none	Don't know
Technical aspects of using handhelds	12			
Ideas for designing learning experiences		12		
Managing learning activities		13	1	1

Anticipated impact on teaching

Although there were still a significant number who were not able to decide whether handhelds would have an impact on teaching, Table 4 demonstrates that in terms of whether teachers

anticipated that there would be an impact on various aspects of teaching, most were in strong agreement or agreement that there would be an impact on instructional planning (58%) addressing student needs (68%) managing student assignments (74%) and organizing teacher work and schedules (94%).

Table 4: Anticipated impact of handheld use on teaching

	Strongly Agree	Agree	Disagree	Strongly Disagree	Don't Know
Instructional planning	2	9	1	0	7
Addressing student needs	4	9	0	0	6
Managing student assignments	3	11	0	0	5
Organizing my own work and schedule	5	13	0	0	1

Anticipated impact on student learning

Participants were asked to consider the anticipated impact of using handheld technologies in specific aspects of teaching and learning. Although a majority (79%) strongly agree or agree that involvement in this project has the potential to motivate students for learning, teachers were less agreed or certain of potential benefits on learning. While 47% indicated that they strongly agreed or agree that students would be more successful, 53 % indicated they did not know. Similarly respondents were split in their opinions about the potential impact on organization for learning that student use of handhelds might have. While 39% were in agreement or strong agreement that there would be a positive impact, 16% disagreed and 43% did not know.

Table 5: Anticipated impact of handheld use on student learning

Students will...	Strongly Agree	Agree	Disagree	Strongly Disagree	Don't Know
be more successful in their learning	3	6	0	0	10
manage their schedules and assignments	2	4	2	4	7
be more motivated for learning	3	12	0	0	4
be organized for learning	3	5	2	1	8

Special needs

When asked to identify through an open ended question, the special needs that handheld use could potentially help to address, teachers identified that they anticipated handhelds could support special needs learners in the following areas:

- organizational skills
- motivation
- higher level thinking

- language skills
- lack of home access to technology



Several respondents indicated that they saw the potential for handhelds to impact organizational difficulties as is indicated in the following response:

Organization is a huge factor with our students. Handhelds, if students are allowed to use iPads at home, could greatly help them in this area.

Several other teachers were of the opinion that motivation for learning could potentially be positively impacted through the ability of the handheld device to provide *immediate feedback on learning activities*.

Five of the nineteen responses to this question were related to the perceived potential of handhelds to support higher level thinking skills. One teacher predicted that handheld use *“will allow for lateral thinking and learning, enhancing knowledge construction at the pace that gifted learners are comfortable with”* while another referred to the ability to address the needs of learners to *“think critically and creatively”* and another anticipated that this was a means for gifted students to have a *“more sophisticated access to resources.”* One suggested that handhelds might support those with *“limited skills in evaluating and selecting appropriate web sites for research.”*

Several comments proposed that handheld technology use would be helpful in addressing components to support language learning including English as a Second Language (ESL), reading and writing skills, access to appropriate reading material, supporting poor scribing skills. One respondent hoped that a program with text to speech capabilities could be used to support students’ access to science and social studies text.

A number of comments referred to the potential capacity of handhelds to provide support of the kind and in the space that each student when they needed it.

Providing additional remedial or advanced information as required by each student; providing alternate learning modes (e.g. visual, auditory and tactile)

Comments in this area speak to teachers’ anticipation that handhelds may appeal to students’ learning strengths, providing for *“auditory/visual/kinesthetic learners.”*

Finally one individual indicated that handheld technology use in school could compensate for students’ lack of access to technology at home.

Addressing diversity

When asked for opinions on the value of using handheld technologies to meet students’ diverse needs and enhance learning, all respondents indicated some level of value, with 63% of the opinion that handheld use would be valuable or high valuable (Figure 4).

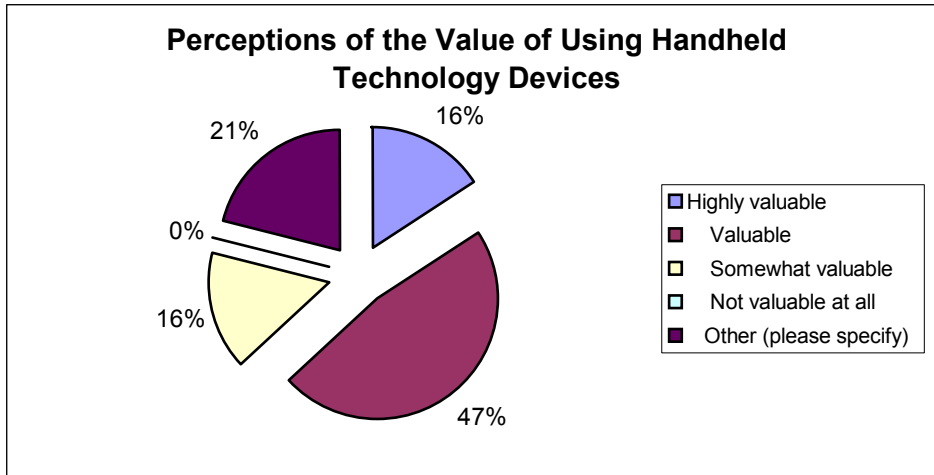


Figure 4: Perceived value of using handheld technologies

Using the "Other" option, some teachers indicated that the value of handhelds is dependent on *how they can be utilized in a classroom*. One individual noted that s/he wasn't sure of the value for student learning, only that *"it seems very limited in its capabilities in that the iPads are not going to be connected to the internet."* S/he continued, remarking that, *"It seems as though the usefulness of the device will be limited by how much accessibility students have to the internet."* One individual was of the opinion that s/he didn't *"think that the devices will provide that much information and support to the educational process unless there are some really specific purposes developed for these devices in class."* Finally s/he indicated a high degree of motivation as a teacher who was *"anxiously awaiting the introduction of these devices into the classrooms as I am curious to see how they can be used in an educational setting in a high needs high school."* Finally there was a comment that indicated uncertainty about the *"size of the screen."*

Curriculum fit

The majority (89%) of respondents predicted that within their program they would be able to make best use of handheld technologies in Social Studies (52%) and in Language Arts (37%) (Figure 5). Given the nature of the projects within each school, this may have influenced the responses of participants, in that plans for this project focus mainly on Language Arts and Social Studies, rather than Mathematics and/or Science.

One respondent indicated that until *fully aware of all the possibilities of handhelds*, s/he could not predict in which curricular areas handhelds would be put to best use. Another suggested that handhelds could be used to support a *multidisciplinary approach to understanding concepts imbedded within the curriculum, specifically the inquiry process using literature as a springboard."*

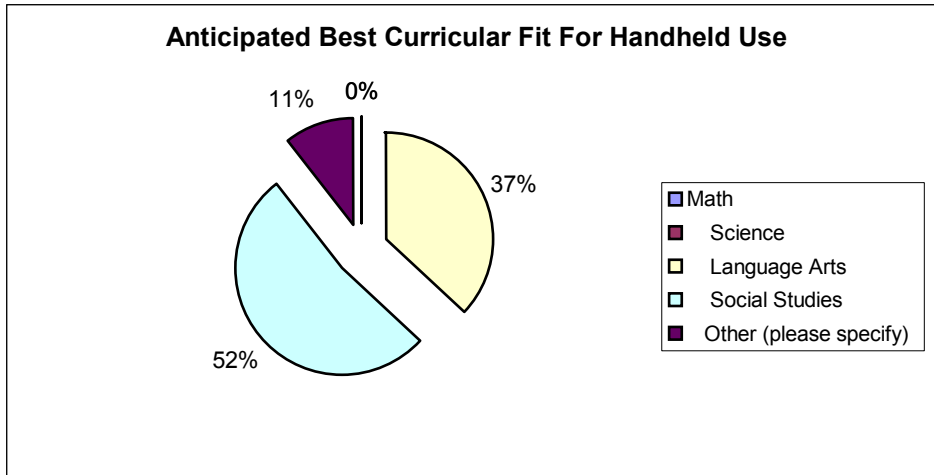


Figure 5: Anticipated best curricular fit for handheld use

Parent involvement

Teacher participants were asked to describe plans that they have to involve parents in this project. In response, most of the eight teachers, who provided a comment, chose to speculate on the impact of the project on parental involvement and on their support for home use.

