AN ABSTRACT OF THE DISSERTATION OF

Heidi M. Wegis for the degree of Doctor of Philosophy in Exercise and Sport Science presented on July 18, 2008.

Title: Pre-Service Physical Education Teachers' Attitudes Toward, and Use of, Handheld Technology

Abstract approved:

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Hans van der Mars

A current trend in educational reform requires teachers to be proficient in employing technology in their classrooms. As a result of this trend, teachers need to be prepared to integrate technology into their teaching, and teacher preparation programs have a responsibility to prepare their students accordingly. The handheld computer (PDA) is a potentially useful way to integrate technology into the classroom. Physical education is a field in which technology can potentially impact the areas of research and classroom teaching. The purpose of this study was to explore pre-service physical education teachers' attitudes toward, and use of, handheld technology and to determine what factors play a role in the decision-making process on whether to use technology. Data collected from surveys, interviews, focus groups, observations, and project reflection papers, presented mixed results. Despite the initial interest in integrating technology into their teaching, a decline in interest and opinions followed. Merely using the PDA was not enough to bring full integration and sustained use into their classes.

Pre-Service Physical Education Teachers' Attitudes Toward, and Use of, Handheld Technology

by
Heidi M. Wegis

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Dean of the Graduate School

I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

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Heidi M. Wegis, Author

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PRE-SERVICE PHYSICAL EDUCATION TEACHERS' ATTITUDES TOWARD, AND USE OF, HANDHELD TECHNOLOGY

1 Introduction

Technology is commonly used in everyday life. A current trend in educational reform requires teachers to be proficient in employing technology in their classrooms (International Technology Education Association [ITEA], 2000; Thomas & Cooper, 2000). As a result of this trend, teachers need to be prepared to integrate technology into their teaching, and teacher-preparation programs have a responsibility to prepare their students accordingly (National Council for the Accreditation of Teacher Education [NCATE], 1997; 2006). The handheld computer is a potentially useful way to integrate technology into the classroom.

Handheld technology is a fairly recent development that has been shown to be a valuable resource in many fields (e.g., business, medicine, law). Handheld computers, also known as personal digital assistants (PDA's), allow for easy and accurate collection, storage, and access of data (Ernst, 2001; Juniu, 2002; Torre & Wright, 2003). They can accomplish a wide variety of clinical, organizational, and educational tasks, including tracking grades and assessments, as well as managing course assignments (Ray, 2005; Ray, McFadden, Patterson, & Wright, 2001; Torre & Wright, 2003).

The handheld computer was first introduced as an electronic version of the daily planner. The initial software package included scheduling capabilities, an address book, and a memo pad. Today, the application software has expanded to

include internet and networking capabilities, word processing programs, and presentation and spreadsheet software, and has even been integrated with cell phones to provide even greater mobility and communication (Frauenfelder, 1999).

The devices have also become less expensive and are being carried by people of all ages and professions. Handheld technology provides a way to extend the use of paper and pencil documenting tools, as well as the desktop computer, to an environment in which mobile handheld technology can be used to collect data and retrieve information while in the field (Franklin, Sexton, Lu, & Ma, 2007; Tinker, Staudt, and Walton, 2002). Despite all the advantages and potential these devices have, the field of education has not accepted them as readily as other fields have (Purcell, 2005).

1.1 Technology and Teacher Education

The use of technology for instruction and assessment has been recognized by NCATE as a necessary component of teacher preparation. It is expected that educators in teacher-preparation programs will prepare candidates who are able to use educational technology in their classrooms (NCATE, 2006). Despite the potential to revolutionize the field of education, there is evidence that physical education teachers are less likely to use technology than their subject-matter counterparts (Vahey & Crawford, 2002). This is disturbing, considering the National Association for Sport and Physical Education's (NASPE) National Standards for Beginning Physical Education Teachers (NASPE, 2003) include a standard on the use of technology to enhance learning and productivity, both personally and professionally.

1.2 Utilization of Technology in Physical Education

The use of handheld computers in physical education may see the greatest effectiveness and importance in their ability to provide classroom support (Dragula, 2005; Franklin, Sexton, Lu, & Ma, 2007; Kim, Holmes, & Mims, 2005; Pride, 2003; Rajala, 2003; Ray, 2005). Some potential uses in the physical education setting include: (a) keeping attendance; (b) storing and retrieving fitness test scores; (c) filing electronic lesson plans; (d) keeping inventory; (e) grading; (f) tracking student physical activity levels; (g) recording student performance in the various learning domains (e.g., psychomotor, cognitive, and affective); (h) performing assessments of various skills and behaviors associated with learning; and (i) expanding available resources via internet capabilities.

Physical education is a field in which technology can potentially impact the areas of research and classroom teaching. To date, little research has been done on the overall effect of the utilization of technology in physical education, yet its presence in the field makes it an important area for extended research.

1.3 Theoretical Framework

Diffusion theory is important to understanding why certain technologies are accepted and adopted by members of a community. There are four main factors that influence the diffusion of technology. The four factors are the technology itself, how information about the technology is communicated, the time it takes to learn the technology, and the nature of the social system in which it is being introduced (Rogers, 1995). There are multiple theories of diffusion because the study of

technology integration is relatively new. The theory that provides a framework for this study is Perceived Attributes.

The Theory of Perceived Attributes (Rogers, 1995) explains that there will be an increased rate of diffusion if prospective technology adopters perceive the technology to have five specific attributes. The first attributes of the technology must be that it can be tried on a limited basis before it is completely adopted. The second attribute of diffusion is that the technology offers observable results. Third, it must have an advantage over other technologies. Fourth, it must not be too difficult to figure out. If it is too complex, the potential adopter will be less likely to use it. Finally, it must be compatible with existing practices.

Teacher educators have the responsibility to convince future educators of the need for technology. In order to achieve this goal, teacher educators need to understand what their students think and feel about technology, and make adjustments to incorporate teaching practices that will have a positive effect on students.

Research in the field of teacher education has shown that beliefs and attitudes of pre-service teachers play a crucial role in the integration of many tactics and skills, including the integration of technology. These attitudes are formed during pre-service training, which includes licensure program coursework, observations, and student teaching (Hardy, 1998; Wallinger, 1997). It is during this time that the technology must be introduced and practiced.

Positive attitudes that are formed during pre-service training are easier to create and maintain (Pajares, 1992). Factors that influence pre-service teacher

attitudes toward technology are effective modeling (Keiper, Harwod & Larson, 2000), quality experiences in undergraduate and graduate-level courses (Crowe, 2003; Crowe & van ‘t Hooft, 2006), time to practice (Keiper, Harwood & Larson, 2000; Mason & Berson, 2000), and instructor and peer support (Crowe, 2003). With positive attitudes being formed in pre-service training, the likelihood is greater that technology adoption will be more successful and effective (Hunt & Bohlin, 1995). These concepts fit in line with the *Diffusion Theory of Perceived Attributes*. It is important that researchers and teacher educators understand the many factors that influence the adoption of such technology, and how it is possible to better prepare pre-service teachers to fully integrate the technology.

1.4 Purpose

The purpose of this study was to explore pre-service physical education teachers’ attitudes toward, and use of, handheld technology and to determine what factors play a role in the decision-making process on whether to use technology. Also of importance are assessments and how the integration of handheld computers affects their attitudes toward performing various types of assessments in the field.

In the following two manuscripts, descriptive information about the pre-service physical education teachers’ views and use of handheld technology is provided. This project is important for at least two reasons. First, the use of technology is one of ten performance standards for both beginning and experienced physical educators (NASPE, 2001; NASPE, 2003; NBPTS, 1999; NCATE, 2006). Standards-based education is at the forefront of the educational environment. As a result of this, it is essential to develop and strengthen physical educators’ skills and

to perhaps alter their disposition toward using technology. Second, results of this project are of importance to Physical Education Teacher Education (PETE) programs to more effectively prepare teachers to integrate technology, with the emergence of employing formal integrated assessments as a key set of skills.

The following research questions were used to guide this investigation: (1) How do pre-service physical education teachers utilize handheld technology in their physical education classes? (2) What are pre-service physical education teachers' attitudes toward handheld technology? (3) Under what conditions are pre-service physical education teachers more likely to utilize handheld technology in their classes? (4) Will attitudes change following exposure to the technology and/or to different assessments?

1.5 Understanding the Study Design

A multi-method design approach combining both qualitative and quantitative methods was used. The research questions warranted the use of a mixture of qualitative and quantitative elements. Attitudes, desires, and decisions made can begin to be understood using both types of methods. For this study, the purpose for using a multi-method approach was for triangulation, complementarity, and expansion.

Triangulation seeks the convergence and correspondence of results from the different methods being used. Complementarity seeks to elaborate, enhance, and further illustrate or clarify the results from one method with the results of another method. Expansion seeks to increase the extensiveness and range of questions by

using different methods for different types of questions (Greene, Caracelli, and Graham, 1989).

In this study, the qualitative and quantitative data collection methods were used concurrently. The different components were carried out at the same time, yet were independent of each other. The findings from both methods are presented in the following two manuscripts. The manuscripts are written with the intent they will be submitted and published in tandem (i.e., back-to-back papers in one journal issue or in consecutive issues). This will reduce the redundancy of background information being included.

This was not intended to be an experimental or quasi-experimental study. The intent was to see what happens when you introduce technology to pre-service teachers. A graphic timeline of the study is presented in Figure 1.

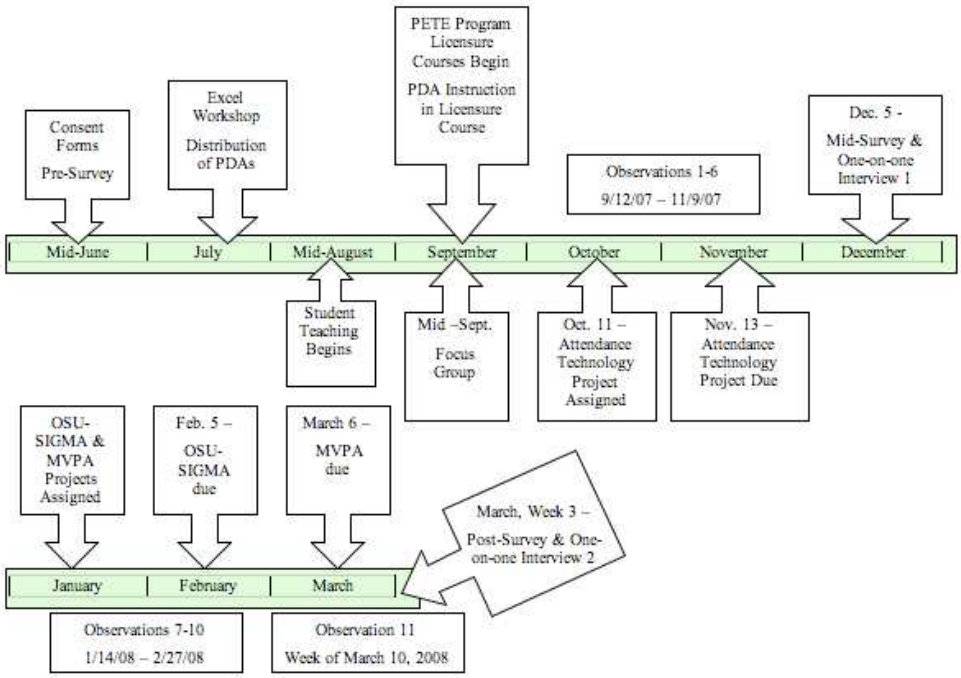

Figure 1 Timeline of Study Events

2 Pre-service Physical Education Teachers' Attitudes Toward, and Use of, Handheld Technology: A Qualitative Approach

Handheld technology is a fairly recent development that has been shown to be a valuable resource in many fields (e.g., business, medicine, law). Handheld computers, also known as personal digital assistants (PDAs), provide a way to extend the use of paper and pencil documenting tools, as well as the desktop computer, to an environment in which mobile handheld technology can be used to collect data and retrieve information in the field (Franklin, Sexton, Lu, & Ma, 2007; Tinker, Staudt, & Walton, 2002). Despite the advantages and potential these devices have, the field of education has not seen the same amount of buy-in as other fields have (Purcell, 2005).

The field of education has utilized computer technology for approximately twenty-five years. Throughout this time, researchers have looked at the benefits and limitations of the technology in schools, concluding that, when appropriately used, technology can have a positive impact on teaching and learning (Vahey & Crawford, 2002). The nature of handheld technology allows for relatively easy integration of technology into the learning environment (Gado, Ferguson, & van 't Hooft, 2006). Those educators who reported using handheld technology expressed that handhelds increased their productivity, positively impacted their teaching, and promoted student learning. They found their own, as well as their students, learning to happen relatively quickly (Ray, 2005; van 't Hooft, Diaz, & Swan, 2004).

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Another area of focus in the National Association for Sport and Physical Education's (NASPE) National Standards for Beginning Physical Education Teachers (NASPE, 2003) is assessment. It is NASPE's position that highly qualified physical education teachers, coming from an accredited physical education teacher education program, will "view assessment as an integral component of the teaching-learning process" (NASPE, 2007, p. 2). However, in an interview focusing on standards in physical education, one professional in the field stated that many physical educators do not assess appropriately and are unable to report if their students have met the content standards (Sherman, 2000).

Assessment of student learning in the psychomotor, cognitive, and social-behavioral domains offers a means to demonstrate program impact, to inform

teachers of changes they may need to make in their instructional strategies and/or curriculum offerings, and to document student performance (NASPE, 2007). In order to achieve these tasks, physical education teachers need to determine what should be assessed and how to perform these assessments. This can be a challenging task for teachers, so introducing this information in the physical education teacher education programs could be of considerable help. By integrating assessment with instruction on a day-to-day basis and allowing pre-service teachers time to practice this technique, there is the potential to link instruction, learning, and assessment (Shepard, 2001; Wood, 2003).

Engaging in formal assessment of student learning can be a daunting task for any teacher or pre-service teacher. Teachers have to focus on instructional duties, class management, and assessments, often with high student numbers. When utilizing the paper and pencil techniques, teachers must transfer the data to a computer and then perform the necessary calculations at the completion of class. This process takes considerable time, but it is a necessary component to enhance the quality of instruction. The integration of handheld technology can reduce the time-consuming nature of performing assessments. Lambdin (1997) argued that using computerized data-management systems can provide a strong foundation for student and teacher accountability. Furthermore, Moallem, Kermani, and Chen (2003) stated: "Providing continuous assessment and immediate feedback via wireless computers during instruction yielded a positive effect on students' learning and their attitude toward various forms of assessment and the use of handheld computers in the classroom to assist in learning" (p. 1398).

Despite the potential to revolutionize the field of education, physical education teachers are less likely to use technology than their subject-matter counterparts. Vahey and Crawford (2002) reported two potential reasons for this. The first was that only a small number of projects with a physical education component were completed. Second is the lack of inquiry regarding the outcomes of physical education.

Many potential reasons for educators' avoidance of using handheld technology have been reported (Cooper & Bull, 1997; Crowe & van 't Hooft, 2006; Dragula, 2005; Jones, Johnson, & Bentley, 2004; Purcell, 2005). These reasons include the number and types of devices that are classified as *handheld*. The number of choices and options can be overwhelming. Other reasons are: (a) limited professional development and training opportunities; (b) limited software; (c) difficulties entering, displaying, and exporting text and data; (d) perception as toys, not learning tools; (e) teacher motivation; (f) teacher mindset; (g) lack of understanding of technology; (h) lack of support (money and time); and (i) attitude. Despite this list of potential issues that may arise in efforts to promote the utilization of handheld technology, Gado, Ferguson, and van 't Hooft (2006) argued that this type of technology is a realistic alternative to the use of desktop and laptop computers and is even more beneficial than utilizing the paper-pencil technique.

Since little research has been done on the use of handheld technology in physical education, this study focused on getting baseline information related to the following research questions: (1) How do pre-service physical education teachers utilize handheld technology in their physical education classes? (2) What are pre-

service physical education teachers' attitudes toward handheld technology? (3) Under what conditions are pre-service physical education teachers more likely to utilize handheld technology in their classes?

2.1 Methodology

2.1.1 Participants

Participants were pre-service physical education teachers (*n*=6) enrolled in a graduate-level physical education teacher education licensure program at a university in the Northwest of the United States. The group included two females and four males (average age: 23.2 years; range: 22-25). None of the participants indicated any prior use of handheld devices. Although participation was voluntary, portions of the study were directly connected with requirements in two of the required courses that were part of the licensure program.

To conceal their identity, the six participants were given pseudonyms: Sarah, Jodie, Sam, Luke, Justin, and Scott. The participants spanned a wide spectrum of initiative, enthusiasm, and effort. One was a very enthusiastic participant and took initiative in using the PDA. While in the student-teaching setting, this individual had a great amount of energy and passion and assignments were thorough and often turned in prior to their deadlines. On the other end of the spectrum was a different individual who did the minimum and did not always have a lot of energy. The initiative, enthusiasm, and effort of the other participants fit between these two individuals. Academically, all participants met program expectations when completing assignments. By the end of the study (March), fatigue was evident

among the group, as they did not have as much enthusiasm or put in as much effort as they had at the beginning of the study. A more thorough understanding of the participants can be obtained by reading the following manuscript results.

2.1.2 Apparatus

The HP iPAQ 1910 Pocket PC was utilized for this project. The device comes with a USB synchronizing cable and installation CD-ROM, as well as a hard-cover case to protect it from damage. The PDA was loaned to each participant for the school year.

The Excel documents provided to the students were created by researchers at Oregon State University. The Ohio State University Scale of Intra Gross Motor Assessment (OSU-SIGMA) (Loovis & Ersing, 1979) tool was adapted for use in Excel. The Moderate-to-Vigorous Physical Activity (MVPA) tool was also adapted for use in Excel. Adapting these documents involved the following considerations:

- Due to the small screen, key words were used to describe various skill categories.
- Identification of options was minimized and allowed for easy calculations (e.g., yes and no responses for MVPA were substituted with the numbers 1 and 0, respectively).
- The number of students being observed at a time was set at three, allowing an assessment period to be made without scrolling.

2.1.3 PDA Integration

A timeline of study events can be found in Appendix B. Potential participants were addressed using a pre-written recruitment script (Appendix C). Once participants agreed and consent forms were signed (Appendix D), they were presented with three articles to read regarding the integration of technology and use of handheld devices in physical education. Two articles were from *Teaching Elementary Physical Education,* and the third was from the *Journal of Physical Education, Recreation, and Dance* (JOPERD). The article written by Castelli (2005) provided a brief introduction to a set of articles published as a special feature in the *Teaching Elementary Physical Education* publication. The author discussed the possibility of integrating technology into physical education programs. It provided readers with small glimpses of how technology is currently used and how it can possibly be used in the field.

The second article, written by Mohnsen (2005), provided readers with three potential questions physical educators should ask when thinking about using technology in their physical education programs. The article provided possible answers to the posed questions.

The final article, written by Wegis & van der Mars (2006), discussed the integration of personal digital assistants into the field of physical education as a tool that can be used to facilitate the process of assessing student learning. The authors presented the readers with information regarding the importance of assessment and how the PDA can be used to assist in the process. The article offered example templates, along with the basic setup of the templates. These three articles served as

the foundation for the focus group session that was held at the beginning of the study.

In July, participants completed a mini-workshop on the use of Excel, led by the investigator. Some knowledge of Excel is critical when working within the provided spreadsheet-assessment templates. The workshop focused on the basics of Excel (e.g., file creation, inputting data, adding and deleting cells), as well as more advanced tasks (e.g., how to link sheets, formula creation, creating graphs). Three one-hour workshops were held and included short take-home assignments that allowed the participants to practice utilizing some of the capabilities of Microsoft Excel. The workshops took place prior to the start of classes associated with the licensure program.

Following participation in the workshops, participants were given an HP Pocket PC (the PDA of choice), cables to sync the PDA with a computer, and the software needed to perform this operation. Participants were asked to take the PDA home and "play with it." At the beginning of the fall term, participants learned the basics of how to use the PDA in a course taught by a local high school physical education teacher who is an experienced user of such devices in her own physical education program.

One class period was used to instruct participants on the basics of using the device. Its setup and use were demonstrated, including how to load the software and sync the device with a desktop computer. As expected, the syncing process took the majority of the time, as well as caused the most confusion at this stage. To verify the

instruction given during this time, the primary researcher observed this class period, but did not offer any additional support.

Participants were given multiple practice tasks, including syncing (within the appropriate file folders), beaming, and modifying and creating files (opening, modifying, and saving). After the initial instruction on how to use the device, problems or issues were handled on an individual basis, primarily, by the course instructor. Any technical issues with the device (e.g., battery problems, device failure, cable issues) were handled by the primary researcher.

Several spreadsheet documents used throughout the study were presented in two PETE licensure program courses. These documents were Excel-based and included templates for assessing: a) attendance, b) student physical activity levels, c) student game performance, and d) elementary-aged students' fundamental motor skill performance (i.e., throwing, kicking, striking, etc.). Participants were also presented with weekly journal questions, which included specific topics and prompts on which to reflect, and were asked to provide details of their use of the device during the week (Appendix F).

Following the initial lessons, participants were assigned a technology-integration project, as part of one of the licensure courses, that focused on tracking students' class attendance (a managerial focus). During the fall term, participants were placed in a middle school setting. The project requirement was to use the PDA device and Excel template to take attendance and to record the students' dress-down requirement for four weeks. The attendance files were to be synchronized via a cable

to a personal computer. Participants were asked to email these files weekly to the course instructor, who provided the files to the project investigator.

At the end of the four weeks, the participants completed a project reflection paper pertaining to their use of the PDA. In this paper, they were asked to discuss their ability to use the template and PDA, their likes and dislikes, ideas for other potential uses of the PDA, and the probability of their continued use of the device.

During the winter term, participants were at an elementary school. They were asked to complete two separate technology-integration projects. The first project related to determining the gross motor skills of students. An Excel-based, adapted version of The Ohio State University Scale of Intra Gross Motor Assessment (OSU-SIGMA) tool was used. The second project used another assessment template to record student participation in Moderate-to-Vigorous Physical Activity (MVPA). The requirements for these projects were the same as the previous term's project, with students submitting their files to the course instructor and finishing with the submission of a reflection paper.

Project participants were also provided with additional assessment templates at various points in the study. They were given templates to assess students' performance on selected aspects of game play. The templates were specific to certain sports, but they could be easily modified to fit other sports in the same categories (i.e., invasion, net/wall, target). The participants were introduced to the concept of transfer-of-learning in a previous course and were encouraged to try the assessment templates if they felt comfortable. Utilizing the Excel version of these assessment

templates was not required, but it was the desire of the researcher that some of the participants would attempt to utilize the tools to assist in their class projects.

2.1.4 Data Collection

One focus group interview with all participants was held in mid-September. The focus group interview was semi-structured, with predetermined questions and with the researcher reserving the right to ask follow-up questions. The goal of the focus group was for participants to come prepared to talk about their preliminary experiences using the PDA technology, as well as to provide other participants with new ideas and aspirations to continue to use the device. The previously assigned journal articles were also discussed during this focus group session.

In addition, two one-on-one interviews were conducted with each participant. The first individual interview took place following the completion of the fall-term project, while the second interview took place in March, at the end of the entire study. The individual interviews focused on pre-service teachers' perceptions of handheld technology use, the Excel workshop and class assignments, the likelihood of their continued use of the device, the learning process, and perceived barriers and difficulties in integrating the technology. The goal was to understand the participants' reasons for either resisting or utilizing the technology. The interview sessions were conducted in a semi-structured format, utilizing a predetermined list of questions (Appendix G) from which follow-up questions were asked.

All interviews were audio-taped for transcription purposes. The focus group interview was also videotaped to capture participants' various nonverbal responses. The focus group proceedings were transcribed by the researcher. Field notes were

taken to document the participants' behaviors and other observations of the researcher.

The journal prompts and interview questions contained information relating to specific components of the *Pownell-Bailey Model of Computing Literacy* (2000). At the foundation of this model are leadership functions that focus on what "information-literate leaders can do with handheld computers." The specific functions included in the prompts and interviews were: (a) organizing and planning, (b) gathering and analyzing, (c) learning and self-improvement, (d) communicating, and (e) teaming and collaboration.

Organizing and planning refers to time management, keeping track of contacts, and creating to-do lists. Gathering and analyzing refers to collecting and managing information from which questions can be answered or decisions made. This is especially critical for performing assessments and utilizing those assessments to better instruct. In the learning and self-improvement function, a user can employ assessment tools to learn more about the students in a class and more about an individual's own teaching. The function of communicating allows for the exchange of information. Students, teachers, administrators, and parents can all benefit from the ease of communication afforded by using handheld technology. The final function is related to teamwork and collaboration. At this point, planning tools and information may be easily shared to improve the teaching and learning processes (Pownell & Bailey, 2000).

The journal entries also included questions of reflection similar to those included in *CODE 77: Self-Evaluation Rubrics for Basic Teacher Computer Use*

(Johnson, 2002). These rubrics address professional productivity and demonstrate that teachers who have mastered the described skills are able to use the computer to improve the ease of performing instructional tasks, including record-keeping, lesson planning, and assessment (Johnson, 2002).

Additional artifacts created by participants were collected, including class assignments, attendance sheets, and physical activity and motor-assessment records. These were analyzed and assessed based on thoroughness, and specific comments that could be used to document student learning and/or attitudes toward handheld technology were noted.

2.1.5 Data Analysis

The transcription of interviews and focus group responses was done by the primary researcher. Interviews, focus group responses, journal entries, and project response papers were coded using the Qualrus analysis software (Brent, 2002) and analyzed for specific themes and sub-themes. These documents were also read by a research assistant and coded for themes and sub-themes. The themes were continuously compared and refined based on discussions between the researcher and the research assistant. The coding scheme is provided as an appendix to this document (Appendix M).

2.2 Results

2.2.1 One-on-One Interviews & Journal-Response Analyses & Findings

Based on the data analyses, individual participants' comments fell into three main themes. They included: technology, the learning process, and attitude.

2.2.1.1 Technology

In terms of the technology, the participants saw many potential uses for the PDA. One participant said the device could be used “to assess, to take attendance, to keep grades, everything. I did that for my work sample, and typed in all the numbers in the PDA and then transferred it into my computer” (Sarah, Interview 1). Most participants agreed that the main use for the PDA was to assist in assessing students. When asked what they would assess in their own program, several participants agreed on the importance of assessing moderate-to-vigorous physical activity (MVPA). “I think MVPA is really important because it allows you to see whether the activities you have planned are getting your students active” (Sarah, Interview 2). Others commented on assessing skills and game performance. “I will be assessing students on their motor skills and how well they perform. I’ll be doing authentic assessment, how well they perform in game situations” (Scott, Interview 2). Few participants commented they would use the device for organizing and planning, but they did see the potential for that. “You can do everything on them. If you know how to use them, you can do everything on them. They are very useful. You can keep track of your personal stuff, dates, and appointments” (Jodie, Interview 1).

Playing games is another potential way to use the PDA. However, this was not a common use for the participants. They found their time for getting off-task was very limited. As one participant noted, “I pretty much used just the Excel spreadsheet that I had, and then games if I got bored, but that was pretty rarely that that happened” (Sam, Interview 1).

In the beginning, there was a general consensus that using the PDA was a better option than using paper and pencil. “In the classroom it really takes away the clipboard so you can be a lot more fluid in what you’re doing. If you are first period or third period, you don’t have to search through the individual sheets and find them” (Justin, Interview 1). Another participant said, “You don’t lose things as easily. Because when I do write things down I tend to lose the little piece of paper I wrote it down on. So it makes it easier to keep track of things. The functions on my computer make calculations and everything just quicker, so it makes life just a little easier” (Jodie, Interview 1).

Following the initial use of the PDA, the PDAs were seen to have positives and negatives, and for some of those aspects, it was a catch-22. For example, the device was small. So while the participants liked that it was small enough to put in a pocket, they did not like that the screen was so small. “The screen is really small. I have bad eyes, so it is hard for me to see. If you make it bigger, then the boxes are bigger and you have to scroll more” (Jodie, Interview 2). This was a factor that discouraged several of the participants from using it. “The screen is a little small for being able to have a wide range of information on there. Like with ours, I don’t know how easy it would be to have a lot of input for game points and all that because I basically had my attendance row and that was it” (Luke, Interview 1).

Another complaint regarding the size of the PDA was the weight. Because it was small enough to fit into a pocket, it was easy to carry around. However, some complained that the weight of the device, approximately three pounds, including the hard protective cover, was enough to weigh down shorts or pants. “I don’t like how it

is heavy and weighs your pants down when you put it in your pocket" (Jodie, Interview 2). "My attire isn't jeans or khaki's, it's usually stuff with an elastic band at the top and it weighs everything down when I move" (Sam, Interview 2). This was a common complaint among the participants. One participant went so far as to attach the PDA to a belt that could be worn with any outfit. "It's kind of heavy. I have this belt, but it still pulls. When I'm actually engaged in activity, I have to really pull it up" (Sarah, Interview 2).

Other hardware-configuration limitations, aside from the small size, included the letter recognizer, the small keyboard, limited available memory, and poor internal batteries due to the age of the devices. "I would like to see a newer updated version with faster capabilities and a longer batter life" (Scott, Journal 11). Some participants found difficulty with entering certain letters and numbers in the letter recognizer. This, coupled with having to enter specific numbers or letters in Excel while performing assessments, caused many participants to want the capability of only tapping buttons to enter information into the software.

> What would be nice, I know they have some programs that you can purchase, but if there is a way on Excel, which I don't think there is, where you can just click a button, and then click a cell. That would make it a lot easier. Instead of clicking the cell, then going to the keyboard, or letter recognizer, which I'm sure gets a lot easier once you get used to it. (Jodie, Interview 1)

A couple of the participants complained that the PDA "kept resetting itself" (Scott, Journal 6), or "erased documents for no reason" (Sarah, Journal 5). "I don't know if it was just the battery, or the connection, but losing my data was a huge problem. When the battery goes dead, you also lose your memory, so it doesn't

actually keep that, or at least with the PDAs that we use" (Scott, Interview 2). In his journal entry, Scott said he probably wouldn't use a PDA at this point because "currently I am still more comfortable using paper and pencil plus I know that my paper won't lose battery power and lose my collected data" (Journal 11). When this situation occurred, the participants realized the importance of regularly charging and syncing the device to their home computers. "I tend to forget to charge it, so I'd probably lose my data a lot if I didn't have it backed up on the memory card or synced to my computer" (Jodie, Interview 2). Another participant would "sync it three times a day, after every class" (Sarah, Interview 1) and have "the documents backed up on the computer and zip drive" (Sarah, Journal 5).

During the fall term, the participants used the PDA to take attendance. For several of the participants, this became a burdensome task because of the lack of technology available at the school where they were placed. The schools required the teachers to send the attendance sheet to the office during each class. In order to do this, the students would take attendance on their PDA, copy the information to the teacher's grade book (if the teacher was not using an electronic gradebook), and then copy it a third time to an attendance slip for the front office.

> The issue is lack of technology in the school (e.g., not having computerized attendance). Having a school that can support the use of technology by providing programs and docking stations would make implementation easier. If my school had better technology, using the PDA would have been easier. (Jodie, Journal 6)

Four of the six participants commented on this concern throughout the interviews and journal responses. One participant stated, "A problem with the handheld computer is that the school is not wireless and attendance needs to be

written two separate times" (Justin, Journal 5). "I got more frustrated as [the term] went by because I did have to record it on the PDA and record it on the clipboard and write out the attendance slip" (Jodie, Interview 1). Another participant said, "Having to write it in the grade book was kind of more of a hassle than anything else. I got really fast at doing it on the PDA and if I could have just done that then it would have been great" (Luke, Interview 1).

As the year continued, a few of the participants commented on potential alternatives to using the PDA. In his second interview, Sam said, "Even when I assess at the elementary school, I had paper and pencil and I just wrote it down, and for me right now, that's good enough." He continued, "But did I have to put it into a computer? No, I didn't. So when I have to do that, I might look at a PDA." He went on to discuss the potential for the PDA to save time. "It could potentially save a lot of time because you don't have to transfer from paper/pen to your computer."

Another potential alternative to the PDA would be to use a tablet computer. This is still utilizing technology, but the format is a little larger than the handheld computer. One participant felt this would be a better way to do assessments, despite the larger size. "I've heard people talk about it [the tablet]. Granted, it does kind of go back to the clipboard size, but it is easy to see and you can put more on it" (Justin, Interview 2).

2.2.1.2 Learning To Use a PDA

The second theme addressed by the participants during the interviews and journals was related to the process of learning to use a PDA. Prior to this study, none of the participants had much, if any, experience with a PDA. None of them

owned a PDA prior to the study. “I integrated the PDA as soon as I received it. It was a slow process when beginning to utilize it to take roll; however, now it has sped up. My main challenge was focusing on both the PDA and monitoring the class” (Justin, Journal 6). Each participant discussed the importance of learning by doing and/or seeking out help from someone who is more experienced. “If there’s something I can’t do, or don’t know how to do, I usually ask somebody or figure it out myself” (Justin, Interview 1). When asked what they have done to expand their knowledge of its use, most of the participants gave a similar response, “I’ve played around with it a lot to see what kinds of functions it did have and what it could possibly be used for if I were to ever dive into that world of PDA use” (Jodie, Interview 1).

Participants were eased into the process of using the PDA’s while teaching. They were asked only to complete attendance during the first term. If and when they felt comfortable with the PDA, they had the option of using it for other things, but the only actual assignment was related to attendance. This may have been somewhat of a discouraging factor for some of the participants. During the interview at the end of the first term, when asked if he planned to use a PDA in his teaching, one participant said, “I’m skeptical right now, but if we get introduced to more stuff I can actually see a good use for, maybe; but just for attendance right now, probably not” (Sam, Interview 1).

Another important consideration was the amount of new information being presented to these participants. As pre-service teachers, the participants were already overwhelmed with coursework and their role in student teaching. “I actually didn’t

think I'd like it that much. It's just something new, I guess, and just one more thing I had to use or worry about as I was learning. Being a beginning teacher, I had enough stuff going through my head" (Justin, Interview 1). This sentiment was also expressed when participants were asked if they planned to use the technology in their own teaching. "Maybe not the first year because I'll have a bunch of other stuff to deal with, but definitely as I get more comfortable in the classroom" (Scott, Interview 2).

The amount of time related to the learning process was another factor mentioned by most of the participants as being something they had to deal with when faced with this new technology. In the final interview, Jodie said she felt the technology was more of a limitation because of the amount of time it takes to learn how to use it and to develop the assessments to be used on the PDA.

> I think for me it's the time. It's going to take awhile for me to get used to it. I think that some people are more go-getters with that kind of stuff and it will really help their program and help them, but other people will probably not be willing to put the time in to it because I think it takes a long time.

Despite the amount of time it takes to learn how to use the device, the participants did agree that it would probably save time in the long run, "especially if you are at a bigger school where you have lots of kids, it could save a lot of time" (Sam, Interview 2). Becoming more efficient was also included with comments related to time. "You don't have to take the time to write it on a sheet of paper and then put it into the computer for the grades. You can do it all right there" (Justin, Interview 2). This was a positive factor for most of the students when considering the

utilization of the PDA in their teaching. Using the PDA allowed for “less time spent inputting data from assessments” (Scott, Interview 2).

One potential challenge associated with the learning process was related to scanning the class while using the PDA. Several participants agreed that using the PDA took away from their ability to scan while teaching. “I didn’t feel like I was scanning my whole class. I felt like I just couldn’t pay enough attention to my whole class” (Jodie, Interview 2). When asked to identify one challenging aspect, Justin said, “Focusing on the PDA use rather than scanning the class” (Justin, Journal 7). He found the “actual PDA use was very easy,” but trying to incorporate that into his teaching became more of a challenge.