In order to assess whether the technology will best work for families, we need to allow them to be used at school and at home. The initial response from students that I talked to was excitement and a feeling that their parents would be willing to purchase iPads for student use. This would be exciting because it would allow us to include this as part of the transition plans for students back to their community schools.

Parents will have to be involved if the handhelds go home - basic liability; optimally the child should teach the parent the technology; parent council is very enthusiastic - like the tape recording function

I would love to be able to have students take iPads home daily to assist with organizational and study skills. If parents, teachers and students see the value of using the technology it would be advantageous for them to buy one at the end of the project.

The teacher pre-survey provided baseline data regarding the perspectives of teachers in terms of their own abilities and comfort level with handheld technologies as well as technology use in general. Approximately half of the teachers indicated their limited use and comfort with technology. Additionally there was uncertainty and a diversity of opinions regarding what value the use of these devices for students. There was agreement among most that the handhelds would have an impact on several aspects for teaching and teachers provided a number of anticipated the survey indicates that teachers anticipated the value handheld may provided for differentiating instruction.

Student Pre-survey Results

At the time of writing, 46 students from Nellie McClung and six students from Dr. Oakley have completed this survey as a result of the nature of how the project is being implemented within each school. ([Method: Student Pre-Survey](#)). James Fowler students will respond upon project implementation in February 2005.

The student pre-survey provides some baseline data that provides an insight into student opinions of school, their reported attendance and work habits. Students also provided

information regarding their comfort level, use and experience with technology (including handhelds) as well as their anticipated expectations around the use of handhelds.

Feelings towards school

When asked to indicate their feelings about school, most students indicated that *school is okay-some days I like it, some days I don't*. Approximately one quarter of the students who responded *really enjoy school and look forward to it*.

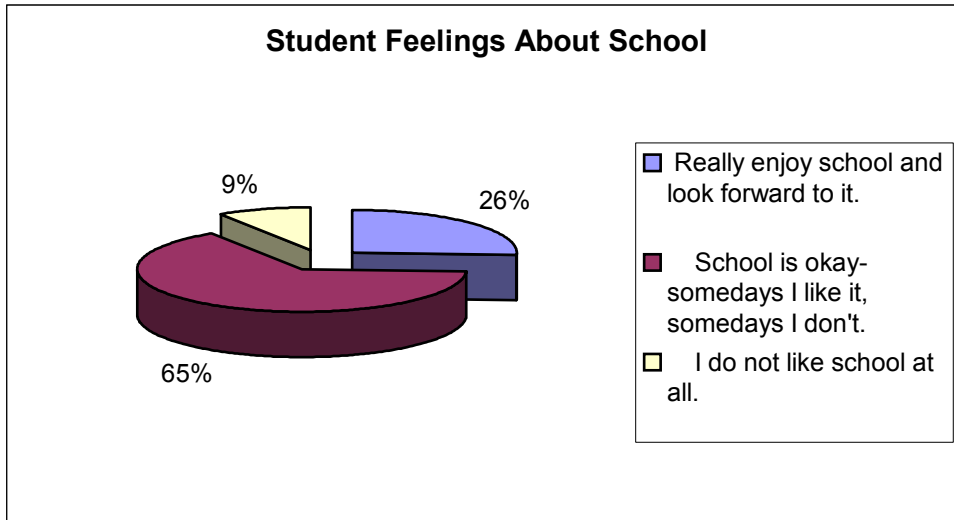


Figure 5: Student feelings about school

Absence frequency

Asked how often they are absent from school in a month, over half (58%) reported that they either never miss school or miss less than a day, while a third (33%) reported that they miss 1-2 days and 9% say that they miss three or more days (Figure 6).

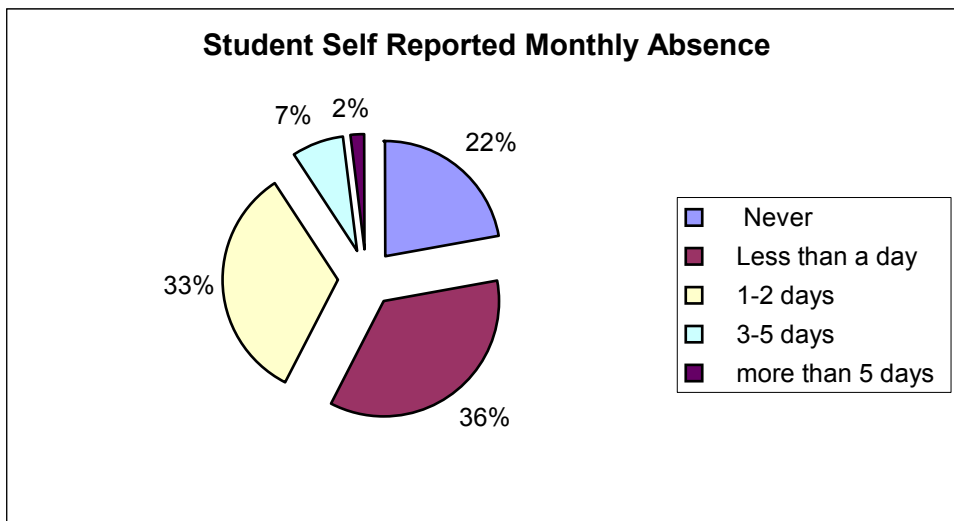


Figure 6: Student self reported monthly absence

Work habits

The students were asked to provide their perspectives on their school work habits by identifying how often they respond to school related activities. Table 6 demonstrates that strong majority indicated that they see themselves to have strong school work habits, with 92% indicating that they always or most of the time: *get homework done* (92%); *put forth their best effort in class* (95%); and *participate in school* (98%).

Table 6: Student self reported work habits

	Always	Most of the time	Sometimes	Never
Get my homework done	57%	35%	7%	0%
Put forth my best effort in class	39%	56%	6%	0%
Participate in school.	63%	35%	2%	0%

Comfort with technology

In response to being asked about how good they were at using technology, student participants indicated overall, that they are at least, reasonably comfortable with their technology abilities. Figure 7 reveals that all respondents indicated that they judged themselves to be, at least, *somewhat good*, with 87% offering that they were either *very good* (44%) or *good* (43%) at using technology.

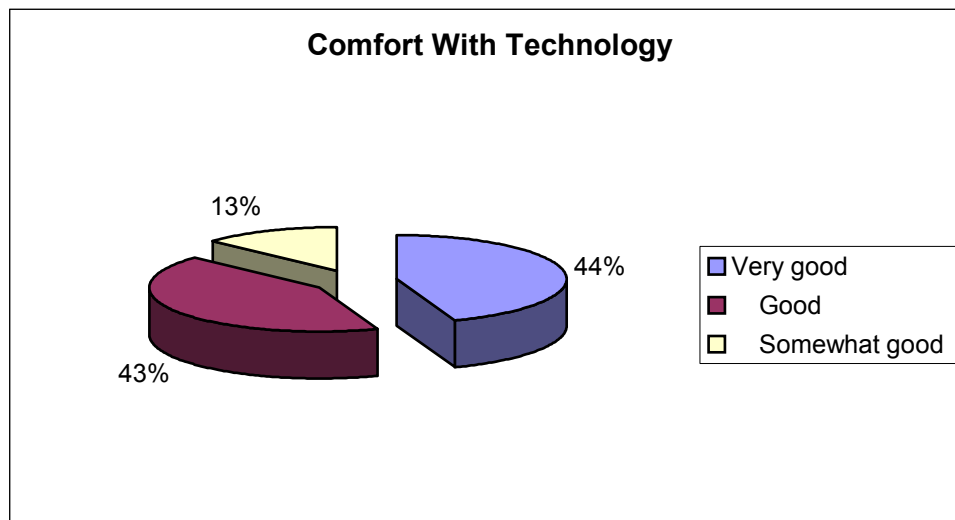


Figure 7: Student comfort with technology

Frequency of school technology use

Figure 8 illustrates students' frequency of use with technology in school. While over a third (35%) revealed that they use technology almost daily, 17% indicated that they use it either less than once per month (2%) or one to three times per month (15%). The remainder (48%) use technology at least once per week at school. These responses suggest that students' time on technology at school varies broadly across participants.

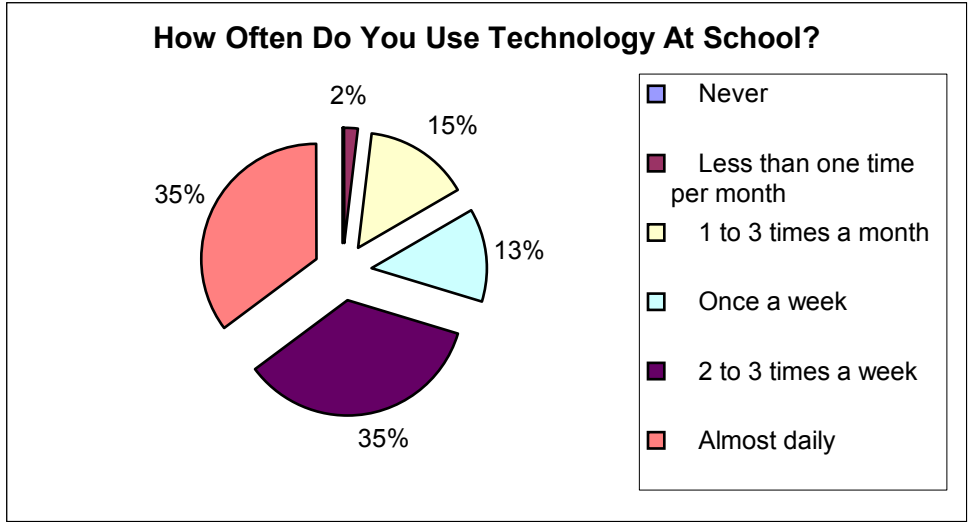


Figure 8: Frequency of school technology use

Experience with handheld technology

Figure 9 indicates that a very small number of students were experienced, regular users of handheld technologies (9%). Almost half (46%) had rarely or never used handheld devices before this project. The remainder of respondents (45%) revealed that they had used a handheld device only from time to time.

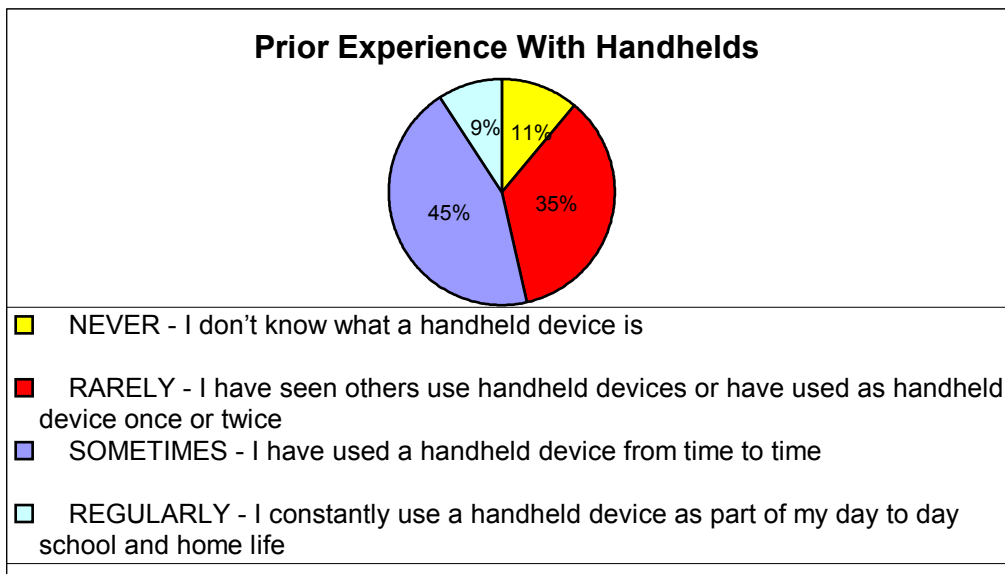


Figure 9: Prior student experience with handhelds

Anticipated value of handhelds

Table 7 shows that, when asked to rate the helpfulness of handhelds, students' responses revealed that overall, they were of the opinion that handhelds would be quite helpful. Given a selection of learning activities participants offered their opinions to indicate that the majority felt that handheld devices would be either very helpful or helpful for *internet research* (87%), for *taking notes during class* (78%) and for *creating presentations* (75%). Students were less inclined to see the usefulness of handhelds for conducting research through emailing others. 61% selected either very helpful or helpful.

Table 7: Students' predictions of value of handhelds

	Very helpful	Helpful	Somewhat helpful	Not too helpful	Not helpful at all
research from the Internet	54% (29)	33% (18)	9% (5)	4% (2)	0% (0)
research by emailing others	28% (15)	33% (18)	28% (15)	9% (5)	2% (1)
taking notes during class	52% (28)	26% (14)	15% (8)	6% (3)	2% (1)
creating presentations	31% (17)	44% (24)	17% (9)	6% (3)	2% (1)

Anticipated uses for handhelds

Communication

Figure 10 describes that, when given a list of potential uses of handheld devices for communicating, students saw that handhelds offered potential in a wide variety of communication tasks. Most often, *email of teachers or friends* was selected. Fewer selected *emailing experts for research*. Students also indicated that they saw this tool as potentially valuable for *sharing work in progress with their teacher or parts of assignments with group members*.