In his second interview, Sam added, “It just seemed like I was kind of a slave to it, especially at the middle school, during fitness I had to assess everyone. I felt I had my face just buried in it the whole time. I wasn’t able to look at the kid and say, ‘Hey, good job!’ I was just constantly plugging away at it.” This comment was repeated by another participant: “I felt it really took away from scanning. That was one of the big things that it did. I felt like my head was down looking at the PDA, especially at the beginning” (Scott, Interview 2).

These views were not consistent across the entire group. During her second interview, when asked if there were any changes in teaching as a result of using the PDA, Sarah said, “I’m more effective. I can do more things at once. Scanning has increased.” When further probed about any changes in scanning, she said, “It increased. I’m more efficient now. In the beginning it took longer, but now I don’t really have to think about it.”

2.2.1.3 Attitude

The final theme, focusing on attitudes of the participants, was extensively covered during the one-on-one interviews and journal questions. Several factors played a role in the participants' attitudes. The first factor with regard to attitudes revolved around the participants' comfort/anxiety associated with technology and the PDA. During the first interview, all participants stated they were fairly comfortable with using the PDA. "I'm pretty confident. I know how to use it pretty well" (Sam, Interview 1). Several of the participants added that it helped that their mentor teacher used the same technology. "I'm fairly comfortable with it. I mean, it helped that my cooperating teacher was big into it and he expected us to use a PDA or just update his after classes once he stopped taking attendance and assessing" (Justin, Interview 1).

Three participants were assigned to a school where the mentor teacher frequently used a PDA. Despite the potential for these students to see the benefits of PDA use being demonstrated, only one of these three individuals truly bought in to the technology. "Just seeing that it is actually being used by teachers outside was like, wow, this is awesome!" (Sarah, Interview 2). The other two did not experience the same exuberance following their use of the PDA.

> I was pretty excited about getting it at first, but once I realized the only thing I was using it for was attendance and fitness scores, I was kind of like, 'Great, get out the PDA and do it.' The only reason I was using it at the end was because [my mentor teacher] was using it…I had to. (Sam, Interview 1)

Sam also discussed this issue in his journal responses. “My motivation to use it is honestly because [my mentor teacher] loves it and if I know what’s good for me, I will too” (Journal 5).

Those whose mentor teachers used the PDA found that it was helpful to have someone who could answer their questions. “Being able to have someone who knows a lot about PDAs to talk to after trying to use a program on the PDA” (Sarah, Journal 11) would decrease the frustration level. It was in those classes that the students’ reactions were also more obvious. “When I got my PDA out they knew they were being assessed and tried harder” (Sam, Journal 6).

There was a novelty factor for both the participant and the students in their classes. “When I first got [the device], I was really intrigued and played around with it a lot” (Luke, Interview 1). Depending on whether the mentor teacher used a PDA, the students may or may not have been that interested in it. “The kids kind of wondered what it was sometimes” (Justin, Interview 1). Scott definitely “saw student improvement in their behavior performance and skill they were working on” when the PDA was out and in use (Interview 2).

There was a distinct change in attitude toward using the PDA as the study progressed. At the beginning of the study, the participants were excited about using the PDA and saw it as a better tool than paper and pencil. In an answer to a first-set question, Sam said, “I think it is a very helpful way for physical educators to quickly assess things such as physical activity and behavior without having to drag a clipboard around.” When later asked if he would continue to use the PDA in his teaching, he stated:

> Probably not. While it would eliminate paperwork, I just feel more comfortable using a clipboard or a grade sheet. I don't like how I have to keep it in my pocket all the time. When I do keep it in my pocket and I start jogging/brisk walking around the gym, it pulls down my pants or shorts. If I chose not to keep it in my pocket and leave it out, I run the risk of someone taking it. With a clipboard, I doubt anyone wants to steal a clipboard of papers. All in all, the clipboard suits me better at this point. (Journal 12)

Sam felt he would only continue to use the PDA if he had the "opportunity to do something meaningful with it" (Journal 11). While this reaction was not the same from all participants, it was shared by several.

By the end of the study, there was a distinct change in attitude toward the PDA, and most of the participants were not using it. "After my projects were over, I kind of put it away" (Scott, Interview 2). This was a consistent message among the majority of the group, which was in agreement with the initial hypothesis for the third research question that the participants would only use the PDA when required. The following expressions reflect their feelings: "If I had to use it" (Jodie, Interview 2). "…just for the projects" (Scott, Interview 2). "…more class projects" (Jodie, Journal 11). "I haven't faced something in my school setting that I have to use it for" (Sam, Interview 2). There wasn't "anything where it might have been helpful" (Sam, Journal 9). "I could have, but I didn't. We didn't have to" (Justin, Interview 2).

Despite not using the PDA for the entire project, most of the participants did state they would "eventually" use the technology for their own classes. Most agreed that "it depends on how comfortable [they] feel with how things are going in the first year."

2.2.2 Focus Group Analysis & Findings

Participants in the focus group session brought up many of the same points that were eventually discussed in the journals and project reflection papers. The focus group began with a general discussion about the articles and the potential for technology in the field of physical education. “I think it’s needed right now in our generation, especially with what the kids are exposed to now” (Sarah, Focus Group Interview). Each of the participants agreed with nods of the head or verbal confirmation.

> I think that we are going to reach more students if we are using this type of technology. Even if it is just for attendance, which is all we’ve done so far, from what we read in the articles, I think that we can really reach the students in our classes. (Scott, Focus Group Interview)

A common complaint from the group referred to their initial experience with the Excel templates. “I think if we had some software that made it easier to actually hit some type of hot key, rather than having to draw a letter or number, it would be more helpful for me” (Sam, Focus Group Interview).

On the whole, the individuals in the focus group expressed excitement about using the PDAs in their classes. They looked forward to actually using it for something more than attendance.

> I’m really excited with using it in Sport Ed. From what I have heard, it is really easy to use it for keeping track of team points and all that. I’ve talked to [Carol] about it and she has really helped. [Jessica], too, has been a big help in talking about how it is used in Sport Ed. (Scott, Focus Group Interview)

2.2.3 Class Assignment Analyses & Findings

During both terms, the participants were asked to integrate the PDA into their physical education classes to perform various tasks, to submit the different assessment forms, and then to write a reflection paper on that integration. The reflection papers were analyzed using the same technique as the journals and interviews, looking for common themes throughout. The first-term assignment was for the participants to use the PDA for daily managerial tasks. The reflection paper was to include their initial reaction to the PDA, a description of how they used the PDA, and a personal reflection on the project.

Each of the participants had a positive initial reaction to using the PDA. “I jumped at the chance to use a handheld personal digital assistant (PDA). In fact, the night that I received the PDA I began playing with it” (Sarah, Technology Integration Project). Another participant said, “When I first received my personal digital assistant (PDA) I went home and charged it up immediately” (Luke, Technology Integration Project).

Despite this initial excitement, most were a little hesitant about actually using the PDA in their classes. “I was a little hesitant to begin using the PDA in my classes because I was not sure how easy it would be to use, but I decided to create an attendance template and give it a shot” (Jodie, Technology Integration Project). This was a common plan for most of the participants. The attendance templates were not given out immediately and most created their own to try out. “I never used the Excel attendance sheet provided. I created my own that kept track of attendance, tardies, and if the student was dressed down or not” (Justin, Technology Integration Project).

During this first term, as the participants were using the PDA for managerial purposes, several found their students were quite interested in what they were doing. Of the six participants, half of those were in classes where students had not seen a PDA being used by their teacher. It was a participant in one such class who commented:

> A lot of the students were curious as to what was in my hands, the purpose of the device, and my intentions for its use within the class. At first the students were amazed that this type of technology was being used in physical education, but this amazement soon wore off as students became used to me using the PDA on a daily basis. They now accept its use as routine and they know what they need to be doing as soon as I pull out my PDA. (Sarah, Technology Integration Project)

Sam, whose mentor teacher had also used a PDA in his classes, said, “They never asked any questions about what it was or why I was using it.”

In agreement with the interviews and journal responses, reflection papers showed that participants found the PDA to be fairly easy to use, but the lack of school technology continued to be a challenge. “I was pleased to discover that using the PDA for attendance was not difficult, but it was cumbersome to record attendance on my PDA, in my cooperating teacher’s grade book, and on the absence sheet” (Jodie, Technology Integration Project).

Other challenges expressed in the reflection papers were the slowness and age-related issues associated with the PDA. “One thing I didn’t like about the PDA that I was using is that it was slow and did not have enough memory to use the programs effectively” (Justin, Technology Integration Project). His potential solution to this problem was, “If I was going to use a PDA again, I would make sure that it had plenty of memory so that it was not as slow, and also insert a memory card to

allow for me to save data on something other than the PDA in case it crashes." Several other students gave the same solution to the problem. "If I were to begin using a PDA when I get a job, I would make sure I had a memory card to back up my data on" (Jodie, Technology Integration Project).

Despite some of the issues with learning how to use the device while teaching, the majority of participants felt "the PDAs are an essential tool that all physical educators could benefit from implementing into their classrooms" (Sarah, Technology Integration Project). And when thinking about continuing to use the device, Luke stated:

> I do believe that I will continue to use the PDA to perform my managerial tasks in my future placements and when I get a teaching position. I think it is a great time saver and space saver. It will keep my hands free so I can help out with demonstration and participate in a few activities if the need comes. As I get more comfortable with other aspects, I hope to add them to my PDA tracking as well. (Technology Integration Project)

Although there were positive reactions to using the PDA, not everyone was completely sold on the device.

> When I first used the PDA in class, I was really excited about using new technology in the classroom. However, once I started using it more throughout the quarter, it began being more of a nuisance than anything. I thought we were using the PDA to make it easier to do things like attendance and track behavior, but I felt the exact opposite. For me, having a clipboard with paper and marking who was absent was much more efficient at the school I was teaching at. I will continue to use the PDA during my student teaching, but I don't think I will use a PDA when I'm out at my own school. (Sam, Technology Integration Project)

The second project the participants were asked to complete was to use the PDA to assess students' gross motor skills. For the majority of the group, this was

their first attempt at using the PDA for formal skill assessment. For several of the individuals, this assignment was challenging because of having to know the criteria associated with each of the levels and, as one participant said, “understanding how to differentiate between the different levels of performance. Are they performing at a level one, two, or three?” (Luke, OSU-SIGMA Project). The lack of familiarity with the criteria caused some of the participants to feel less confident in their ability to use the PDA to assess students’ skills. “This assignment was difficult to complete because of the detail of each criteria and not having a good knowledge base for the criteria. Also, when having to focus on specific students, it took my attention away from the class and I was only focused on the students I was assessing” (Justin, OSU-SIGMA Project).

This particular project caused most of the group to reflect on how they will perform their own class assessments in the future. The majority felt it was difficult to know the criteria and to create a lesson that would incorporate this type of a skill assessment. “I found that the OSU-SIGMA scoring guide was somewhat difficult to use in the physical education setting. It seems like it was more designed to be used in a laboratory setting because the definitions are so detailed” (Jodie, OSU-SIGMA Project). These detailed descriptions are not intended to be memorized, as the electronic scoring guide had key words that summarized the different categories. As one participant noted, “Not being well-versed in the criteria and trying to teach while looking at the criteria was difficult” (Justin, OSU-SIGMA Project). This is what caused the most trouble for the majority of the group.

One individual did go above and beyond throughout the entire process. For this assignment, she chose to practice using the assessment tool and carefully studied the levels, as well as discussed her pre-assessment findings with her mentor teacher. “Before recording any data, I carefully studied each level of the five motor skills that I had selected, observed ten classes over the course of two days, and discussed my ratings of students’ skill levels with my cooperating teacher.” She felt this “was a critical step in helping [her] be successful with this project” (Sarah, OSU-SIGMA Project).

The final project the participants were asked to complete utilized the moderate-to-vigorous physical activity (MVPA) assessment tool. These projects were analyzed for information pertaining to the use of the PDA only. The reactions the participants had relating to the concept of MVPA and formative assessment were not analyzed for inclusion in this study. For this project, the complexity was increased. The participants were asked to use the PDA to perform an assessment using the Momentary Time Sampling (MTS) technique, which required them to use a Motiv-Aider. MTS is an observational strategy used to capture what is occurring at one moment in time. The Motiv-Aider is a tool that uses a vibration signal to cue the individual, after a pre-determined amount of time (every 90-120 seconds), to make the observation.

Despite the increased challenge of incorporating several factors into this assessment, the majority of the group felt the assignment was helpful. It gave them an additional opportunity to practice using the PDA. “The PDA did become easier to use over time and with practice. To gain more experience I spent some time

practicing MVPA assessment on previously videotaped classes and while a fellow student teacher was teaching" (Scott, MVPA Project). This was a technique the researchers hoped the participants would utilize when trying to become more familiar with the PDA. Despite the potential of this technique to improve the learning process, only two participants ever mentioned practicing when another person was teaching.

The MVPA project reflections included much of the same information relative to the different themes found throughout the entire project. One participant summed it up by saying:

> The hardest part while performing this kind of assessment was carrying a heavy PDA and the Motiv-Aider on my waistband. This was problematic because at times I seemed more focused on trying to keep my pants up rather than focusing on what I was teaching or assessing. Another factor was using the PDA. I felt the screen was very small and hard to read and it took a lot of time entering the data, clicking, saving, and entering the right key. (Scott, MVPA Project)

Most of the participants found the project useful and helpful in their process of learning how to use the PDA and of gaining experience in performing assessments. As one student stated:

> At first using the MTS, Motiv-Aider, and the PDA was overwhelming. However, through consistent practice and taking the process in small steps, I was able to increase the accuracy of my observations and the number of students that I could observe during one class session. Overall, I found the MVPA project to be extremely meaningful to me as a beginning teacher. (Sarah, MVPA Project)

2.2.4 Observational Analyses & Findings

Field notes were taken by the researcher during the interviews, the focus group session, and while the participants were teaching. Observations of the

participants while they were using their PDA's and during interviews and discussions provided some insight into their attitudes. Body language, including shoulder positioning, eyes, breathing patterns, and stance, were all recorded in field notes taken during the observations.

During the first observation of Sarah, while she was teaching, the researcher noted that she was extremely enthusiastic about using the PDA. "She pulled it out of her pocket and waved it in the air in my direction. She had a huge smile on her face and gave me the thumbs-up sign" (Researcher, Field Notes, Observation 1). This was a common reaction from Sarah throughout the study. Her exuberance was obvious in her actions and her demeanor as she moved around the class. Except for two sessions, Sarah used the PDA during every observation. Even when her mentor teacher took over to cover some new material or interact with the students, Sarah would pull out her PDA and take notes on what was happening.

"It helps me to remember what it is he is doing," she said, in reference to her mentor teacher. "It has been a great tool for me to remember what happened from class to class and throughout the day" (Sarah, Field Notes, Observation 7).

On the other end of the spectrum, Sam's use of the PDA was scattered and, during the few times the researcher observed him using the PDA, it was because "it was absolutely necessary" (Researcher, Field Notes, Observation 4). Sam's demeanor when using the device appeared to the researcher like "someone is having his teeth pulled" (Researcher, Field Notes, Observation 6). During one early observation, Sam was observing his mentor teacher interacting with the students. The mentor teacher asked Sam to assess the physical activity levels of students during the

activity. Sam “slumped his shoulders and rolled his eyes as he turned around to get the PDA out of the office” (Researcher, Field Notes, Observation 4).

Sam’s disinterest in the technology was also apparent in the manner in which he responded to questions during his interviews. He was quick to answer when asked about problems he was having within the study and about what he disliked about the device. When asked about what he liked about the device or what he saw were potential benefits to using the device, it took him a long time to respond.

This was the same for several of the participants during the study. During the initial focus group session, the participants were excited about using the PDA in their teaching settings. “I’m looking forward to getting a chance to try out the PDA and the Excel templates you wrote about in the article,” said Justin. As he was saying this, he was sitting forward in his chair, arms resting comfortably on the table, making direct eye contact with the researcher, while keeping a slight smile on his face. The interest of most of the participants was the same during this process. No one appeared to be avoiding discussion or uncomfortable with the idea of using the technology.

The observational field notes provided supporting insight into the attitudes and comfort level of the participants and the learning process they were experiencing while using the technology. Based on the field notes, the conclusion can be drawn that the majority of the participants were more interested and excited during the beginning of the study than they were during the latter part of the study.

Frustration was apparent in the first set of interviews, which took place at the end of the fall term (December). Several of the participants seemed somewhat

deflated, as evidenced by their manners and voice tones during these interviews. It was obvious they were disappointed with the technology not living up to their expectations. “Jodie’s voice seems flat today. She has slumped shoulders and just doesn’t seem to be responding well to the PDA. She isn’t holding eye contact with me as we are going through the questions. It is almost as if she is embarrassed at her lack of interest and use of the PDA” (Researcher, Field Notes, Interview 1). Despite this potential embarrassment, her use of the PDA did not improve significantly during the next term.

2.3 Discussion and Conclusion

When examining all of the data collected, the majority of concepts and ideas discussed fit into three main areas: technology, the learning process, and attitude. A common area of dislike among the participants had to do with the technology available at the school. This was not a finding reported in previous studies (Cooper, & Bull, 1997; Crowe & van ‘t Hooft, 2006; Dragula, 2005; Purcell, 2005). When asked to take attendance in the middle school setting during the fall term, most of the participants had to record attendance in three different places. This was a discouraging factor for them. The one individual who did not complain about this process was a participant who was placed with a mentor teacher who modeled use of the device, and this participant was able to utilize the mentor teacher’s PDA while taking attendance, taking out one step in the recording process.

A key limitation reported by the participants was the size of the device. All of the participants commented, at some point during the study, on the overall weight of the PDA. This was a negative feature for them. As physical educators, the attire worn

often consists of shorts or warm-up pants with an elastic waistband. The PDA was found to be heavy enough to weigh down the pants. The weight of the device was not described as being an issue in previous studies. However, the size of the screen was a reported issue.

Churchill & Hedburg (2008) reported the small screen to be a major limitation. In their exploratory study, participants reported that the small screen affected the clarity of the on-screen material, as well as negatively impacted their acceptance and integration of the tool into their teaching. This finding was echoed by the participants in the current study, who felt the screen size was a limiting factor, as reported in the journal responses, the interviews, and project reflection papers.