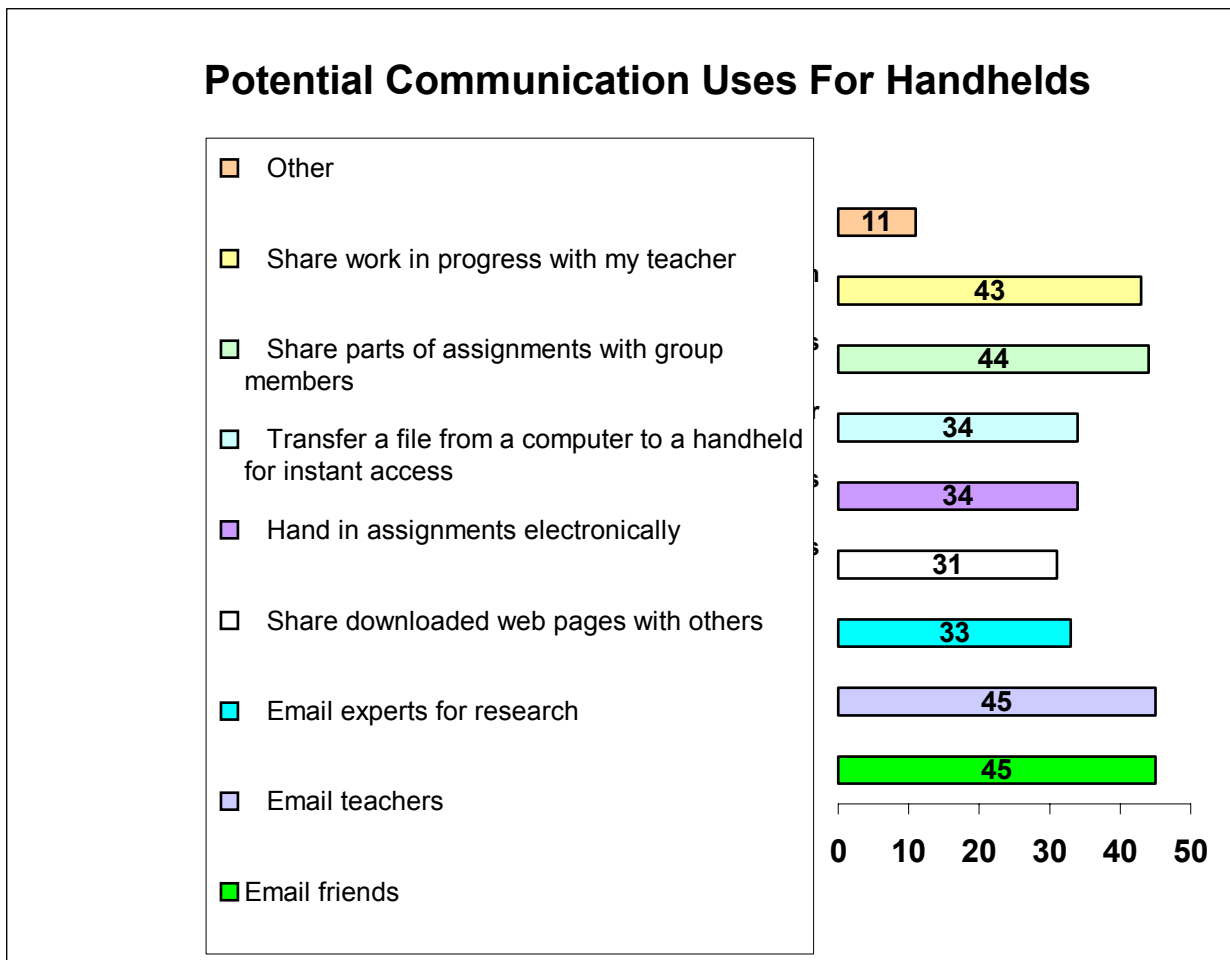


Figure 10: Potential student communication uses for handhelds

Data gathering

Students were asked about the possibilities for using handhelds for to *collect information for school projects* (Figure 11). The choices most often selected were *recording information using word processing and reading information from the web*. *Keeping track of homework assignments and schedules* as well as *recording information into the spreadsheet* and were also options that were frequently selected. Students indicated that overall they saw less potential for the use of handhelds to gather data from *watching videos, listening to music, or using a concept map, or using online tutorials*.

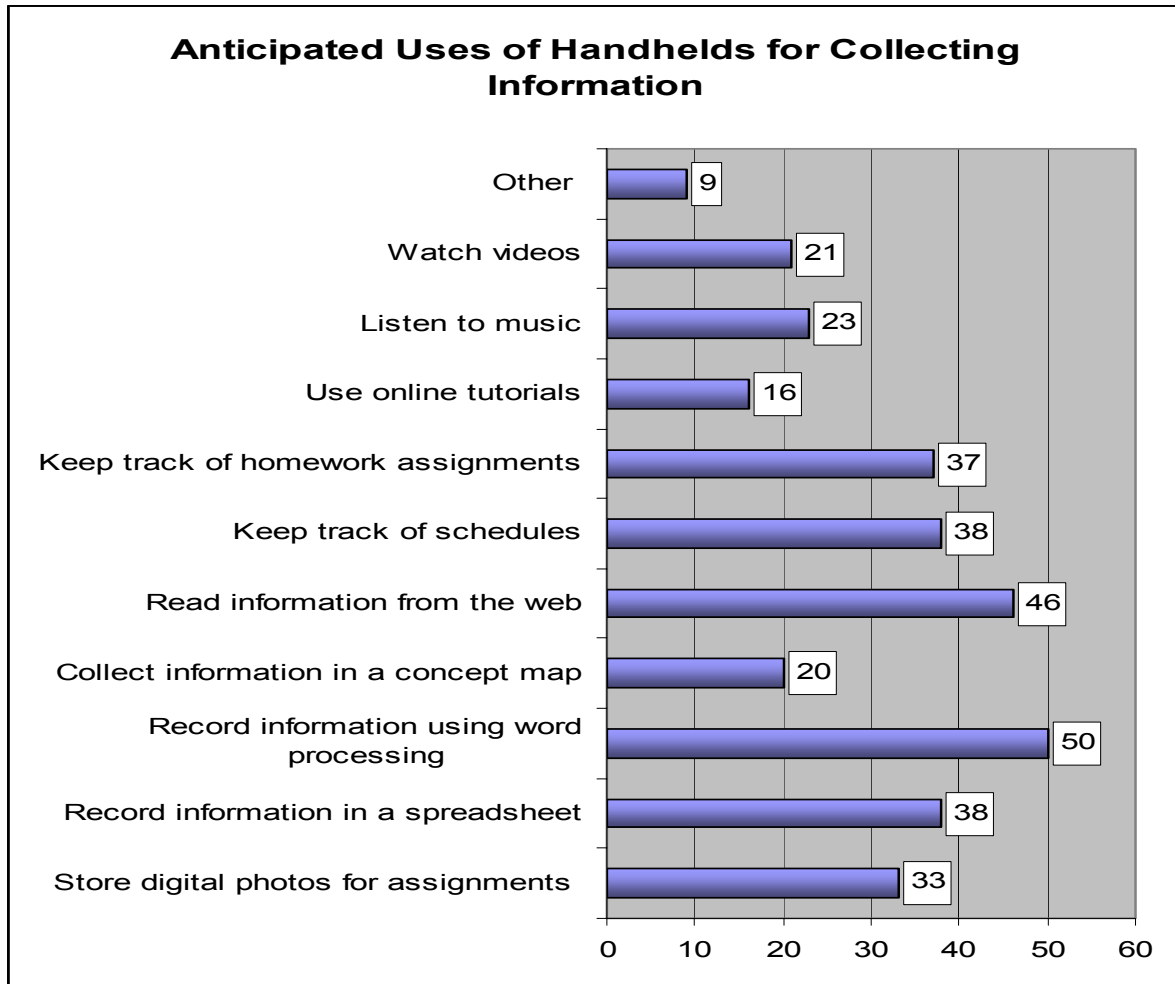


Figure 11: Anticipated uses of handhelds for collecting data for school projects

Technology Experience

Frequency of use of software applications

Table 8 provides information on student reported use of software applications types for school project work. Most frequently used are word processing and the internet, while over half of the students indicated that they use spreadsheets or concept mapping less than once a month. In addition 41% of students indicated that they use Student Mail (CBE's student email service) less than once per month.

Table 8: Frequency of use of software applications

	Less than once a month	1 to 3 times a month	Once a week	2 to 3 times a week	Almost daily
Word processing (Word)	4% (2)	24% (13)	22% (12)	24% (13)	26% (14)
Spreadsheets (Excel)	56% (30)	22% (12)	15% (8)	7% (4)	0% (0)
Concept Mapping (Inspiration)	59% (32)	22% (12)	11% (6)	7% (4)	0% (0)
Presentation Software (Such as Powerpoint)	35% (19)	39% (21)	11% (6)	11% (6)	4% (2)
Internet	2% (1)	13% (7)	17% (9)	35% (19)	33% (18)
Student Mail	41% (22)	24% (13)	15% (8)	19% (10)	2% (1)

Anticipated impact of handhelds

Student pre-survey responses reveal that overall students see potential for a positive impact on their learning through the use of handhelds, as described in Table 8. A very strong majority either agreed or strongly agreed that they anticipated that handhelds would *have a positive impact on learning* (96%), *help get homework done* (80%), *help the student be more organized* (96%) and *make learning more fun* (98%). Correspondingly, most students disagreed or strongly disagreed that handhelds would *make learning more difficult* (92%).

Table 8: Anticipated impact of handhelds

<i>Using handheld technologies will...</i>	Strongly Agree	Agree	Disagree	Strongly Disagree
have a positive impact on my learning	46% (25)	50% (27)	4% (2)	0% (0)
help me to get my homework done	39% (21)	41% (22)	19% (10)	2% (1)
make learning more fun	76% (41)	22% (12)	0% (0)	2% (1)
make learning more difficult	2% (1)	6% (3)	59% (32)	33% (18)
help me be more organized for learning	52% (28)	44% (24)	4% (2)	0% (0)

Advantages

Students also provided more complete explanations of what they anticipated to be the most beneficial aspect of handheld computers. These included: i) increased access to technology; ii) portability; iii) personalized learning; iv) organization; v) communication; and vi) motivation.

Increased access to technology

Students' comments indicate anticipation that having access to handhelds will allow more frequent and easy access to technology when needed.

... would be helpful to learn and get information off the internet, instead of waiting for a time to book the computers.

...would be able to use them in class and not have to book the computers in the library

Students also indicated that they saw potential to use handhelds for collecting data on field trips: *"If at outdoor school and find something wanting to write down, you can do it without having to go on a computer."*

Portability

Students also offered that size and portability were features that would offer value for them. Students saw potential in having access to tools when and where they were needed, indicating that there would be value when, *"You want to do an interview or record your ideas and the camera for taking pictures."*

Comments that handhelds will be *"simple to use and very portable,"* and be able to be used *"anywhere to do research"* indicate that students anticipate a value in the ability to access information, applications and organizational tools any time any place.



It's portable and you can move to a small space and it's not very noisy because you are all on the computers in one place

They will let me do a lot more homework on the bus. I can also take notes easier at the carpet (teaching space). I think it would be easier to use instead of the computers because you can hold it in your hand

Personal Learning Tool

According to students, many anticipated that handheld devices would help them take more initiative for their learning through the ability to access information and technology for collecting information when needed. Student comments revealed that they anticipated being able to *"Keep notes while teacher is talking."* One student suggested that *"If the teacher is talking about a certain thing we have access to the internet right there on our desks."* Others offered,

I strongly think that these will be helpful because if the teacher asks a question we don't know the answer to like, 'What is retrograde motion' or 'what the Ptolemaic system is?' we will be able to go on the internet and find the answer.

If your teacher asks you a question you can quickly log on to the internet and find the answer which saves not only us but also the teachers by saving time.

Organization

Several students discussed the anticipated benefits of handhelds as an organizational tool, allowing them to keep track of assignments and homework as well as keeping notes and data more organized.

I think it's good because all your work is in one thing rather than having it in books all over the place.

They indicated that the handheld would make it *"easier to carry around"* and bring *"all your work to school and other places without having a bunch of papers floating around."*

Communication

Student comments revealed that they anticipated that handhelds could be useful as a communication tool. Potential communication uses included, “e-mail(ing) your homework assignments to your teacher” and “instant messaging.”

Motivation

As might be expected with the introduction of a new technology, several student comments indicated that the novelty of the new device would add a “fun” component to learning.



I think that using handheld technologies for learning would be a good thing, because it makes it more fun. It is a new and different way of learning for most students, and it would make them get more out of the lesson(s).

Students indicated that this aspect of handhelds might “motivate people to look forward to studying” and that “this will help because everyone will work quite hard and especially since it’s quite fun to work on them.”

Disadvantages

Although the survey revealed that students were on the whole enthusiastic about the potential advantages of using handheld technologies for learning, they also provided comments regarding potential drawbacks of using these devices.

Learning curve

Some students anticipated that, because they might need to be “very skilled with electronics in order to efficiently work with them” they might “negatively impact (their) learning.” One student explained,

Some students might not completely understand how to use the handhelds, and this might cause them to not properly finish assignments and/or do something wrong.

Classroom management issues

Some students revealed that the “fun factor” also offered a potential disadvantage for the way the class worked as a whole.

We might get distracted. We might pay too much attention to it. We may not share. They are also not good for group projects because people fight over them.

Students also revealed that inappropriate use might be an issue that might detract from the effective use of these devices as learning tools.

Students could be playing with them instead of learning

I can play solitaire while my teacher is giving a lecture... You can Instant message without the teacher knowing.

Another problem is that you kind of want to play with the transcriber and other things, which make the work last longer.

Damage considerations

Concerns of breakage were expressed by a number of students who indicated that they thought that handhelds would be “fragile and easy to break.” One student was concerned of the cost of replacement of the devices.

One of the major problems is that if you accidentally break it or are basically accident prone then these are quite bad because they cost around \$700.

Usability

Comments describing potential disadvantages of handheld computers were primarily related to issues of usability. Size was one area of concern. Students suggested that the keyboard could potentially make *“typing slower or even cause troubles focusing in class.”* Size of the screen was also mentioned in that it was so small that it would be *“hard to see writing”* and *“a lot of things would be very hard to do on it.”*



One student expressed concerns with initial use of the handwriting transcriber,

...the letter recognizer cannot recognize my writing so when I type my name the computer thinks I'm saying something in Chinese.”

Discussions regarding features of handhelds for students indicated might cause potential difficulties were that the *“backlight goes off every few minutes”* and that because handhelds run on batteries, they *“may run out of power and they need to be recharged.”*

Focus Group Results

Three focus groups sessions were conducted by Dr. Edit Petrovic, an educational researcher from ILS, in participating schools between December 6 and 14 in each of the participating schools. A total of 20 teachers participated in these interviews. A series of seven questions provided guiding topics for each focus group discussion. (Appendix D). Teachers discussed:

- Anticipated enhancement of learning experiences
- Support for instructional planning
- Integration of handhelds into current practice
- Organization and management strategies and technical issues
- Benefits and challenges
- Emerging professional development (PD) needs
- Potential impact of an online environment to address PD and technical needs

Field notes, which were taken during the interviews, were analyzed using open coding and axial coding to reorganize the data into categories and subcategories according to similar characteristics that were noticed. The following summary represents the analysis of the three focus group interviews, which is synthesized into these six topics: i) management and technical issues; ii) integration with existing technologies; iii) suggested management strategies for success; iv) anticipated benefits to learning and teaching; v) anticipated drawbacks for learning and teaching; and vi) professional development strategies and challenges.

Management and Technical Issues

Multiple users to one device

Concerns were raised around the collective use of a device which had been designed for personal, individual use. Several teachers commented on the logistics managing handheld technology among several classes.

A variety of rotation strategies were discussed within the three locations to address the need to share the resource equitably amongst participating classes. In one case, teachers proposed to rotate the handhelds to classes on a curriculum unit rather than a daily basis. Rotation on a weekly basis amongst participating classes was also seen as feasible. Several teachers noted that because the devices would rotate to other classes, this might affect students' sense of ownership and responsibility. In one school teachers planned to have three teams use the

devices on a rotation basis but that each team would use the devices for a substantive period of time during the year. This strategy was proposed as an alternative to the less desirable strategy of moving the devices back and forth between teams on a regular, daily basis.

Network issues

Given that wireless connectivity to the Internet or to the local area network is not yet in place in each of the schools, teachers expressed concern over how data could be synched to desktop stations and the lack of ability for students and teachers to access resources on the Internet.

Participants expressed that they were rethinking how they could use the devices without wireless and were concerned with the amount of time needed to download files to a desktop computer at the end of a class or a time block.

Teacher work load

Teachers pointed out given that there were workarounds needed to incorporate the device among many users when it had been designed for one user. This created many issues, including downloading files and regularly updating the information for different groups of students who are using the handhelds. Therefore, teachers cautioned that handheld use would create a huge work load for teachers and require a rapid learning curve with *“no promise of positive learning outcomes.”*

One teacher described that each Friday s/he would download all the files from all handhelds to one computer. Teachers expressed that they had concerns with time needed to set up handheld with software additions. In one case, a teacher described that it two hours per handheld to load GPS software on individual handhelds. S/he ran out of time after completing installations on six devices. The teacher explained that the process was slow because handhelds were not designed to be used by 20 people at the same time. Although teachers anticipated that there would be successful outcomes, they felt it important to track the ratio of teacher work to student success.