Despite the potential for the mentor teacher's modeling of the device to have a positive effect on the students, only one of the three students placed with a mentor who modeled the device reflected the experience to be a really positive one. The others felt they had to do what their mentor teacher was doing, and it was more of his thing than theirs. There was no ownership for these two participants, and that was reflected in their attitudes toward the technology. This finding was similar to that reported by Crowe & van 't Hooft (2006). In their study, modeling took place, yet many of the participants still did not embrace the technology provided.

The observational data also tied into the findings of the artifacts and interviews. The participants were very excited to use the technology at the outset. However, as the term progressed, attitudes changed and the majority of the group saw the technology as more of a hassle than an asset. This tied in with the lack of initiative the majority of the group took in using the PDA. Just using it for

attendance did not seem to be enough reason to motivate the group to use the device. After other assessment templates were provided, the group seemed to be more receptive, yet still appeared to be overwhelmed by the amount of material they were being asked to digest. As one participant stated when asked about using the PDA in the future, “I’m skeptical right now, but if we get introduced to more stuff I can actually see a good use for it, maybe. But just for attendance right now, probably not” (Sam, Interview 1).

The findings of this study show there are a number of factors that prevented these individuals from completely utilizing the technology. These factors are similar to those reported in previous studies (Crowe & van ‘t Hooft, 2006; Dragula, 2005; Jones et al., 2004; Purcell, 2005). The participants made frequent comments regarding the software limitations. The common verbalized desire was for “hot” buttons to be integrated into the templates. Half the participants felt it would be much easier to use the PDA if there were on-screen buttons specific for what was being observed. They felt this would decrease the amount of time it would take to use the PDA for attendance or assessing moderate-to-vigorous physical activity.

The first research question asked how pre-service physical education teachers utilize handheld technology in their physical education classes. Throughout the study, the majority of the participants used the PDA only for the projects they were assigned. This included using the PDA for attendance, assessing moderate-to-vigorous physical activity, and assessing gross motor skills. Only one participant regularly used the PDA throughout the entire study.

The second research question focused on the pre-service physical education teachers' attitudes toward the technology. There were a mixture of feelings and attitudes expressed throughout the study. The participants were excited at the outset and motivated to begin using the technology. Most made some attempt to try to learn the device as soon as it was given to them. During the first term, the only assigned project was related to attendance, but due to school-technology issues, this experience was challenging for the majority of the group. Most felt using the PDA just for attendance was not enough to warrant its use. Once other templates were provided, many found the PDA easier to use. Yet, in all but one case (i.e., Sarah), they only used it when they had to for course assignments. This finding begins to answer the third research question regarding the conditions under which the pre-service teachers will utilize the technology. It also points to the need for school administration and teacher education programs to expect their teachers and pre-service teachers, respectively, to assess on an on-going basis. It may be only then when they will more likely utilize such technology.

In terms of helping pre-service teachers learn how to use this technology, physical education teacher educators need to address the hardware issue and provide their students with appropriate technology. They also need to provide appropriate software training, including Excel workshops and hands-on training sessions. Another potential factor that needs to be addressed is finding ways to get the pre-service teachers to accept the different assessment tools and utilize them.

Future research areas should focus on ways to get pre-service teachers to evaluate the usefulness of these tools in their own classes and on how well these

individuals learn when presented with this new material. Another area for consideration would be to look at the different placement sites and see the effect of having a mentor teacher model the use of the PDA. Would such an exposure make a difference in a pre-service teacher's perception and use of the technology? Based on this study, it is too difficult to tell. There were mixed results from the various sites where the modeling was occurring, and no experimentation was done to check for individual differences. Finally, more research needs to be done in the area of technology's integration into physical education. It is important to research the impact the integration of technology has on student learning. Specifically, if teachers communicate that assessment using a PDA (as a tool) impacts one's grade, what effect does that have on students' performance and effort?

In conclusion, despite the potential PDAs can have on the field of physical education, the majority of participants did not find the device to present enough advantages to warrant adoption into their teaching. It was not substantially more beneficial than using paper and pencil. After implementing the device, there were positives and negatives stated by all, with the majority stating they probably wouldn't use it as is, but would accept the possibility of adopting such technology at a later date if it was warranted.

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3 Pre-service Physical Education Teachers' Attitudes Toward, and Use of, Handheld Technology: A Quantitative Approach

In the previous manuscript, findings were presented regarding the attitudes and use of handheld technology among pre-service physical education teachers based on qualitative data that was gathered. This manuscript will focus on the quantitative data collected during the same study.

Research to date on handheld technology has come from the K-12 setting (Kim, Holmes, & Mims, 2005; McGhee & Kozma, 2001; McKenzie, 2001). In 2002, SRI International, an independent research institute, conducted the first objective, large-scale study with participants utilizing handheld computers. The two-year study was conducted in elementary and secondary classrooms that received Palm Education Pioneer (PEP) technology grants (SRI International, 2002). The results of the study indicated that handheld computers offer benefits to both students and teachers. For example, 89% of the teachers found the handhelds to be an effective instructional tool. Most all teachers (93%) believed handhelds can have a positive impact on students' learning Furthermore, elementary school teachers had more positive perceptions than middle and high school teachers. And, over 90% of teachers in science-based curricular areas believed that handheld computers can improve the quality of learning activities. Approximately 66% of teachers in physical education (the smallest percentage of all groups studied) believed that handheld computers could improve the quality of learning activities. This last finding was similar to that reported by Vahey and Crawford (2002).

To date, the reason for a smaller percentage of physical education teachers using the technology remains unknown. This is disturbing, considering the National Association for Sport and Physical Education's (NASPE) National Standards for Beginning Physical Education Teachers (NASPE, 2003) include a standard on the use of technology to enhance learning and productivity, both personally and professionally.

The results of the qualitative data collected in this same study and presented in the earlier manuscript revealed a mixture of findings. The quantitative data, consisting of pre-, mid-, and post-test surveys, and observational data were collected to triangulate and/or clarify results from the qualitative data (Caracelli & Greene, 1993). The quantitative data will provide further information about the pre-service physical education teachers' views and use of handheld technology, and how they may have shifted throughout the study.

Little research has been done on the use of handheld technology in physical education. Therefore, the purpose of the study was to explore the pre-service physical education teachers' attitudes toward, and use of, handheld technology and to determine what factors play a role in the decision-making process for these individuals when it comes to choosing to use technology. The following research questions were used to guide this portion of the study: (1) How do pre-service physical education teachers utilize handheld technology in their physical education classes? (2) What are pre-service physical education teachers' attitudes toward handheld technology? (3) Under what conditions are pre-service physical education

teachers more likely to utilize handheld technology in their classes? (4) Will attitudes change following exposure to the technology or to different assessments?

3.1 Methodology

3.1.1 Participants

Participants were pre-service physical education teachers (*n*=6) enrolled in a graduate-level physical education teacher education licensure program at a university in the Northwest of the United States. The group included two females and four males (average age: 23.2 years; range: 22-25). None of the participants indicated any prior use of handheld devices. Although participation was voluntary, portions of the study were directly connected with requirements two of the required courses that were part of the licensure program. Potential participants were addressed using a pre-written recruitment script (Appendix C). Once participants agreed, consent forms were signed (Appendix D). To conceal their identity, the six participants were given pseudonyms: Sarah, Jodie, Sam, Luke, Justin, and Scott.

3.1.2 Apparatus

The HP iPAQ 1910 Pocket PC was utilized for this project. The device comes with a USB synchronizing cable and installation CD-ROM, as well as a hard-cover case to protect it from damage. The PDA was loaned to each participant for the school year.

The Excel documents provided to the students were created by researchers at Oregon State University. The Ohio State University Scale of Intra Gross Motor Assessment (OSU-SIGMA) (Loovis & Ersing, 1979) tool was adapted for use in

Excel. The Moderate-to-Vigorous Physical Activity (MVPA) tool was also adapted for use in Excel. Adapting these documents involved the following considerations:

- Due to the small screen, key words were used to describe various skill categories.
- Identification of options was minimized and allowed for easy calculations (i.e., yes and no responses for MVPA were substituted with the numbers 1 and 0, respectively).
- The number of students being observed at a time was set at three, allowing an assessment period to be made without scrolling.

3.1.3 Technology Integration with Assessment

A timeline of study events can be found in Appendix B. In July, participants completed a mini-workshop on the use of Excel, led by the investigator. Some knowledge of Excel is critical when working within the provided spreadsheet assessment templates. The workshop focused on the basics of Excel (e.g., file creation, inputting data, adding and deleting cells), as well as more advanced tasks (e.g., how to link sheets, formula creation, creating graphs). Three one-hour workshops were held and included short take-home assignments that allowed the participants to practice utilizing some of the capabilities of Microsoft Excel. The workshops took place prior to the start of classes associated with the licensure program.

Following participation in the workshops, participants were given an HP Pocket PC (the PDA of choice), cables to sync the PDA with a computer, and the

software needed to perform this operation. Participants were asked to take the PDA home and "play with it." At the beginning of the fall term, participants used class time to learn the basics of how to use the PDA in a licensure program course taught by a local high school physical education teacher who is an experienced user of such devices in her own physical education program.

One class period was used to instruct participants on the basics of using the device. Its setup and use were demonstrated, including how to load the software and sync the device with a desktop computer. As expected, the syncing process took the majority of the time, as well as caused the most confusion at this stage. To verify the instruction given during this time, the primary researcher observed this class period, but did not offer any additional support.

Participants were given multiple practice tasks, including syncing (within the appropriate file folders), beaming, and modifying and creating files (opening, modifying, and saving). After the initial instruction on how to use the device, problems or issues were handled on an individual basis, primarily by the course instructor. Any technical issues with the device (e.g., battery problems, device failure, cable issues) were handled by the primary researcher.

Several spreadsheet documents used throughout the study were presented in two PETE licensure program courses. These documents were Excel-based and included templates for assessing: a) attendance, b) student physical activity levels, c) student game performance, and d) elementary-aged students' fundamental motor skill performance (e.g., throwing, kicking, striking, etc.).

Following the initial lessons in fall term, participants were assigned a technology integration project. This project focused on the managerial aspect of tracking students' attendance. During this term, participants were placed in a middle school setting. The project requirement was to use the PDA device and the Excel template to take attendance and record the students' dress-down requirement for four weeks. The attendance files were to be synchronized via a cable to a personal computer. Participants were asked to email these files weekly to the course instructor, who provided the files to the project investigator. At the end of the four weeks, the participants were no longer required to take attendance for their course requirements. Any further use of the PDA was through their own initiative.

During the following winter term, participants were asked to complete two assessment projects. The projects were aimed at integrating the use of technology with the participants' assessment function during their elementary school student-teaching internship. The first project used an electronic version of the assessment template, The Ohio State University Scale of Intra Gross Motor Assessment (OSU-SIGMA) (Loovis & Ersing, 1979), to determine the gross motor skills of students in their classes. The OSU-SIGMA tool was presented and practiced by the participants in a fall-term required class within the PETE licensure program. During this class, the assessment tool was practiced using paper and pencil and by watching videos of students participating in the various gross motor skills.

The second winter project was related to assessing students' Moderate-to-Vigorous Physical Activity (MVPA) levels while teaching, using periodic observation of students. Each day, teachers would select one to three different target

students. A prompter, called a Motiv-Aider, provided the participants with a vibrating cue after a pre-determined amount of time (every 90-120 seconds). The requirement for this project was the same as in the previous term, with students submitting their files to the course instructor.

Participants were also provided with additional assessment templates at various points in the study. They were given game-performance templates to assess students' performance on selected sport-related techniques and tactical aspects of game play. These templates were specific to certain sports, but they could be easily modified to fit other sports in the same categories. Participants were introduced to the concept of transfer-of-learning in a previous PETE program licensure course and were encouraged to try the assessment templates if they felt comfortable. Though not required, utilizing the Excel version of these assessment templates was one of the goals of the project.

3.1.4 Data Collection

Once consent forms were signed (Appendix D), data collection commenced. It included data from a survey, as well as direct observation of the participants during their student teaching internships. Participants completed a technology-use survey (Appendix E) three times throughout the study. The first survey was completed immediately after consent forms were signed and served as a baseline measure of the participants' attitudes before they were introduced to the use of the HP Pocket PC for the purpose of assessing students' performance. The second administration took place at the end of the fall term, shortly after the completion of the technology integration project. The third administration took place following the completion of

projects at the end of the second term (i.e., winter) to see if additional practice with the use of the PDA would result in any changes in participants' attitudes toward the use of technology.

3.1.4.1 Survey

The survey, entitled *The Handheld Computer Attitude Survey* (Crowe & van 't Hooft, 2006), was modified from the *Computer Attitude Survey* developed by Lloyd and Gressard (1984). The 45-item survey focused on four specific areas. These included handheld computer comfort/anxiety (16 items), handheld computer liking (11 items), handheld computer usefulness (10 items), and learning activities related to handheld computers (8 items). An internal consistency reliability coefficient (Cronbach alpha) of .95 was calculated for the *Computer Attitude Survey* (Lloyd & Gressard, 1984).

The survey was adapted by adding five additional questions related to the use of handheld technology being used in college-level courses. Each of the additional questions was thoroughly scrutinized and modified until the desired construct was achieved. The survey was given to a research assistant who was asked to complete the survey as if he were an actual respondent. Any question the assistant had related to the survey indicated a defective item. The items were modified and the survey given to a new respondent. The process occurred two times, until there were no questions or concerns about the survey questions.

3.1.4.2 Observations

Throughout the fall and winter terms, participants were observed while teaching in the field in order to assess the inclusion of formal assessment in daily instruction by way of the handheld device. The Systematic Observation of Formal Assessment of Students by Teachers (SOFAST) observation tool was used during the observations (van der Mars, 2006). The observations were done throughout the term (i.e., prior to, during, and after the required projects). These observations provided insight into whether or not the participants bought into the usefulness of the PDA. The question that interested the researcher was: Will participants continue to use the technology once required course assignments, as in the technology integration project, have been completed?

SOFAST was developed to collect data on Physical Education Teachers' behaviors related to assessing student learning. It provides data on teachers' distribution of time on formal and informal assessment efforts (compared to their instructional and managerial teaching functions), the focus of the assessment (i.e., students' managerial performance, content performance, or social behavior), and the context of class activities (e.g., skill practice, knowledge, management, etc.). For the purpose of this study, only the teacher-assessment function was included to determine the amount of class time teachers devoted to assessment, instruction, and management functions. The mode of assessment was also recorded (i.e., PDA or paper/pencil). The observer coded teacher function using interval recording with a 20-second interval.

3.1.5 Data Analysis

Survey results were analyzed using the Wilcoxon signed rank test. This is a non-parametric test used to test the median difference in paired data. It is the non-parametric equivalent of a paired t-test, which uses data on an interval scale and requires the need to make the assumption that any differences follow a normal distribution. The Wilcoxon signed rank test is based on the rank order of the differences rather than the actual value of the differences, which does not require the assumption that the differences follow a normal distribution.

The SOFAST data were plotted graphically using Microsoft Excel. The data were put into Excel and graphed to show participants' time spent using the PDA and paper/pencil as part of the participants' efforts in employing any form of formal assessment. Visual analysis was completed by identifying stability of data, variability within and between phases, any overlap between phases, and trends.

3.1.6 Observer Reliability

To ensure observer reliability for the direct observation data, inter-observer agreement (IOA) was established outside of the data collection context of the study and was completed prior to the start of and during the remainder of the study. Videotape analysis and field practices were completed so a research assistant could be trained in the use of the SOFAST tool. A minimum of 80% IOA was required. In order to reestablish reliability, this process was repeated between the fall and winter terms.

Two independent observers coded two to three observations for each participant, accounting for 23% of the total observations made. IOA checks were conducted during both the fall and winter terms. A greater number of checks occurred earlier in the project rather than later. Observation checks were performed in live settings and through the use of video. A single tape recorder was used to pace both observers. Only the data from the primary observer was used.

In order to estimate inter-observer agreement, the percent of agreement was calculated between the observers using the Total-Interval (T-I) method. In this method, observers totaled the number of intervals in which they saw the behavior occur, and then divided the smaller number by the larger number and multiplied by 100. Only those intervals in which the behavior occurred were included. IOA was calculated for the three levels (i.e., Teacher Function Behaviors, Teacher Assessment Focus, and Lesson Context) even though only the teacher function and assessment focus were used. The formula used was Percent IOA = (< # / > #) * 100.

3.2 Results

3.2.1 Attitudes Toward Technology

Graphic and descriptive analyses of the survey data show a general downward pattern, followed by a slight increase for three of the four factors: handheld computer comfort/anxiety (comfort being represented by a higher score), handheld computer liking, and learning activities related to handheld computers. The fourth factor (i.e., handheld computer usefulness) showed a slight increase from the mid-point administration to the third survey. A downward trend represents more

negative attitudes toward the PDA, while an upward trend represents more positive attitudes.

The graph below (Figure 2) depicts the general downward trend from the pre-test to the mid-test administration and a slight increase in all factors from the mid-test to the post-test. The error bars depict the standard deviation. In considering the initial downward trend from the pre-test to the mid-test, this was the time period in which the PDA was originally used. The pre-test came prior to any use of the PDA. During the first school term, the PDAs were heavily used and attitudes were most strongly affected. Following the administration of the mid-test survey, the students were presented with new types of assessment templates, which did not have to be used every day throughout the term.

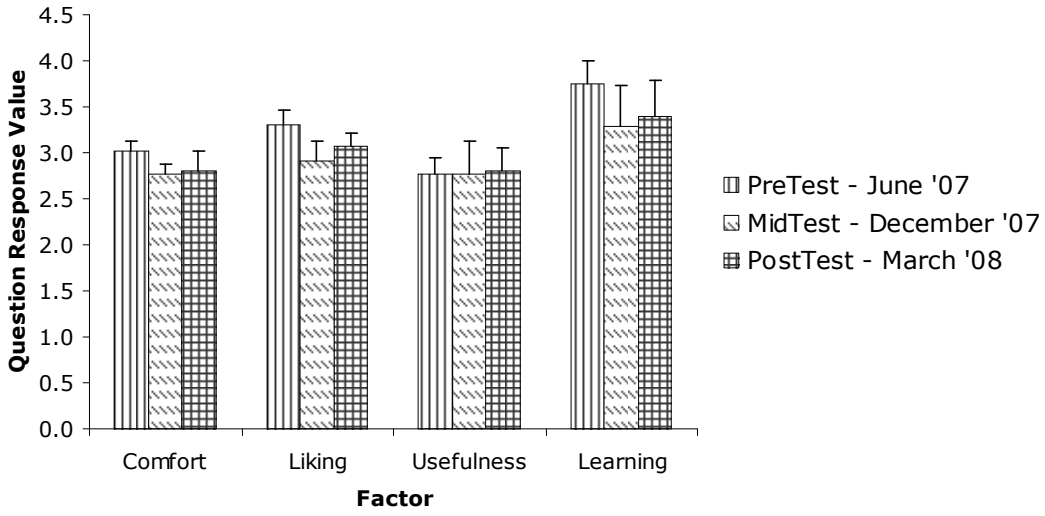

Figure 2. Group Averages of the PTATHT Survey Results by Factor

The Wilcoxon matched-pair signed-rank test ($p = .05$) was conducted for a more thorough statistical analysis. Z-scores are presented (Table 1) to show results by factor between the pre-test and mid-test, mid-test and post-test, and pre-test and

post-test. Statistical significance was found for handheld computer anxiety between the pre-test and mid-test (Z = -2.214, p = .027), and from the pre-test to the post-test (Z = -2.032, p = .042). The pattern was also found for handheld computer liking between the pre-test and mid-test (Z = -2.032, p = .042) and the pre-test and post-test (Z = -2.214, p = .027). Learning activities related to handheld computers showed statistical significance during the first survey period (Z = -2.060, p = .039). There were no statistically significant differences in any of the factors in the mid-test to post-test comparison.

Table 1. Wilcoxon Test Statistics for the PTATHT Survey by Factor

Comparison	Comfort	Liking	Usefulness	Learning Activities
Pre – Mid	-2.214*	-2.032*	-.368	-2.060*
Mid – Post	-.405	-1.897	-.431	-.730
Pre – Post	-2.032*	-2.214*	-.272	-1.761
*p < .05				

Table 2 provides the Z-scores for the individual survey items, which showed significant changes for each of the four factors.

Table 2. Significant Shifts in Wilcoxon Test Statistics for the PTATHT Survey (2, 6, 37, 44, 45)

Comparison	Item				
	2	6	37	44	45
Pre – Mid	-2.121*	-2.333*	-2.041*	-1.732	-2.070*
Mid – Post	-.577	.000	-1.857	-1.414	-.447
Pre – Post	-2.070*	-2.333*	-1.732	-2.236*	-1.179
*p < .05					

Several of the individual items showed statistically significant changes over time, with all these occurrences happening between either the pre-test to mid-test comparison, as well as from the pre-test to post-test comparison. No statistically significant attitude shifts occurred during the mid-test to post-test comparisons. The

five questions are located in Appendix E. All survey item Z-scores are listed in Appendix N.

3.2.2 Participants' Assessment of Student Performance Results

Throughout their student teaching internships at the middle and elementary school-level, participants were observed using the Systematic Observation of Formal Assessment of Student Teachers (SOFAST) observation tool (van der Mars, 2006). These observations were made to assess the participants' time spent on formal assessment both prior to, during, and after licensure program course requirements, as well as whether the assessment results were recorded via paper and pencil or with a PDA. Furthermore, it allowed the investigator to determine if the participants' time spent in formal assessment was affected by whether the use of a PDA was required as part of a course assignment within the PETE licensure program.

Figures 3 through 8 depict participants' use of the PDA and paper/pencil for formal assessment throughout the observations. Figure 3 is a graphical display of Sarah's use of the PDA and paper/pencil assessments over the two terms of the research project. The break in the data paths between observations five and six, or six and seven, signify the break between the fall and winter terms during which the observations were conducted. Sarah utilized the PDA during the first nine observations. During the first four observations, Sarah utilized the PDA for attendance only. A decline in the percent of class time used is visible in those first four observations. This depicts an increase in the speed in which she is able to complete the attendance. The increase during the fifth observation was due to using

the PDA for assessing other student behaviors. She was never observed using paper and pencil for any type of assessment. This was not a common finding among all of the participating pre-service teachers.

Upon visual analysis of Figure 3, there was a stable baseline phase during observations one through three. Observations four through ten showed variability within the phase during which time required projects were assigned. One observation was made following the completion of all assignments (i.e., observation 11). There was an overlap between this observation session and the previous session (i.e., observation 10). Sarah had completed her final PDA project by observation 9, and no longer needed to collect project data.

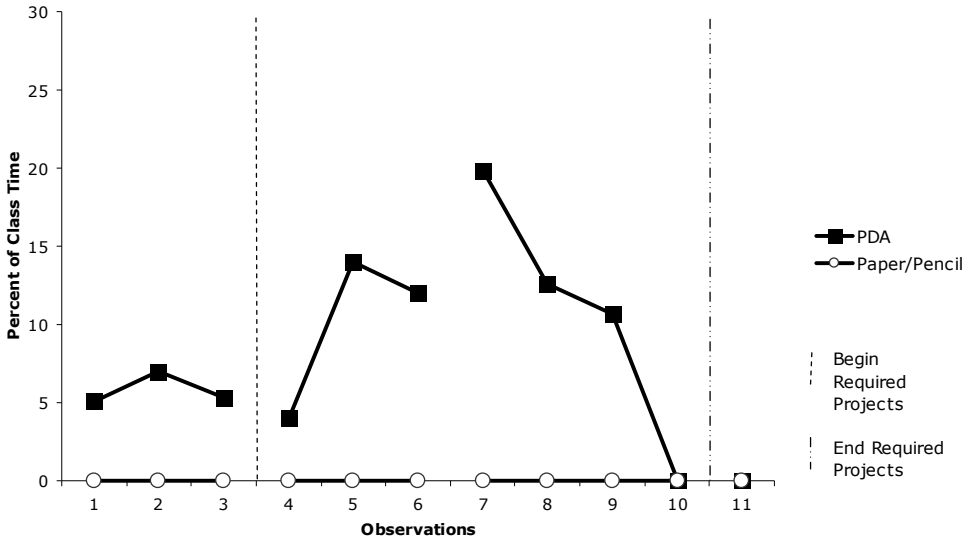

Figure 3. Sarah's Use of PDA vs. Paper/Pencil for Assessment Purposes

Jodie's use of the PDA and paper/pencil assessments over the two terms of the research project is presented in Figure 4. Jodie was more hesitant of using the PDA. Being in a non-technical school setting was a hindrance to the potential time-

saving nature of using the PDA. She was only observed using the PDA during the first term when it was required everyday during a specific period of time.

In the baseline session (Figure 4), despite having few data points (i.e., observations 1-3), the time used for formal assessment was stable. Following the initial practice of using a PDA for attendance in observation session 3, there was a decrease in the amount of time it took for Jodie to take attendance. The next data point (observation 5) shows another slight decrease, but not as substantial as the drop from using the PDA in the third observation to the fourth observation. The increase of formal assessment during observation six was due to skill assessments being completed in her elementary placement site, using the mentor teacher's paper version of a skill assessment. Following observation seven, no formal assessment was observed, and there is an overlap of scores during the last three observations when no formal assessment was being made.

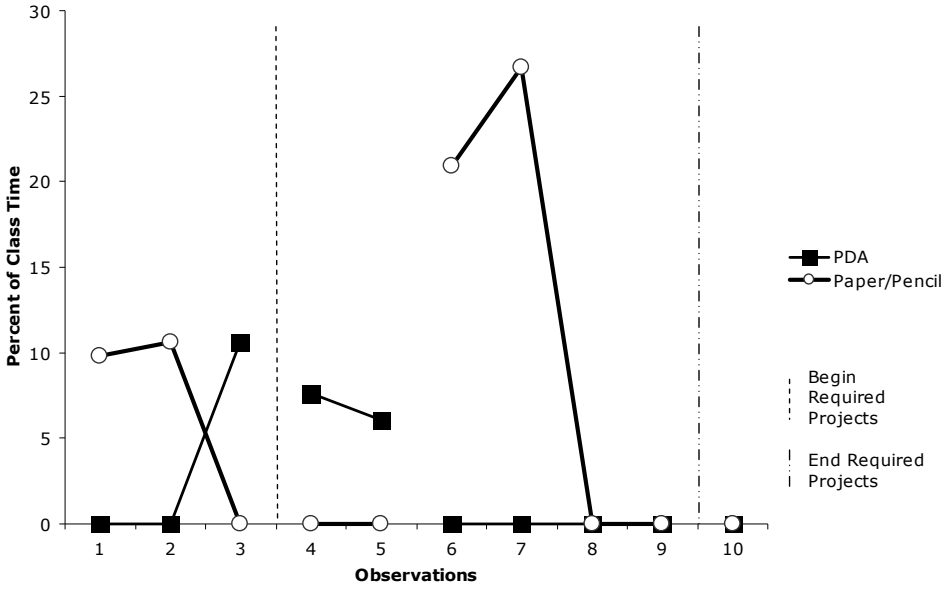

Figure 4. Jodie's Use of PDA vs. Paper/Pencil for Assessment Purposes

Figures 5 through 8 depict the graphical display of the use of the PDA and paper/pencil for Luke, Sam, Justin, and Scott, respectively. In each of these figures, there is a lot of variability within and between phases. This was to be expected because of the nature of the tasks (i.e., attendance, OSU-SIGMA, MVPA). During the first term, Sam and Justin were placed with a mentor teacher who required them to use the PDA for various tasks. They were to take attendance and record physical activity scores during class. This is the likely reason for the increased percentage of class time the participants used the PDA during the first term.

Luke (Figure 5) took attendance using paper and pencil more often during the first term, but used the PDA to assess students MVPA on two separate occasions when being observed. During the first term, Scott used both paper/pencil and the PDA to take attendance. The results from this observation show a distinct difference in the amount of time it takes to take attendance using paper/pencil versus using the PDA. There is a visually significant change in the amount of time it took him to take attendance using the two different tools.

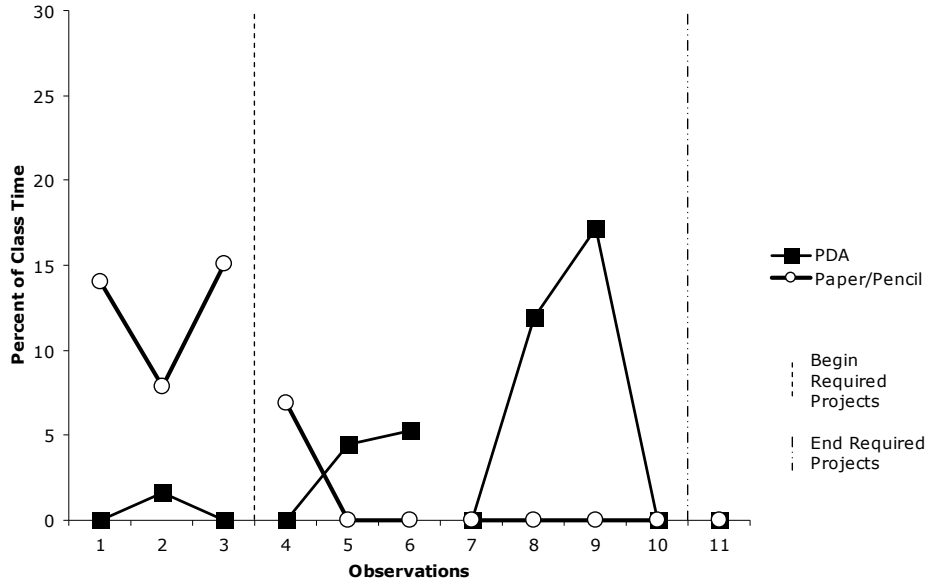

Figure 5. Luke's Use of PDA vs. Paper/Pencil for Assessment Purposes

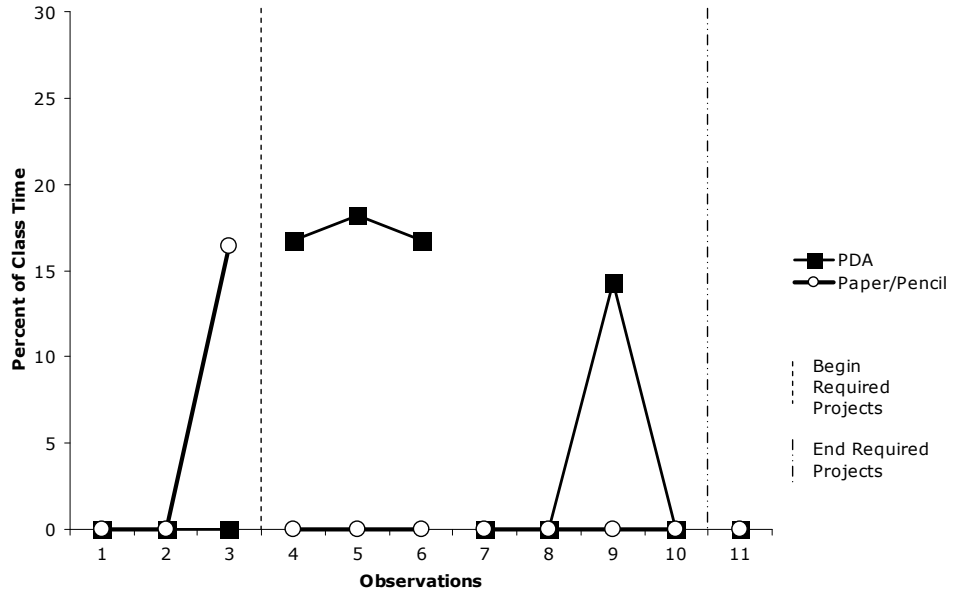

Figure 6. Sam's Use of PDA vs. Paper/Pencil for Assessment Purposes

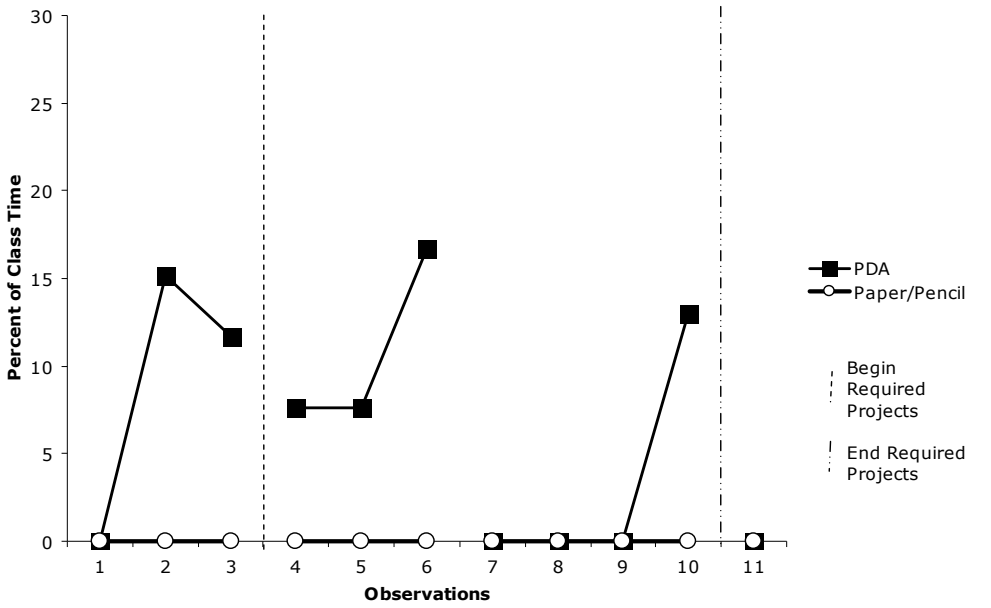

Figure 7. Justin's Use of PDA vs. Paper/Pencil for Assessment Purposes

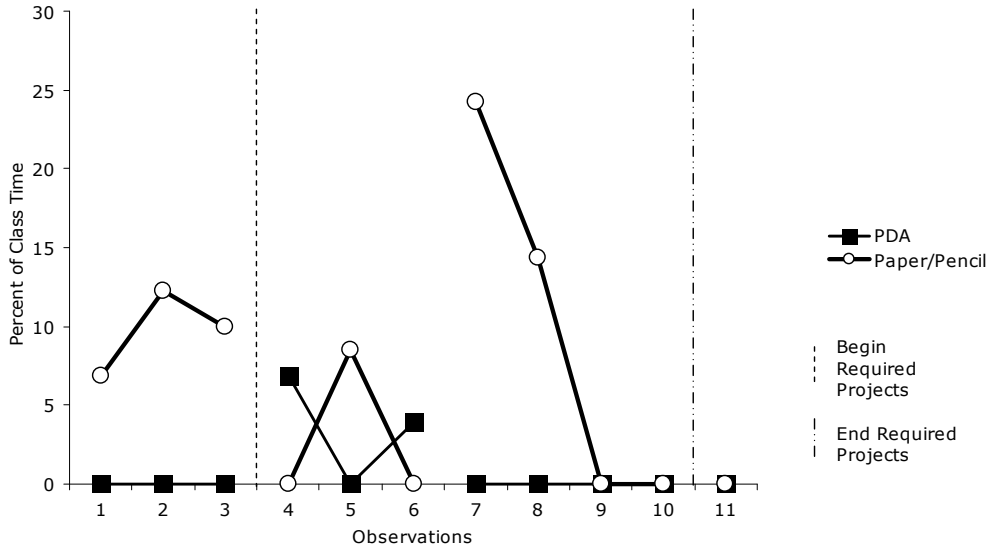

Figure 8. Scott's Use of PDA vs. Paper/Pencil for Assessment Purposes

Despite the fact there were more assignments given during the second term, there were fewer instances of the PDA being used, as well as less class time. This can be seen from Figures 3 through 8. The attendance assignment was required every

day following the third observation during the first term. The two assignments in the second term required the PDA to be used only on certain days. Many of these times were not on days that were observed by the researcher and, therefore, they are not depicted in the graphs.