Home use

Teachers discussed the possibility for students to take the devices home. In two of the three schools, the decision was made not to allow home use. The concern expressed was that handheld technology is fragile and can be easily damaged. In the school where it was planned that handhelds could go home, teachers spoke of a strong partnership with parents. Teachers emphasized that parents need to be made aware of the initiative to support the project. Teachers feel that they need to promote how handhelds are used but also need to take into consideration the financial capabilities of parents. In some cases, teachers noted that not all parents are in favour of the use of handhelds. In some cases, parents do not want their children experimenting with technology. Teachers expressed that they hoped that results from this study will help inform parents of the benefits to learning resulting from handheld use.

Battery life and memory

The issue of battery life was expressed in all three focus groups. Related to this was that when a battery dies, all information can be lost, requiring reinstallation of some software. Teachers were concerned about potential lost work, if the device hadn't been synched prior to the battery draining.

Teachers noted that the side button could be accidentally turned on without the user being aware and this would quickly drain the battery. Teachers stressed that HP should adjust this design feature of the iPaq.

Some teachers also mentioned that video clips did not always work and suggested that the memory was insufficient to run larger MP3s.

Network security

The issue of network security was discussed in each focus group. For security reasons, ITS explained that students were not yet able gain wireless access to the Internet. Because there is no log-on required on each handheld, there is not yet a system to track the end user. The issue of concern is that students can be downloading inappropriate information, particularly if the devices are available for home use. Teachers expressed that in a teacher controlled environment, this type of use is unlikely. Teachers revealed that they were concerned of the limitations on the use of the handhelds without access to the Internet.



Tracking student sign-out in handheld storage unit

Technical support

Teachers identified through their discussions that technical support was needed to more effectively launch the work of this pilot. Some expressed that it was difficult to determine the potential of the devices before the full implementation, without knowing all the features of the devices. Teachers explained that, not knowing what the technology is capable of, limits instructional planning and visioning student learning with the handhelds.

Teachers have also worked together using release time provided by ILS along with their own personal time to experiment with various uses of the handhelds. For example, in one school, teachers experimented with downloading MP3s and beaming one another documents. They had difficulty discovering how to beam to more than one individual and how to get videos to play. Support involves much peer and individual problem solving.

Currently some teachers are accessing online support provided through HP but expressed concern that this requires registration and often has a two day turnaround time. They prefer just in time support. Teachers suggested that, for the duration of the pilot they would like to have had the expertise of someone from HP to provide support. Included in this proposed support would be information regarding types of users (adults and students) who typically purchase these devices. Teachers felt there would be value in knowing how different people use the devices for different purposes.

Teachers also expressed that they need clarification regarding ITS support for this pilot. In one case a teacher explained that they had been told at a meeting that school based technicians could support this work only if handheld use was within his/her comfort level or area of interest. Teachers expressed that they needed a better understanding of what type of support could be offered from IT.

Finally, teachers expressed that they need support in terms of purchasing decisions regarding associated software. They are interested in knowing what software programs are available and what they do before they can decide what they want to buy. Teachers described that they would like to know what other software is available for download for the iPaq. One teacher was curious about whether text to speech software, such as Microsoft Reader, which is available on the desktop, could be used with the handheld devices.

Security and storage

Security emerged as an issue of importance, to varying Degrees, in each of the schools. Because of the size of the devices and their associated parts such as writing stick, teachers expressed concern over breakage, loss or theft. Teachers expressed that the mobility of the devices could be impacted by the choice selected for storage and carrying the handhelds. Because the handhelds travel in numbered class sets, the storage case selected might be protective but not very portable.





Teachers highlighted the paradox that mobile devices may not actually be used as mobile devices because of security issues emerging from network security issues and multiple users.

Integration with Existing Technologies

Teachers indicated that currently various technologies are integrated to different degrees in each of the three schools.

Teachers anticipated using handhelds with existing technologies, incorporating familiar software and new tools and processes. Teachers expressed interest collecting student reactions to using familiar software with handhelds, hoping to gain understanding of what works and what doesn't work. Currently, teachers have noticed the iPaq version of some software offers reduced functions. For example, the iPaq version of Excel lacks some graphing components. Teachers anticipate that they will be able to introduce some use of statistics using the modified version.

Teachers are also interested in seeking to understand what device is appropriate for which purpose. For example, when does it make sense to book a computer lab as opposed to booking out a set of handheld devices? One focus group expressed that for them, a critical question is, "What can be done with handhelds that cannot already be done with laptops or a desktop?"

Teachers described the following learning experiences, among others, that will integrate software (spreadsheets, word processing, the Internet) and hardware (scanners and cameras) while capitalizing on some of the unique features of handheld devices:

- collecting data in the field on temperature oscillations
- capturing text, sound and pictures on field trips
- using e-books to access multiple copies of appropriate literature for students
- publishing students' illustrated books for peers to read

Suggested Management Strategies for Success

Teachers suggested that they envisioned that the project would be more successful if students were given open, continuous access rather than access to the handhelds during limited timetabled blocks of time. Teachers also described how student files could be synced to one desktop computer. More than one teacher suggested a system of setting up numbered folders, which would correspond to numbered iPaqs and enabling easy access individual student files.

One teacher also noted that students had very quickly picked up on how to use the handheld devices and were then easily discovering new features. This teacher emphasized that teachers often can impose their own perceptions when predicting how students might use new technologies and that this perception was often not the same as the perception of technology that students have. S/he noted that students were approaching the handhelds, not as a toy but as a learning tool. Teachers also discussed the possibility of developing student leadership in support of handheld use.

To address issues around battery recharging, teachers suggested that the devices not be used back to back between classes and that recess and lunch periods be used to recharge batteries. Teachers discussed creating a student club, whose responsibilities might include downloading new software and taking care of recharging as well as working as mentors and tutors for others within the school.

In terms of home use, some teachers suggested that students be allowed to take them home and that cradles be stored at home with students bringing just their keyboards and iPaqs to school and being responsible for ensuring that their handhelds are recharged.

Anticipated Benefits to Learning and Teaching

Participating teachers provided detailed descriptions of what they anticipated to be the enhancements to learning which may result from handheld computer use. While teachers expressed that it was too early in the process to determine whether there might be a long term positive effect through handheld use, they did offer a number of potential benefits for teaching and learning. These included: i) increased access to technology; ii) portability; iii) personalized learning; iv) organization; v) communication; and vi) motivation.

Increased access to technology

Focus group participants discussed the potential for their students to have immediate access to the internet through handheld use. This would enable research to occur when the students needed access and answers rather than having to wait for a scheduled lab time. Participants also indicated that handhelds might also provide immediacy in terms of access to downloaded materials as well as student created materials recorded through sound or text.

Teachers also anticipated that, as a result of the lower cost comparatively of handhelds to desktops, families might be better able to afford these. Several participants indicated that, if it is proven that there are benefits to student learning, they anticipated that parents would be encouraged to acquire handhelds for their children, with the goal of providing more access to technology tools and online resources.



Some participants noted that increased accessibility could offer benefits for special needs learners. Currently many have to send these students either to a computer lab or to another classroom to use a desktop computer. Some special needs students are sensitive to being asked to work in isolation from the regular classroom and hoped that with access to handhelds, this sense of isolation would be eliminated.

Portability

Teachers anticipated that the portable nature of handhelds offered benefits for learners. One teacher described that a student had commented that the portability of handhelds would make them better than desktops, through allowing students to use them wherever they students might need them. Teachers also described plans for students using the devices for fieldtrips, taking them home as organizers, and using them for taking notes with word processing. Participants also anticipated that in the near future, once students would have wireless access to the internet, further benefits to learning will occur in school settings.



Organization

Teachers indicated that they saw organizational uses for the handhelds for both themselves and for their students. Some teachers indicated that they anticipated using the devices for day to day planning, while others noted that they already have their own devices and are using them as organizational tools. One teacher described that the device could help to move work back and forth from home in that s/he could synchronize the handheld with the calendar at home and do planning with the help of handheld device. S/he downloads information from a desk top to the handheld, describing this as an additional method to using email for transferring files back and forth from a home computer desktop to the school.