Following each observation using SOFAST, each participant's use of formal assessment was calculated. The mode of formal assessment (i.e., PDA, paper and pencil) and the assessment focus were determined and the total percent of observed class time was calculated. These percentages were averaged for the group and then graphed to show the average percentage of class time used to complete the assessments during each observation (Figure 9).

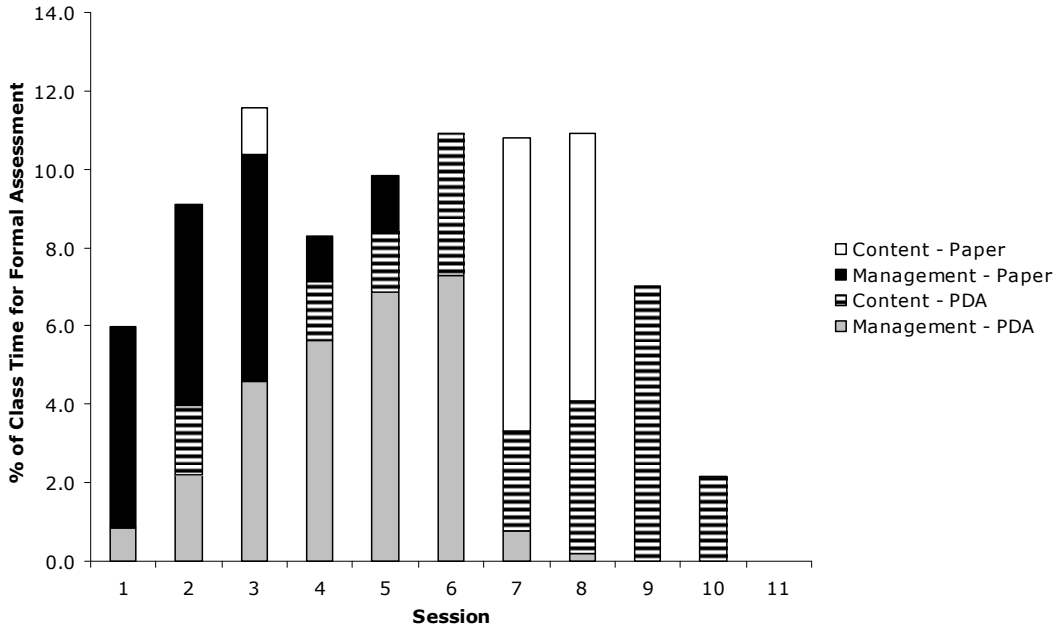

Figure 9. Mean Percentage of Class Time Spent on Formal Assessment Using PDA or Paper/Pencil

As is illustrated in Figure 9, management accounted for the majority of time participants spent in formal assessment during the first six observations. During the

winter term (starting with session 7), there is a definite switch to the assessment of content-related activities, which consisted of gross motor skill assessment and moderate-to-vigorous physical activity assessment.

Figure 9 also illustrates the changes in the type of tool used for formal assessment. During the first three observations, there were no licensure program course requirements for the PDA. This explains the larger percentage of paper/pencil used for formal assessment. There is a continued upward trend during sessions four through 6, during which time the PDA was required for completing management-related assessments.

The winter term observations began in session seven with a sharp visual decrease in the amount of time the PDA was used for formal assessment. The large percentage of content-related assessment using paper and pencil during the seventh and eighth sessions were due to skill assessments being performed at one of the elementary placement sites. The participants were completing these assessments for school-site purposes, and not for any licensure program coursework.

Observation sessions nine and ten took place during the time period of the MVPA project. Session 11 observations, during which time no use of the PDA was seen, were completed following the end of all licensure program course requirements.

3.3 Discussion and Conclusion

The initial survey results showed positive attitudes toward handheld computer comfort, handheld computer liking, and learning activities related to handheld computers. However, these positive viewpoints diminished following the first term

of using the PDA. This finding makes sense. As was reported in the previous manuscript, the participants did not feel the use of a PDA was warranted for just gathering attendance-related information. The decrease in positive attitudes was consistent with the findings by Crowe & van ‘t Hooft (2006), who reported a similar decline in attitude following the first time period in which the handheld device was most heavily used.

Contrary to the findings of the Crowe & van ‘t Hooft study (2006), following the second term of PDA use, survey results did increase, showing more positive attitudes toward the handheld computer. These survey results followed a time period when the PDA was being used for other more substantive types of assessments, which the participants felt made it more useful and worthwhile.

The first research question asked how pre-service physical education teachers utilized handheld technology in their physical education classes. Based on the SOFAST observations, the majority of the participants used the PDA only for the projects they were assigned. This included using the PDA for students’ attendance, assessing moderate-to-vigorous physical activity, and assessing gross motor skills. Figures 3 through 8 depict if/when the use of the different types of formal assessment occurred. Four of the participants used the PDA prior to its being required after the third observation. However, for two of these individuals, those instances were very limited. On one occasion, one participant took attendance using paper/pencil, and then quickly transferred that information to the PDA. Only one participant regularly used the PDA throughout the entire study. This participant did

not use any type of formal assessment during the last two observations, which were made after the completion of all technology integration projects.

As depicted in Figure 9, the majority of formal assessments being completed were for management purposes (i.e., attendance). Content assessments comprised a small percentage of time during the fall-term observations, and a larger percentage of time during the winter-term observations. These findings coincide with when the different technology integration projects were due. The use of the PDA for management almost completely disappeared during the seventh and eighth observations and was completely nonexistent during the last three observations. The final observation was made following the completion of all technology integration projects. As seen in Figure 9, formal assessment of any kind did not happen following session 10.

The second research question focused on the pre-service physical education teachers' attitudes toward the technology. The survey results depicted a general decline in positive attitudes toward the device following the first term and a slight increase in positive attitudes after the second-term projects were completed. During the first term, the only assigned project was related to attendance, but due to school-technology issues, this experience was challenging for the majority of the group. Using the PDA only for attendance may not have been enough of a selling point. After being provided with other templates and opportunities to use the PDA, the general attitude toward the device became more positive, yet it was still only used to complete course assignments. This finding begins to answer the third research question regarding the conditions under which the pre-service teachers will utilize

the technology. It also points to the need for school administration and teacher education programs to expect their teachers and pre-service teachers, respectively, to assess on an on-going basis. It may be only then when they will more likely utilize such technology.

The fourth research question focused on the potential for attitudes to change following introduction to the technology or to different types of assessments. Based on the survey results and visual analysis, the participants' comfort level and liking of the PDA did increase following the winter-term projects. They saw the PDA as more useful, as well, although this change was not statistically significant. The final factor, learning activities related to the handheld computer, also increased, as the practice of using the PDA for different kinds of formal assessments was implemented.

In conclusion, despite the potential benefits PDAs can have on the field of physical education, the majority of participants had a decline in interest and opinion of the PDA as the study progressed. Most participants used the PDA only when they were required to use it to complete course assignments, which is the reason no occurrences of PDA use were observed during the last observation sessions. An increase in attitude was observed following the winter term projects, but it was not statistically significant from the mid-test survey results.

3.3.1 Implications for Physical Education Teacher Education

Given the results of the data gathered for this survey, it would seem more efforts need to be made to introduce the technology earlier on and to model its usage in the context of physical education classes for various types of assessment. This early modeling may provide enough of an exposure to, and interest in, the

technology to get pre-service teachers to more fully buy in and attempt its use. This follows the theoretical foundation from which the study was designed.

Research in the field of teacher education has shown that beliefs and attitudes of pre-service teachers play a crucial role in the integration of many tactics and skills, including the integration of technology. These attitudes are formed during pre-service training, which includes licensure program coursework, observations, and student teaching (Hardy, 1998; Wallinger, 1997). In order to more fully comprehend the needs of pre-service teachers, teacher educators must make the effort to begin to understand these beliefs and attitudes. The effective modeling of technology in college-level courses may also lead to more positive attitudes toward technology. Beaudin and Grigg (2001), along with research done by Bell (2001), reported that the teacher is the most important factor when determining the ultimate success of classroom-technology integration.

According to Pajares (1992), positive attitudes that are formed during pre-service training are easier to create and maintain. With positive attitudes being formed in pre-service training, the likelihood is greater that technology adoption will be more successful and effective (Hunt & Bohlin, 1995). This is important for increasing the interest levels of the pre-service teachers and for giving them as much exposure as possible to better prepare them while in teacher preparation programs.

Factors that influence pre-service teacher attitudes toward technology are: effective modeling (Keiper, Harwod & Larson, 2000); quality experiences in undergraduate and graduate-level courses (Crowe, 2003; Crowe & van ‘t Hooft, 2006); time to practice (Keiper, Harwood & Larson, 2000; Mason & Berson, 2000);

and instructor and peer support (Crowe, 2003). Teacher educators have the responsibility to convince future educators of the need for technology. In order to achieve this goal, teacher educators need to understand what their students think and feel about technology, making adjustments to incorporate teaching practices that will have a positive effect on students.

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4 Conclusion

Integrating the PDA into physical education classes by pre-service teachers had mixed results. Despite the initial interest of pre-service physical education teachers in integrating technology into their teaching, merely using the PDA was not enough to bring full integration and sustained use into their classes. The participants' strong interest and excitement about using the PDA at the start of the project dissipated as the project progressed. Preparing pre-service teachers to use the technology requires ample time for them to learn how to use the device and the associated software. This finding, combined with providing appropriate technical support and effective modeling of the device, may lead to a more effective and beneficial integration of the technology.

Following the conclusion of the study and analysis of the results, it is important to reflect on the initial research questions: (1) How do pre-service physical education teachers utilize handheld technology in their physical education classes? (2) What are pre-service physical education teachers' attitudes toward handheld technology? (3) Under what conditions are pre-service physical education teachers more likely to utilize handheld technology in their classes? (4) Will attitudes change following exposure to the technology or to different assessments?

Throughout the interviews, project reflection papers, and observations, the majority of participants used the tool only for the required assignments. They used the device for managerial purposes (attendance), for assessing physical activity levels (MVPA), and for assessing gross motor skills (OSU-SIGMA). Despite being given the assessment templates, most of the participants did not attempt to use the

PDA for these purposes. Even though they expressed an interest in using the PDA for other types of assessments, when presented with the option to use them, the majority of participants chose not to attempt the different assessment templates.

Some potential reasons for this could be due to the technology itself. Participants complained about several hardware issues (e.g., batteries, memory, screen size, weight, wireless capabilities) throughout the study. These issues may have been enough of a deterrent to keep the participants from using the PDAs.

Contrary to initial belief, having a mentor teacher model the use of the device was not enough to keep participants excited about it. It is important to urge the participants to take more ownership for the device and the potential uses of it. Having a school with appropriate technology was another factor that played a role in the participants' attitudes regarding the technology. It was quite discouraging for the participants to have to take the time to make three copies of the daily attendance. It is not an efficient practice and was frustrating for the majority of the group. Available school technology could either enable or suppress a pre-service teacher's use of the handheld technology.

During the first term, the individuals were presented with a task that was meant to ease them into the process of using the PDA. During this term, the majority of participants were overwhelmed with the number of tasks and new material they were being assigned in their student teaching. As a result, the majority of participants did not take the initiative to develop their own assessment tools or other uses for the PDA, nor were they convinced that using the PDA was useful.

After reviewing the findings of the interviews and various project reflections, as was hypothesized, most participants used the PDA only when they were required to use it to complete course assignments in their PETE licensure program. This finding was also apparent during the observations made while the participants were teaching, which showed most participants beginning to use the PDA after the third observation, but none using it by the eleventh, and final, observation.

Shifts in the participants' attitudes were apparent throughout the study. Attitudes definitely changed as the study progressed, with more positive attitudes at the beginning of the study, a decline in interest and opinions following the fall term, and a slight increase in overall feelings of usefulness and motivation following the winter term. This shift in attitude was clearly reflected while reading through the interviews, reviewing the survey results, reading the project reflection papers, and observing the participants while using the technology.

The overall findings indicate that more work needs to be done and several issues need to be addressed, including upgrading the devices and providing more support. Potential questions for future research include: (1) How much time is needed to effectively train pre-service teachers to learn to use a new device in order to effectively use it within teaching? (2) Does the placement site matter? (3) Will having a mentor teacher modeling the use of the device have an effect on the pre-service teachers? (4) How can pre-service physical education teachers be convinced that the use of technology can be a beneficial tool for them? (5) What effects does the utilization of the device have on student learning? (6) To what extent do programmatic requirements affect learning?

These questions are just the beginning when it comes to understanding the use of technology and its potential for increasing teacher effectiveness and student learning. As this research has shown, in agreement with the few studies previously done, the impact technology could have on the field of physical education is not fully known.

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Appendices

Appendix A

Literature Review

Technology is commonly used in everyday life. A current trend in educational reform requires teachers to be proficient in employing technology in their classrooms (International Technology Education Association [ITEA], 2000; Thomas & Cooper, 2000). As a result of this trend, teachers need to be prepared to integrate technology into their teaching, and teacher-preparation programs have a responsibility to prepare their students accordingly (National Council for the Accreditation of Teacher Education [NCATE], 1997; 2006). The handheld computer is a potentially useful way to integrate technology into the classroom.

The term 'technology' is a broad concept that includes material objects as well as systems or methods of organization. In a general sense, technology is the "relationship that society has with its tools and crafts," and how we, as a society, can manage our environment with the application of this knowledge (Technology, n.d.; Wikipedia, 2007). The field of education has seen four predominant phases in the history of educational technology (Pownell & Bailey, 2000). The first phase, in the 1960s, included mainframe computers, which mostly impacted administration. Phase two occurred in the late 1970s to early 1980s, during which time the personal computer allowed administration, teachers and students to have access to computers. The Internet arrived in phase three during the 1990s. The fourth phase is still evolving and includes the use of small, mobile, wireless technology, in which handhelds fit.

Handheld Technology

Handheld technology is a fairly recent development that has been shown to be a valuable resource in many fields (e.g., business, medicine, law). Handheld computers, also known as personal digital assistants (PDA's), allow for easy and accurate collection, storage, and access of data (Ernst, 2001; Juniu, 2002; Torre & Wright, 2003). They can accomplish a wide variety of clinical, organizational, and educational tasks, including tracking grades and assessments, as well as managing course assignments (Ray, 2005; Ray, McFadden, Patterson, & Wright, 2001; Torre & Wright, 2003).

The handheld computer was first introduced as an electronic version of the daily planner. The initial software package included scheduling capabilities, an address book, and a memo pad. Today, the application software has expanded to include internet and networking capabilities, word processing programs, and presentation and spreadsheet software, and has even been integrated with cell phones to provide even greater mobility and communication (Frauenfelder, 1999).

The devices have also become less expensive and are being carried by people of all ages and professions. Handheld technology provides a way to extend the use of paper and pencil documenting tools, as well as the desktop computer, to an environment in which mobile handheld technology can be used to collect data and retrieve information while in the field (Franklin, Sexton, Lu, & Ma, 2007; Tinker, Staudt, & Walton, 2002). Despite all the advantages and potential these devices have, the field of education has not accepted them as readily as other fields have (Purcell, 2005).

The Changing Nature of Educational Technology

The field of education has utilized computer technology for approximately twenty-five years. Throughout this time, researchers have looked at the benefits and limitations of the technology in schools, concluding that, when appropriately used, technology can have a positive impact on teaching and learning (Vahey & Crawford, 2002). The nature of handheld technology allows for relatively easy integration of technology into the learning environment (Gado, Ferguson, & van ‘t Hooft, 2006). Those educators who reported using handheld technology expressed that handhelds increased their productivity, positively impacted their teaching, and promoted student learning. They found their own, as well as their students, learning to happen relatively quickly (Ray, 2005; van ‘t Hooft, Diaz, & Swan, 2004).

Research to date on handheld technology has come from the K-12 setting (Kim, Holmes, & Mims, 2005; McGhee & Kozma, 2001; McKenzie, 2001). In 2002, SRI International, an independent research institute, conducted the first objective, large-scale study utilizing handheld computers. The two-year study was conducted in elementary and secondary classrooms that received Palm Education Pioneer (PEP) technology grants (SRI International, 2002). The results of the study indicated that handheld computers offer benefits to both students and teachers. The following are key findings, as reported by SRI, of teachers’ beliefs and perceptions on using technology: (a) 89% of the teachers found the handhelds to be an effective instructional tool, (b) 93% of the teachers believe handhelds can have a positive impact on students’ learning, (c) elementary school teachers had more positive perceptions than middle and high school teachers, (d) over 90% of teachers in

science-based curricular areas believe that handheld computers can improve the quality of learning activities, and (e) approximately 66% of teachers in physical education (the smallest percentage of all groups studied) believe that handheld computers can improve the quality of learning activities.

Despite the potential to revolutionize the field of education, there is evidence that physical education teachers are less likely to use technology than their subject matter counterparts (Vahey & Crawford, 2002). This is disturbing, considering the National Association for Sport and Physical Education's (NASPE) beginning physical education teacher standards (2003) include a standard on the use of technology to enhance learning and productivity, both personally and professionally.

Technology and Teacher Education

The use of technology for instruction and assessment has been recognized by NCATE as a necessary component of teacher preparation. It is expected that educators in teacher-preparation programs will prepare candidates who are able to use educational technology in their classrooms (NCATE, 2006). The International Society for Technology in Education (ISTE) surveyed teacher-preparation institutions across the country to evaluate their inclusion and teaching of educational technology. The findings suggested that programs needed to increase teachers' exposure to appropriate educational technology to ensure adequate preparation (ISTE, 1999).

In the past, technology professional development was provided through in-service programs or workshops. Pre-service teacher education programs typically did not offer technology training. Over the past 20 years, the amount of information

technology available in K-12 education has grown substantially (ISTE, 1999). It is estimated that the number of computers in private and public schools is more than one per five students (Becker, Wong & Ravitz, 1999), which is a 15-fold increase in fifteen years. However, in-service and pre-service education programs have struggled to keep up with this change (ISTE, 1999).

In 1997, following its initial 1995 technology-standard integration, NCATE conducted a review of its accreditation program with regard to technology. The review found that faculty were not making wide use of technology in their own research and teaching, therefore underestimating its impact on teachers' jobs. It was viewed as a special add-on to the teacher education curriculum (NCATE, Task Force on Technology and Teacher Education, 1997). This is an inconsistency that needs to be addressed in further research.

Utilization of Technology in Physical Education

Physical education is a field in which technology can potentially impact the areas of research and classroom teaching. To date, little research has been done on the overall effect of the utilization of technology in physical education, yet its presence in the field makes it an important area for extended research.

The use of handheld computers in physical education may see the greatest effectiveness and importance in their ability to provide classroom support (Dragula, 2005; Franklin, Sexton, Lu, & Ma, 2007; Kim, Holmes, & Mims, 2005; Pride, 2003; Rajala, 2003; Ray, 2005). Some potential uses in the physical education setting include: (a) keeping attendance; (b) storing and retrieving fitness test scores; (c) filing electronic lesson plans; (d) keeping inventory; (e) grading; (f) tracking student

physical activity levels; (g) recording student performance in the various learning domains (e.g., psychomotor, cognitive, and affective); (h) performing assessments of various skills and behaviors associated with learning; and (i) expanding available resources via internet capabilities.

All procedures associated with using handheld computers are electronic. As a result of this, teachers can reduce the amount of time required for dealing with various types of paperwork inherent in the teaching profession (Kim, Holmes, & Mims, 2005). According to Bonnie Mohnsen, coordinator of physical education and integrated technologies for the Orange County Department of Education, physical education teachers have more paperwork than other teachers (Rittner-Heir, 2000). While this statement may be exaggerated and subject to argument, physical education teachers do have a lot of paperwork, including attendance forms, inventory lists, budgeting documents, grade books, lesson plans, and assessment forms. These documents are related to the numerous students a physical education teacher will see during the school year. For example, an elementary school physical education teacher will see virtually every student in the school, while a classroom teacher will see approximately twenty-five to thirty students. Much of this paperwork may be necessary to demonstrate a program's effectiveness and accountability for meeting content standards.

The goal of physical education is to develop physically educated individuals who have the knowledge, skills, and confidence to enjoy a lifetime of physical activity (NASPE, 2004). The national standards for physical education define student learning, provide a basis for instruction, assessment, and program evaluation. The

integration of technology may be a useful tool in gathering information through various assessments to document learning and effective teaching practices (Moallem, Kermani, & Chen, 2003; NASPE, 2006; Ray, 2005).

Technology's Link with Assessment

One of the national K-12 physical education standards focuses on assessments. This is also an area of focus in the NASPE/NCATE beginning teacher standards (NASPE, 2003). It is NASPE's position that highly qualified physical education teachers, coming from an accredited physical education teacher education program, will "view assessment as an integral component of the teaching-learning process" (NASPE, 2007). However, in an interview focusing on standards in physical education, one professional in the field stated that many physical educators do not assess appropriately and are unable to report if their students have met the content standards (Sherman, 2000).

Typically in physical education, most assessment of learning is informal in nature. This type of assessment comes in the form of offering skill and behavior feedback, prompts, corrections, and non-verbal feedback. Formal assessment, often performed with paper and pencil, has largely been limited to holding students accountable for managerial performance, including dress, attendance, and general class conduct. While important, these do not reflect program outcomes as stated in the national and state content standards.

A large focus of teacher education and physical education research has focused on the importance and promotion of formal assessments. There has been a significant shift in the field of education to document student learning and teacher

effectiveness. Promoting the integration of formal assessments is one way to document this type of learning (Melograno, 2000; Siedentop, 1994; Wood, 2003)

The Systematic Observation of Formal Assessment of Students by Teachers (SOFAST) was developed to collect data on physical education teachers' distribution among teaching functions, the type of assessment they perform (formal and informal), the focus of the assessment (managerial, content, or social behavior), and the context of class activities. This type of formal assessment, along with formal assessment of student behaviors can provide a more immediate indication of learning and teacher effectiveness.

SOFAST allows the tracking of teachers' efforts at performing the multiple functions (especially formative assessment) on a daily basis. Furthermore, SOFAST can be used to determine the efficacy of intervention efforts aimed at developing teachers' skills in integrating assessment into their daily instructional efforts.

Assessment of student learning in the psychomotor, cognitive, and social-behavioral domains offers a means to demonstrate program impact, inform teachers of changes they may need to make in their instructional strategies and/or curriculum offerings, and document student performance (NASPE, 2007). In order to achieve these tasks, physical education teachers need to determine what should be assessed and how to perform these assessments. This can be a challenging task for teachers, and introducing this information in the physical education teacher education programs can be a solution. By integrating assessment with instruction on a day-to-day basis, and allowing the pre-service teachers time to practice this technique, there

is the potential to link teaching, learning, and assessment (Shepard, 2001; Wood, 2003).

The importance of integrating formal assessment with instruction has been widely accepted in pedagogy and assessment literature (e.g., NASPE, 2004; Pryor & Akwesi, 1998; Wood, 2003). In their article, Black & Williams (1998) reported on the increased motivation of students following the integration of formal assessments. The students gained valuable information immediately following activity, upon which they were able to make necessary adjustments in classroom performance.

Completing assessments can be a daunting task for any experienced or pre-service physical education teacher. The instructor has to focus on instructional duties, class management, and performing assessments, often with high student numbers. The use of paper and pencil to perform many tasks can present several problems, such as illegible handwriting, lost paperwork, and missing student information. Once the information has been collected on paper, there is then the extra time it takes to manually transfer that information to a computer, which is also subject to human error. This process takes a lot of time, but is a necessary component to enhance the quality of instruction. Feedback to students is also minimized because of the nature of the task; assessments are either not performed, or the information takes too long to be processed into a computer.

The integration of handheld technology can reduce the time-consuming nature of performing assessments. Using computerized data-management systems can provide a strong foundation for student and teacher accountability (Lambdin, 1997). Moallem, Kermani, and Chen (2003) stated, “providing continuous

assessment and immediate feedback via wireless computers during instruction yielded a positive effect on students' learning and their attitude toward various forms of assessment and the use of handheld computers in the classroom to assist in learning" (p. 1398).

When performing these assessments, teachers use various types of programs, including Microsoft Excel and other electronic gradebooks. By keeping some type of electronic grade system on a PDA, teachers have immediate access if needed to show students, parents, and administrators. They also allow for immediate, or on-the-fly, assessments (Baumbach, Christopher, Fasimpaur, & Oliver, 2004; McFadden, et al., 2002; Ray, 2005).

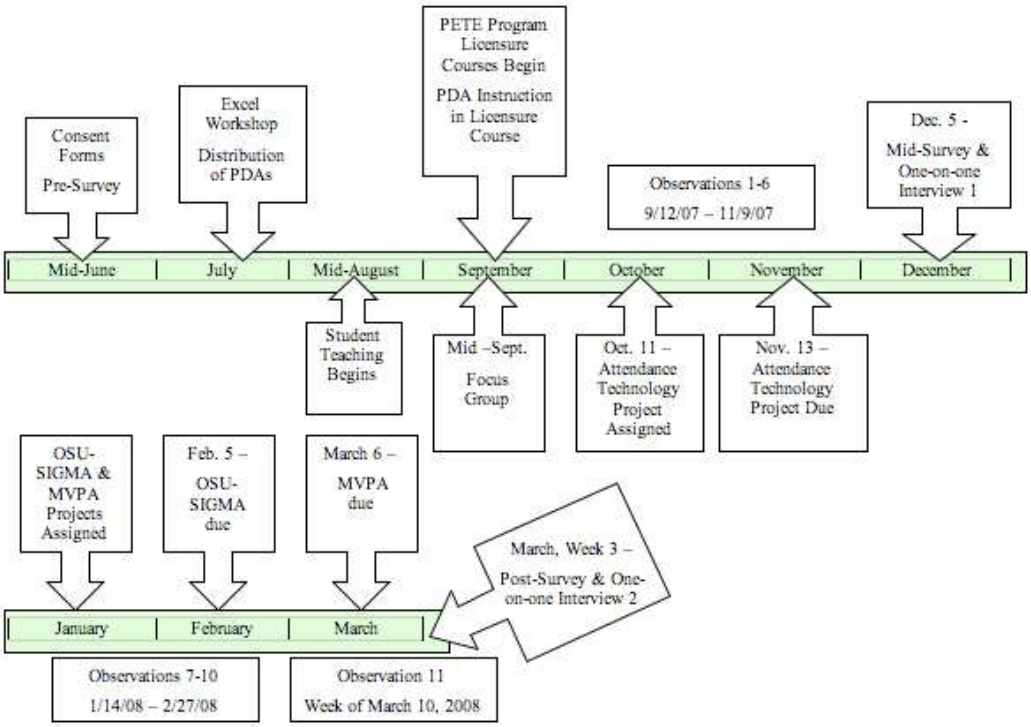
Potential Reasons for the Avoidance of Technology

Many potential reasons for educators' avoidance of using handheld technology have been reported (Cooper & Bull, 1997; Crowe & van 't Hooft, 2006; Dragula, 2005; Jones, Johnson, & Bentley, 2004; Purcell, 2005). These reasons include the overwhelming number and types of devices that are classified as *handheld*. Other reasons are: (a) limited professional development and training opportunities; (b) limited software; (c) difficulties entering, displaying, and exporting text and data; (d) perception as toys, not learning tools; (e) teacher motivation and mindset; (f) lack of understanding of technology; (g) lack of support (money and time); and (h) attitude.

Despite this list of potential issues, it is believed that this type of technology is a realistic alternative to the use of desktop and laptop computers (Gado, Ferguson, & van 't Hooft, 2006), and is even more beneficial than utilizing the paper-pencil technique.

Appendix B

Timeline of Study Events



Appendix C

Recruitment Script

I am completing my dissertation study on physical education pre-service teachers' attitudes and use of handheld technology. We are studying this because little research has been performed on the use of handheld technology in physical education and it is important because of the inclusion of technology and assessment in the performance standards for initial and experienced physical education teachers. You are being invited to participate in the study because you are a physical education pre-service teacher enrolled in an accredited program.

The study will supplement required course work in several of your classes. As part of your course work, you will be asked to read several articles and participate in group discussions, learn how to use a personal digital assistant (PDA), and complete two separate technology integration projects. If you choose to participate in the study, you will be asked to complete the following additional tasks: a) a pre-test, mid-test, and post-test questionnaire, b) an Excel workshop, c) a focus group session, d) two individual interviews, e) be observed during your regularly scheduled student teaching, f) complete a handheld-usage log, and g) complete a weekly journal on topics related to handheld technology.

Aspects of the study will take place at either the university campus, or at your school placement site.

The workshop hours will be swapped for class time in EXSS 552 and will take a total of three hours of class time. The focus group will take approximately one hour and each interview will take approximately 30 minutes. The pre-test, mid-test, and post-test questionnaires will take approximately 20 minutes each.

You will not be paid for participating in the study, however, your involvement will allow you to gain knowledge and experience that may be useful to you in your future. If at any time you decide to withdraw from the study, you will not lose any benefits or rights you would normally have if you decided to not participate. It is completely voluntary.

Are there any questions?

If you would like to volunteer to participate in the study, please raise your hand and the informed consent document will be passed out to you.

Appendix D

OSU Oregon State University

DEPARTMENT OF NUTRITION AND EXERCISE SCIENCES
Oregon State University, 101 Milam Hall, Corvallis, Oregon 97331
Tel 541-737-2643 | Fax 541-737-2788 | mendy.gayler@oregonstate.edu

INFORMED CONSENT DOCUMENT

Project Title:	**Physical Education Pre-Service Teachers' Attitudes and Use of Handheld Technology**
Principal Investigator:	**Hans van der Mars, Department of Physical Education, ASU**
Co-Investigator(s):	**Heidi M. Wegis, Nutrition & Exercise Sciences**

WHAT IS THE PURPOSE OF THIS STUDY?

You are being invited to take part in a research study designed to explore the conditions that affect physical education pre-service teachers' decisions to utilize handheld technology, as well as factors that may suppress or facilitate their decision to actually use the technology once learned. The results will be used in a student doctoral dissertation, and possibly included in publications and/or presentation. We are studying this because little research has been performed on the use of handheld technology in physical education and it is important because of the inclusion of technology and assessment in the performance standards for initial and experienced physical education teachers.

WHAT IS THE PURPOSE OF THIS FORM?

This consent form gives you the information you will need to help you decide whether to be in the study or not. Please read the form carefully. You may ask any questions about the research, the possible risks and benefits, your rights as a volunteer, and anything else that is not clear. When all of your questions have been answered, you can decide if you want to be in this study or not.

WHY AM I BEING INVITED TO TAKE PART IN THIS STUDY?

You are being invited to take part in this study because you are a pre-service physical education teacher enrolled in an accredited program.

WHAT WILL HAPPEN DURING THIS STUDY AND HOW LONG WILL IT TAKE?

This study will supplement required course work in several of your classes. As part of the course requirements, you will be asked to a) read several articles and participate in a group discussion, b) learn how to use a personal digital assistant (PDA), and c) complete two separate technology integration projects. If you choose to participate, you will be asked to complete the following additional tasks: 1) a pre-test, mid-test, and post-test questionnaire, 2) an Excel workshop, 3) a focus group session, 4) two individual interviews, 5) be observed during your student teaching, 6) complete a handheld usage log, and 7) fill out a weekly journal on topics related to handheld technology.

The course work will take place on campus or at your school-site placement. The workshop, interviews and focus group session will take place on campus in the classroom. The workshop will be a total of three hours, and will be split over three days. This time will be swapped for class time in EXSS 552: Analysis of Movement Skills. The focus group will take approximately one hour, and each interview will take about thirty minutes. The pre-test and post-test questionnaire will take approximately twenty minutes.

If you agree to take part in this study, your involvement will last for approximately ten hours over the course of one school year. This is in addition to what is required in your coursework. However, approximately five of the additional ten hours will be where a researcher is observing your teaching, and no additional work will need to be performed during this time.

WHAT ARE THE RISKS OF THIS STUDY?

There is no physical risk involved in participating in this project. There is a small possibility that you may feel somewhat uncomfortable answering questions during the interview. Any time this happens you have the right to not answer the question.

The study will include the transmission of some information via email and beaming. Email and beaming transmissions cannot be guaranteed to be secure or error-free as information could be intercepted, corrupted, lost, destroyed, arrive late or incomplete, or contain viruses.

WHAT ARE THE BENEFITS OF THIS STUDY?

We do not know if you will benefit from being in this study. You will gain knowledge and experience related to using Excel, handhelds, and performing assessment. In the future, other people might benefit from this study because of the knowledge gained about the use of handheld technology by pre-service physical education teachers, and how this type of technology can be used to the greatest advantage.

WILL I BE PAID FOR PARTICIPATING?

You will not be paid for being in this research study.

WHO WILL SEE THE INFORMATION I GIVE?

The information you provide through your participation will be kept confidential to the extent permitted by law. Furthermore, to help protect your identity, the following measures will be taken:

1. Audio records of interviews and the focus group session (i.e., the audiotapes) will be kept in a secure place in the Sport Pedagogy Laboratory, Department of Nutrition & Exercise Sciences, Oregon State University.
2. All data (incl. the interview and focus group transcripts) will be kept in a secure place in the Sport Pedagogy Laboratory; Department of Nutrition & Exercise Sciences; Oregon State University.
3. Access to all the project data will be limited to the members of the research team (i.e. Hans van der Mars and Heidi Wegis).
4. To protect the identity of each participant in all documentations regarding this project (i.e., transcripts, manuscripts, PowerPoint presentations etc.), each will be assigned a pseudonym.
5. Any reference to the school name, community, its location, etc. will also be replaced with alternative names.
6. As noted above, ALL audiotapes with participant responses will be destroyed once all the audiotapes have been transcribed.

DO I HAVE A CHOICE TO BE IN THE STUDY?

If you decide to take part in the study, it should be because you really want to volunteer. You will not lose any benefits or rights you would normally have if you choose not to volunteer. You can stop at any time during the study and still keep the benefits and rights you had before volunteering. If you decide not to take part in this study, your decision will have no effect on the quality of instruction or care you receive in your classes.

You will not be treated differently if you decide to stop taking part in the study. In the interviews, focus group, or questionnaires, you are free to skip any questions that you would prefer not to answer. If you choose to withdraw from this project before it ends, the researchers may keep information collected about you and this information may be included in study reports.

WHAT IF I HAVE QUESTIONS?

If you have any questions about this research project, please contact: Heidi Wegis, 541-737-5321, wegish@onid.orst.edu, or Hans van der Mars, 480-727-1653, hans.vandermars@asu.edu.

If you have questions about your rights as a participant, please contact the Oregon State University Institutional Review Board (IRB) Human Protections Administrator, at (541) 737-4933 or by email at IRB@oregonstate.edu.

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

Participant's Name (printed): _____

_____ _____

(Signature of Participant) (Date)

Oregon State University - IRB Study #:3698 Approval Date: 8/27/07

Appendix E

Survey: Pre-service Teacher Attitudes Toward Handheld Technology
Adapted from Crowe & van 't Hooft, 2006.

Part I:

Please answer the following questions by putting a check mark next to the appropriate response or by filling in the requested information.

1. Gender: _____ Male _____ Female

2. Age: _____

3. I have been using handheld computers for _____ years.

4. Do you own a handheld computer? _____ Yes _____ No

5. Have you seen a handheld computer modeled in your classes?

_____ Yes _____ No

If so, for what? (Check all that apply)

_____ Attendance _____ Assessment _____ Quizzes

_____ Other (Please list) _____

6. During the last month, how often have you used a handheld computer for the following (check one answer per task):

Task	Never	Once or Twice	Weekly	Daily
Basic functions such as calendar, address book, to do list, and note pad				
Word processing				
Multimedia presentations				
Spreadsheet or database				
Drawing				
Internet Access				
Email				
Games				

Playing music				
Viewing pictures				

Part II:

For each of the following statements, circle the number that corresponds with your answer (5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, 1 = strongly disagree).