Teachers were also of the opinion that handheld technology will help students be more organized. Participants described that the use of the calendar could help students in planning long-term projects and preparing assignments, thereby assisting students to more efficiently keep track of their work. Some teachers also commented that they expected handhelds could

potentially help students organize their thoughts more concisely because of the format offered by handhelds.

Some teachers were interested in how student learning could be enhanced through the ability to structure information using a variety of media on one device. In this sense, they anticipated that students would be able to use the handheld as a space to organize their work in a “*multimedia journal*” and were interested in exploring how this might provide enhancements to learning.

In another school, teachers described that they hoped to see benefits for students through the ability to use audio recording on the handheld. Students would be able to record the description of their assignments and have access to these at home via the handheld. In this school, some teachers planned to give students the option to write into either their hardcopy agendas or their iPags or to use the audio recording feature to record homework items.

Motivation

Teachers explained that they anticipated that handheld technologies may be a motivating factor for student learning. Focus group participants indicated that students would view handhelds as “cool” as opposed to handwriting daily items in their agendas. They anticipated that students would also likely develop a sense of ownership for their work. Teachers explained that they had often noticed that their students are eager to try new technologies and tend to quickly pick up on the use of these. They anticipate students could be more motivated to use handhelds to write notes.

Collaboration

Some teachers expressed that, because students could work with the devices any where, the devices could enhance student group work, allowing students to record, take notes, and conduct research within the context of the group projects.

Personalized learning

Focus group discussions elicited many responses that revealed that teachers saw many possibilities for designing learning experiences to meet the needs of diverse learners through the use of handheld technologies. Teachers commented that the device would provide all students with more opportunities to experiment and explore. In addition it will provide a further option for students to choose from when deciding how they want to work: with a laptop, paper and pen, or handheld device.



Several commented that handhelds could be used as an assistive technology device for students who have special needs such as hyperactivity, attention deficit disorder or impulsivity. Teachers anticipated that the handheld could help such learners with tools and strategies for organization.

In addition, teachers noted that the devices could record voice, allowing students with writing difficulties to dictate their ideas or homework assignments into the device. One teacher described that a student had begun to improve his handwriting

in order to allow the handwriting recognition feature of the handheld to more effectively translate his written work to typed text.

Teachers commented that, because the handhelds would be available for all students within each participating class, those with special needs would feel less singled out for extra support. Teachers noted that handhelds are used by a wide range of people, as are other technologies such as mobile phones. Given this, the use of handhelds to address diverse needs, has the potential to diminish special needs students’ concerns about standing out.

Although some teachers expressed concern regarding screen size, others noted that the small screen size would not likely be an issue for learners, given that it is possible to change the font on the screens to improve readability and also that many students had prior experiences other handheld devices such as Game Boy.

Some teachers expressed that predicting how handhelds might enhance learning experiences for students with diverse needs was difficult. These teachers looked forward to identifying how skills such as information gathering, interpretation and analysis would be impacted. They predicted that there would be benefits in terms of addressing learning disabilities, special needs, and English as a Second Language (ESL). They described that students who did not function well with pen and paper would welcome the opportunity to hand in assignments in a different format made possible through the use of handhelds

Other teachers expected that the audio recording capability of the handheld could benefit students with fine motor difficulties by enabling them to use speech to contribute test or quiz answers directly into the handheld.

Teachers discussed the possibility to enhance constructivist teaching with the use of handheld devices. They indicated that handheld use could allow them to respond to students more immediately, readjusting teaching to respond to needs and questions by pointing to websites where the information is available.

Drawbacks to teaching and learning

When asked about the role that handhelds might play in supporting instructional planning, some teachers described some of their concerns related to how these devices might impact teaching and learning.

Some expressed skepticism in whether storing the information in a small device is secure enough and wondered what would happen if information was lost. Some indicated that their comfort level is to stay with desktops and laptops and that, as they get to know handheld devices better, they are likely to use them more.

Teachers anticipated that they will have to spend significant time with their students to teach them about the devices. However, some also expressed that that their students usually pick up technology features quickly.

Professional Development Challenges and Strategies

In discussions around professional development (PD) regarding the use of handhelds, a number of challenges were identified by focus group participants. Teachers indicated that time, and resources were limited for PD. In addition, provisions needed to be made to address appropriateness of PD opportunities. Teachers provided their assessment of potential strategies to address their PD needs.

Limitations of time and resources

Some participants indicated that long hours are being spent by teachers who are teaching themselves how to use handhelds. These individuals noted that, while it is one thing to be provided with release time, they are also in need of external support. The other side of this situation was expressed as well. Although teachers expressed a willingness to learn, even if they had external support, they indicated that they are reluctant to leave their students very often with substitute teachers.

Appropriateness of PD

Teachers ranged from having an interest, background and confidence with handhelds to those with less confidence or background. Teachers who had more experience with handhelds or with technology in general, expressed interest in exploring pedagogical applications using handhelds. Others with less background indicated that, at this point, they were in need of more technical support. Not all teachers have the same comfort level or interest in using technology. One teacher expressed that the more s/he uses handheld devices the less s/he likes them; indicating that the tool does not match her working thinking style. Focus group participants indicated that, unless teachers are comfortable with the use of handhelds, there will be little likelihood of integration into classroom practice.

Teachers also indicated the importance of tailoring PD to the unique needs of the school. For example, a PD provider should be aware of how to address the unique needs of learning disabled students when discussing pedagogical uses of handhelds. Some favoured classroom visits to other projects using handhelds, with the intention of observing these devices in action as a springboard for discussion and new ideas.

Online Community of Practice

Focus groups spent some time discussing the use of an online environment to support their own professional development in the use of handheld technology.

Some suggested that the area could provide support for discussing pedagogy and indicated that it would allow people to meet virtually when needed, addressing the limited aspect of time for PD. In addition it would also provide an arena for immediate feedback, ongoing communication and sharing knowledge.

Conversely, some teachers indicated that discussions focusing solely on technological concerns wouldn't be seen as useful. One teacher suggested that an online community could add complications in terms of learning the communication tool itself as well as managing and coordinating an online community. Other teachers expressed that although all would be using handhelds, the pedagogical issues would be different in each unique location, making online discussions about pedagogy more challenging.

Blended PD

Some teachers expressed that there could be value in meeting once a month for half a day to discuss issues around practice with handheld technologies. Several indicated that, on school based level, informal information sharing has been going on among the teachers involved in this project. Some teachers expressed that they found it beneficial to work on this project using a team approach. These teachers described that they found value in working in teams comprised of those more experienced with technology helping those with less experience. Other teachers described that teachers had been offered time to explore how they might use the devices and that teachers enjoyed the opportunity to discover possibilities.

To address the PD needs of teachers, discussions within focus groups indicated that some combination of formal and informal PD is needed as well as a combination of face to face and online venues, which would offer the opportunity for joint planning around curriculum topics and the integration of handhelds. Focus group discussions indicated a need for some formalized communication system to address PD needs.

Classroom Observations

Classroom observations have currently taken place in two schools: Nellie McLung and Dr. Oakley. Students and teachers were observed using handhelds within the context of reading e-texts and celebrating a collaboratively written and illustrated class story and within the context of a research initiative.

In the first situation, a group of nine students from Dr. Oakley were observed in a guided reading lesson while reading multiple copies of an e-text which had been downloaded by their teacher. Students also were celebrating a book that they had written and illustrated as a class. Images that had been created by students had been scanned and entered into their e-book and were being used as cues for students to read.

These students, who are learning disabled, were observed using features within the word processing software to highlight key words and illustrate with the draw tool difficult vocabulary. Students also were observed accessing notes that they had previously taken within the context of their e-text. Students appeared to be focused on both their reading and supporting one another in using textual cues. This may be a result of each student having their own copy of the text and being able to track, take notes and illustrate within the text using features within the handheld.

During a follow-up interview, one student described how she used the unique features of the handheld to help her with reading strategies:



...with keywords, we just highlight them, and then a little pad would come up and then, like I said it has, "Add bookmark, add highlight, ad text note, add drawing, find and copy text. It means we can copy the text onto another page or something....It says add drawing and then it will come up and we can pick our colour or also undo it. When we're done, we just click and then we have our picture. It helps us get a better picture in our mind and we can put it in our own words...

She went on to describe some of the other benefits of using handhelds for reading.

...if we don't have enough books and we're reading together, we have to use one or two, but if we're using the iPags, we each have one and it's better that way. You can't highlight on a book... another thing is that you can't draw on the words. You can make notes with the iPags and you don't have to do it on a different piece of paper. So we're being more organized and we don't have to carry lots of things around with us. We just have to carry this little thing around with us and it has everything in it, like our books or our notes.

In the second classroom observation, grade six GATE students at Nellie McLung were observed using handhelds to support various components of a research initiative. This research stemmed from a novel study of King Arthur and the Knights of the Round Table. Students had generated essential questions that had arisen during their reading of the text. Each student was in the process of investigating a particular question by conducting primary research through identifying and interviewing a stakeholder group. They were also involved in conducting research via internet and text sources.

One student described that s/he had arrived at the research question, "Why do human stress themselves?" "My teacher asked us to come up with a question related to King Arthur and my question that I came up with, was, 'Why aren't the knights afraid of death?' and it grew and I broke that question down into smaller research questions until I eventually got to, 'Why would people stress themselves through quests that they go through?'

Samples of other student questions for investigation included: What are the qualities of a good leader? Is it ever all right for a society to manipulate others?

A student described that s/he had interviewed members of his/her stakeholder group using the handheld as a tool. Using questions that had been recorded on the handheld using text features,

stakeholders were asked such questions as: *“Do you think that stressing yourself gets you closer or further from death? If you didn’t stress yourself, what else would you be doing with your life? Do you think that extreme sports might change the world in any way?”*

This student described that the handheld was useful because it could *“help you take voice recordings of the people that you’re interviewing so that you don’t have to write it all down...it saves time. You can also have the software for taking video of people that you’re interviewing as well as taking pictures.”*

The student shared reflections on information that s/he had gathered *“...From what I have heard from my friends that I’ve interviewed so far, they’ve told me that because they think that because they do things that they think that they can’t do, they think that they can help others do what they feel they can’t do so they feel pride in what they do. An extreme skier might sometimes jump off 20 foot cliffs just for the thrill of it and in King Arthur they put knights through near life and death situations which is the same as skiing...like they’re fighting a dragon or amongst a huge battle.”*

There was a high level of engagement observed as students were involved in a variety of diverse research tasks. In terms of integration of the handheld devices, students appeared to use them as transparently as other learning tools, such as pencils and notebooks. Students were observed using handhelds to record their questions and notes in text via the mini or peripheral keyboard or via the handwritten translation feature of the handheld. They also were involved in using the handheld to access and organize images and notes within a word processing document that had been gathered using internet sources. Handhelds were used as a tool for conducting interviews with peers and adults in the classroom. Answers to interview questions were being recorded using the audio recording feature of the handheld. Some students were also integrating findings from copies of retrieved email messages that had been answered from cyber mentors from diverse occupations and geographic locations.

Initial classroom observations have led to further plans for more in-depth interviews with students, teachers, and parents in the three school locations with the intent of further capturing details regarding the impact of handhelds on teaching and learning processes. Further interviews will take place during the remaining months of this pilot.

Preliminary Discussion and Conclusions

Teacher and student pre-surveys as well as focus group interviews and observations have generated preliminary finding with respect to investigating questions related to the goals of this investigation.

Teacher pre-survey results provided information on teachers’ comfort level and use of technology as well as their opinions regarding their expectations regarding the use of handhelds for teaching and learning. These results reveal that teachers anticipate that handhelds will impact their practice and that there will be a number of benefits as well as some challenges in their use. Survey results from teachers also indicate that teachers see a use for handhelds in addressing the diverse needs of learners. In particular, teachers have identified that handhelds have the potential to support the diverse needs learners in terms of organization, motivation, higher level thinking, language development and access to technology.

The student pre-survey provides baseline data which offers insight into student opinions of school, their reported attendance and work habits. In addition it provided data regarding student comfort level, use and experience with technology, including handhelds. Finally the student pre-survey provides data that demonstrates students’ anticipated expectations around the use of handhelds. Student pre-survey results have indicated that students anticipate that handhelds will be useful in allowing increased access to resources and tools, are portable, allow for more personalized learning, organization and communication and finally that they make learning more fun.

While student responses indicate that students were on the whole enthusiastic about using handheld technologies for learning, they also indicated cautions regarding potential drawbacks of using these devices. Students expressed that they anticipated that some student might find the learning curve steep. They also revealed that there may be issues related to inappropriate use and distractibility. Students also expressed caution with regard to the fragile nature of the devices. Usability factors were also mentioned as potential drawbacks of using handhelds, including keyboard and screen size as well as memory limitations.

Focus group discussions identified that teachers see a number of management and technical issues that need to be addressed when introducing handhelds within the teaching and learning domain. Teachers also identified issues and challenges in terms of using a device intended for one user with multiple users. They also expressed concerns over connecting to a local area network and highlighted that decisions made with regard to security issues and could have an impact on the portability and potential learning experiences offered by handheld technologies. Teachers also indicated that they anticipated that these issues would lead to an increase in teacher work load. Focus group participants also provided data relating to decisions made regarding home use.

Teachers expressed some concerns over how to strategize for limited battery life and memory and described the impact of network security issues on planned learning experiences. In addition they expressed a need for further technical support.

Teachers indicated that they anticipate that handhelds have greater potential when used with existing technologies and with those, such as wireless, emerging on the horizon. They also proposed a number of management strategies that may lead to successful implementation of the devices. These include such strategies as using student leaders as mentors.

Participating teachers described a number of benefits that may result from the use of handhelds as well as drawbacks that may prove challenging. Benefits echoed results which were identified in the teacher pre-survey. Teachers described that handhelds may offer an increased access to technology. In addition the portable nature of the device offers tools and resources to students when and where they are needed. The use of the handheld to personalize learning was seen as an important benefit as was its use for organization, communication and motivation.

Finally teachers offered opinions with regard to professional development strategies and challenges, expressing their concerns over limited time and resources for PD. They also indicated that PD opportunities needed to be appropriate to the needs of both teachers and of the unique learning situations within each school. Teachers suggested that a combination of formal and informal PD is needed as well as a combination of face to face and online environments. They indicated they would find value in opportunities for joint planning around curriculum topics which would include planning for the integration of handhelds.

Preliminary Recommendations

Findings from analysis of preliminary results suggest number of recommendations for stakeholders of the current pilot study. The following recommendations include strategies for professional development, technical support, network access and communication.

- Professional development should be structured in such a way that it addresses both technical aspects of handheld use and implications for instructional design. Support needs to be provided that addresses the unique needs of schools as well as the common needs emerging from the use of handheld devices.

- Professional development strategies need to incorporate the need for a combination of face to face and online communication as well as both formal and informal communication.
- Professional development should provide opportunities for joint planning around curriculum topics and the integration of handhelds.
- Roles and responsibilities regarding technical support need to be clarified and communicated to all participants. This includes the role and involvement of school technicians, and any support available through IT Support. Potential support from HP should be investigated.
- Network access including wireless needs to be resolved as soon as possible so that teachers and students can proceed with learning activities using handheld technologies connected to the Internet. Further investigation regarding network security and end user identification needs to be pursued to allow users the ability to transfer files wirelessly to a local area network.
- Strategies for successful management and integration of handhelds that have been identified should be communicated with all participants so that all can benefit.