Statement	SA	A	N	D	SD
1. Handheld computers do not scare me at all.	5	4	3	2	1
2. I would like working with handheld computers.	5	4	3	2	1
3. Learning about handheld computers is a waste of time.	5	4	3	2	1
4. I do not feel threatened when others talk about handheld computers.	5	4	3	2	1
5. It wouldn't bother me at all to take handheld computer classes.	5	4	3	2	1
6. I'm no good with handheld computers.	5	4	3	2	1
7. The challenge of solving problems with handheld computers does not appeal to me.	5	4	3	2	1
8. I expect to have little use for handheld computers in my daily life.	5	4	3	2	1
9. Generally, I would feel OK about trying a new problem on the handheld computer.	5	4	3	2	1
10. I would feel at ease in a handheld computer class.	5	4	3	2	1
11. I think working with handheld computers would be enjoyable and stimulating.	5	4	3	2	1
12. I don't think I would do advanced handheld computer work.	5	4	3	2	1
13. I'll need a firm mastery of handheld computers for my future work.	5	4	3	2	1
14. I get a sinking feeling when I think of trying to use the handheld computer.	5	4	3	2	1
15. I am sure I could do work with handheld computers.	5	4	3	2	1
16. I would feel comfortable working with a handheld computer.	5	4	3	2	1
17. Anything a handheld computer can be used for, I can do just as well some other way.	5	4	3	2	1
18. I am not the type to do well with handheld computers.	5	4	3	2	1
19. I don't understand how some people can spend so much time working with handheld computers and seem to enjoy it.	5	4	3	2	1

20. I am sure I could learn a handheld computer language.	5	4	3	2	1
21. I can't think of any way I will use handheld computers in my career.	5	4	3	2	1
22. I think using a handheld computer would be very hard for me.	5	4	3	2	1
23. Learning about handheld computers is worthwhile.	5	4	3	2	1
24. Handheld computers make me feel uneasy and confused.	5	4	3	2	1
25. If a problem is left unsolved in a handheld computer class, I would continue to think about it afterward.	5	4	3	2	1
26. I could get good grades in handheld computer courses.	5	4	3	2	1
27. I will do as little work with handheld computers as possible.	5	4	3	2	1
28. I feel aggressive and hostile toward handheld computers.	5	4	3	2	1
29. I do not think I could handle a handheld computer course.	5	4	3	2	1
30. I have a lot of self-confidence when it comes to working with handheld computers.	5	4	3	2	1
31. Figuring out handheld computer problems does not appeal to me.	5	4	3	2	1
32. Knowing how to work with handheld computers will increase my job possibilities.	5	4	3	2	1
33. Working with a handheld computer would make me very nervous.	5	4	3	2	1
34. Working with handheld computers will not be important in my life's work.	5	4	3	2	1
35. When there is a problem with a handheld computer problem that I cannot immediately solve, I would stick it out until I have an answer.	5	4	3	2	1
36. I do not enjoy talking with others about handheld computers.	5	4	3	2	1
37. Once I start to work with a handheld computer, I would find it hard to stop.	5	4	3	2	1
38. I will use handheld computers in many ways in my life.	5	4	3	2	1
39. It's important for me to do well in a handheld computer class.	5	4	3	2	1
40. Handheld computers make me feel uncomfortable.	5	4	3	2	1
41. I am more engaged in courses that require me to use handheld technology.	5	4	3	2	1
42. The instructors' use of handheld technology in my	5	4	3	2	1

courses has increased my interest in the subject matter.					
43. My school needs to give me more training on the handheld technology that I am required to use in my courses.	5	4	3	2	1
44. The use of handheld technology in courses has helped me better communicate and collaborate with my classmates.	5	4	3	2	1
45. Courses that use handheld technology allow me to take greater control of my course activities (e.g., planning, apportioning time, noting success and failure, assignments)	5	4	3	2	1

Appendix F

Journal Prompts

Journal 1

- What perception do you have about technology integration in physical education classes?
- Do you see any benefit to utilizing handheld technology in your classroom?
- Did you utilize handheld technology this week? If so, how? If not, why not?
- What are the gains and/or losses to your everyday living from using handheld technology?
- What are the gains and/or losses to your everyday living from NOT using handheld technology?
- Do you see the handheld computer modeled in your classes? By whom? How?
- Do you foresee yourself utilizing the technology during the upcoming week?
- Is there anything else you would like to share at this point about your experience with handheld technology? If so, please share your thoughts.

Journal 2

- Did you utilize the handheld technology this week? If so, how? If not, why not?
- Did you see the handheld computer modeled in your class this week? By whom? How?
- What difficulties are you having with the handheld computer?

- What is becoming easier for you to do with your handheld computer?
- Is there any specific type of handheld help/assistance you would like to have at this point?
- What templates, if any, have you designed to use with the PDA?
- Have you shared any of your materials (i.e., templates, games, documents, notes, etc.) with you peers? If so, what?
- Have you received any materials from your peers? If so, what?

Journal 3

- Did you utilize the handheld technology this week? If so, how? If not, why not?
- Did you see the handheld computer modeled in your class this week? By whom? How?
- Have you designed any type of document to use with the PDA?
- Have you had any discussions related to using the PDA this week? If so, with whom, and what was the basic topic of discussion?
- Do you have any ideas about other ways (i.e., not attendance) in which you could utilize the PDA in your school setting?
- Please comment on the progress of your use of the PDA.
- On a scale from 1-5, 1 being not at all comfortable and 5 being very comfortable, what is your comfort level with utilizing the PDA? What is the reason for the score you chose?

Journal 4

- Did you utilize the handheld technology this week? If so, how? If not, why not?
- Did you see the handheld computer modeled in your class this week? By whom? How?
- For how many classes are you using the handheld to take attendance?
- What difficulties, if any have you had in taking attendance with the PDA?
- Please comment on the progress of your use of the PDA.
- What would make things easier for you in trying to use the PDA for attendance purposes?

Journal 5

- What are your thoughts about the use of handheld computers in your physical education class?
- Do you see benefits to using the handheld computers? If so, what are they?
- Are there any problems with using the technology? If so, what are they?
- What would make it easier for you to implement the technology into your program?
- What is your motivation for using the technology in your physical education class?
- Do you use the technology in your life outside of physical education? If so, for what?
- Are you comfortable with using the technology for these purposes?

- What is your motivation for using the technology outside of physical education?

Journal 6

- By now you have completed your technology integration project. Reflect back over the last few weeks and describe what the process of integration was like for you. Think about how you used the PDA, the challenges you may have had, your likes and dislikes, any benefits you experienced, etc.
- Did utilizing the PDA energize you? Explain.
- Did utilizing the PDA in your classes affect your students in any way? Explain.
- Was the task of utilizing the PDA challenging? Why or why not?

Journal 7

- Since turning in your technology integration project, have you used the PDA in your class setting? Why or why not?
- As you think back over this term, describe one challenging aspect of using the PDA, and one uncomplicated aspect.
- Upon your using handheld technology in the future, what would you like to do differently? For what purposes do you see yourself using the technology?

Journal 8

- Comment on your PDA usage this week.
- Do you plan on using the PDA over break? If so, how?

- How prevalent is your discussion around using PDAs? With whom do you have these discussions?
- What discourages you from utilizing the technology?

Journal 9

- Did you use the PDA over winter break? If so, how? If not, why not?
- How do you foresee yourself using the PDA during winter term?
- Do you have any new ideas for using the PDA?

Journal 10

- Did you use the PDA last week?
- If you used the PDA, how and when did you use it? (every day, every class, OSU-SIGMA, MVPA, attendance?)
- Are there any difficulties you are experiencing with the PDA?

Journal 11

- Did you use the PDA in class this week? If so, how?
- What suggestions would you give to someone who was trying to use the PDA in his/her class?
- Is the PDA a useful tool? Explain your answer.
- What would encourage you to use the PDA more often in your classes?
- Are there any questions you have about the PDA that you would like to be discussed?

Journal 12

- How often are you using the PDA?

- What are you currently using the PDA for?
- Have you tried using the PDA to assess while someone else is teaching? Why did you choose to do this?
- Briefly describe your use of the PDA with the OSU-SIGMA project. Comment on ease of use, concerns, difficulties.
- At this stage in your development as a physical educator, if you were to get a job at this point in time, would you choose to use a PDA for any purposes during your teaching? If so, why and for what? If not, what are your reasons?

Journal 13

- Did you utilize the handheld technology this week? If so, how? If not, why not?
- Did you see the handheld computer modeled in your class this week? By whom? How?
- What is becoming easier for you to do with your PDA?
- Do you see any benefit to utilizing handheld technology in your classroom?

Journal 14

- Did you utilize handheld technology this week? If so, how? If not, why not?
- Describe your experience using handheld technology in your teaching.
- What factors (kinds of things) would affect your decision to use technology in your classroom?

Appendix G

Interview Questions

Interview 1

- What are your expectations in the use of technology (both generally and in physical education)?
- What is your perception of the handheld technology?
- What is your perception of technology use in physical education?
- What do you know about handheld computers?
- What have you done to expand your knowledge of its use?
- What do you like about the handheld computer?
- What do you dislike about the computer?
- Have you encountered any issues with your use of this device?
- How can you see this device being used in physical education?
- Do you plan on using this technology in your teaching?
- Is there anything that would discourage you from using this technology?
- Are there any changes you would like to see made to make it more useful?
- How confident are you about your knowledge and skills in integrating handheld technology in your future classes?
- What would encourage you to use this tool in your teaching?
- Did you notice any changes in your teaching as a result of using the technology?

- Can you describe your use of the technology? How often you used it? What it was used for?
- What was it like to use handheld computers in physical education?
- Did any changes occur in your attitude toward technology as a result of your participation in this project?

Interview 2

- What does the term “PDA Integration” mean to you?
- Does it mean anything different to you now than it did at the beginning of the study?
- Do you think this technology will improve your efficiency as a teacher? How so?
- Do you think the technology could help to foster learning in the student? Explain.
- Does using the PDA help to accomplish something that couldn’t be accomplished before without it?
- What are some obstacles you might face when using the PDA outside of school? In school?
- Explain whether you believe the PDA is a limitation or an opportunity? Both?
- Do you think computers are necessary in physical education?
- What can computers be used for in a classroom setting?

- Technology is included as one of the beginning teacher standards. Just knowing that it is included, what could you provide as evidence that you have met this standard? Same thing with Assessment.
- What are your thoughts on integrating assessment with technology?
- What are some things you would assess in your program?
- How is your knowledge of Excel? Can you create your own assessment templates? Have you created your own assessment templates?
- Now that you are done with the projects for your classes and for this project, what do you like about the PDA?
- What do you dislike about it?
- Have you had any technical issues with the device?
- What discourages you from using it?
- Would there be any changes you would like to see made to the device? To the Excel templates?
- Do you have any new ideas on how the PDA could be used in physical education?
- How is your confidence in integrating the technology into the classroom?
- What would encourage you to use the tool in your teaching?
- Does it matter to you if the school helps with the technology piece (e.g., having tech support, wireless capabilities, providing the equipment)?
- Did any changes occur in your attitude toward using the device as a result of the project?

- Did any changes occur in your teaching as a result of using the device?
    - Did it take away from anything in your teaching?
    - Did it add anything to your teaching?
- During the last set of projects this term, how often were you using it? What were you using it for?
- At this point in time, what would it take for you to use the PDA (either home or school)?
- If you were asked to do a tutorial on the use of a PDA, what would you make sure to include? What would be helpful to someone? What would have been more helpful to you?
- Think back over the entire project, what was the most challenging thing for you with the PDA?

Appendix H

Student Attendance Excel Template

Student Attendance & Class Citzenship

Legend Attendance	
	Present, On time & Dressed
T	Tardy
D	Dress demerit
A	Absent
AE	Absent-excused

1	Not following directions
2	Interrupting instructions
3	Language
4	Putdowns
5	

Period:
Grading Period

				Week 1								Week 2							
Day >>																			
Date >>																			
#	Last	First	ID	Att.	Cit.	Att.	Cit.	Att.	Cit.	Att.	Cit.	Att.	Cit.	Att.	Cit.	Att.	Cit.	Att.	Cit.
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
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18																			
19																			
20																			
21																			
22																			
23																			
24																			
25																			
26																			
27																			

Appendix I

Student Activity Level Assessment

Note: Will be modified to count the total number of students active, not assess individual students.

Microsoft Excel - Physical Activity Levels

C77 = =COUNT(C14,C18,C22,C26,C30,C34,C38,C42,C46,C50,C54,C58,C62,C66,C70)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	**Student Activity Level Assessment**									**Student Activity Level Assessment**					
2	**Date:**	10/17/02								**Date:**	10/17/02				
3	**Grade:**	5								**Grade:**	5				
4	**Student 1:**	Stephanie H.								**Student 4:**	Sarah W.				
5	**Student 2:**	Michele Q.								**Student 5:**	Mike B.				
6	**Student 3:**	Jessica T.								**Student 6:**	Allison L.				
7	**Activities:**									**Activities:**					
10	**MVPA=Moderate to Vigorous Physical Activity**									**MVPA=Moderate to Vigorous Physical Activity**					
11	(Walking or any activity that would require more energy than walking)									(Walking or any activity that would require more energy than walking)					
13	**Sample Number**		**Session 1**	**Session 2**	**Session 3**	**Session 4**				**Sample Number**		**Session 1**	**Session 2**	**Session 3**	**Session 4**
14	1	Stephanie H.	1	0	0	1		**1=Yes**		1	Sarah W.	1	0	0	1
15		Michele Q.	0	1	0	0		**0=No**			Mike B.	0	1	0	0
16		Jessica T.	0	1	0	1		**x=no observation**			Allison L.	0	1	0	1
17															
18	2	Stephanie H.	1	0	1	0				2	Sarah W.	1	0	1	0
19		Michele Q.	1	0	1	0					Mike B.	1	0	1	0
20		Jessica T.	0	1	1	1					Allison L.	0	1	1	1
21															
66	14	Stephanie H.	x	1	x	x				14	Sarah W.	x	1	x	x
67		Michele Q.	1	1	1	0					Mike B.	1	1	1	0
68		Jessica T.	1	1	1	1					Allison L.	1	1	1	1
69															
70	15	Stephanie H.	0	1	x	x				15	Sarah W.	0	1	x	x
71		Michele Q.	1	x	1	1					Mike B.	1	x	1	1
72		Jessica T.	0	0	1	x					Allison L.	0	0	1	x
73															
75	**TOTALS:**		**Session 1**	**Session 2**	**Session 3**	**Session 4**				**TOTALS:**		**Session 1**	**Session 2**	**Session 3**	**Session 4**
76	**Number of samples:**									**Number of samples:**					
77		Stephanie H.	14	15	9	11					Sarah W.	14	15	9	11
78		Michele Q.	15	13	14	13					Mike B.	15	13	14	13
79		Jessica T.	14	13	13	13					Allison L.	14	13	13	13
80	**MVPA**									**MVPA**					
81		Stephanie H.	8	9	5	7					Sarah W.	8	9	5	7
82		Michele Q.	10	11	11	6					Mike B.	10	11	11	6
83		Jessica T.	7	11	8	10					Allison L.	7	11	8	10
85	**Activity Level Percentage:**									**Activity Level Percentage:**					
86		Stephanie H.	57.14%	60.00%	55.56%	63.64%					Sarah W.	57.14%	60.00%	55.56%	63.64%
87		Michele Q.	66.67%	84.62%	78.57%	46.15%					Mike B.	66.67%	84.62%	78.57%	46.15%
88		Jessica T.	50.00%	84.62%	61.54%	76.92%					Allison L.	50.00%	84.62%	61.54%	76.92%

SAMPLE SHEET | PAL 1 | Period 1(Teacher Name) | PAL 2 | Period 2(Teacher Name) | PAL 3 | Period 3(Te

Appendix J

OSU-SIGMA Example Sheet

Fundamental Motor Skills

Throwing

PDA Screen visible

	Student	Level
1	Albers, Alicia	3
2	Alvarez, Sopl	4
3	Ball, Jamal	3
4	Bateman, Co	2
5	Baughman, N	3
6	Berkman, Jef	2
7	Brightman, S	3
8	Carusso, Sal	4
9	DeLander, Ka	1
10	Dishman, Bo	2
11	Hogan, Sylvia	3
12	Lee, Ben	4
13	Magano, Mar	3
14	McGregor, M	2
15	Mensch, Kev	4
16	Nady, Ellen	2
17	Peters, Karl	3
18	Rodriguez, A	4
19	Sanchez, Rau	3
20	Simon, Carly	4
21	0	
22	0	
23	0	
24	0	
25	0	
26	0	
27	0	

4 - Opposition Throw

3 - One-sided - Homolateral throw

2 - Arm only - No foot movement

1 - Two-handed Push

4 - Opposition Throw

3 - One-sided - Homolateral throw

2 - Arm only - No foot movement

OSU SIGMA
Scale of Intra-Gross Motor Assessment
Developed by Loovis & Ersing

Two hand push	*Arm only, no foot movement*	*One-sided/ homolateral*	*Opposition Throw*
Less Mature			*More Mature*
LEVEL I	**LEVEL II**	**LEVEL III**	**LEVEL IV**
The child throws the 6" ball in the direction of the examiner and demonstrates the following behaviors in two out of three trials: a. uses a two-handed push or throw with both arms in unison, b. no twisting of the upper body.	The child throws the tennis ball in the direction of the examiner and demonstrates the following behaviors in two out of three trials: a. uses a single-handed throw with the arm swinging in a sidearm (right to left or vice versa) motion, and the direction of swing is either downward or flat, b. twists upper body backwards to side of throwing arm during backswing then forward to side opposite throwing arm during throw, c. no movement of feet.	The child throws the tennis ball in the direction of the examiner and demonstrates the following behaviors in two out of three trials: a. uses a single-handed throw with the arm swinging in a sidearm (right to left or vice versa) motion, and the direction of swing is downward, b. twists upper body backwards to side of throwing arm during backswing then forward to side opposite throwing arm during throw, c. faces target and steps with leg on the same side as throwing arm.	The child throws the tennis ball in the direction of the examiner and demonstrates the following behaviors in two out of three trials: a. uses a single-handed throw with the arm swinging in a sidearm (right to left or vice versa) motion, and the direction of swing is downward, b. twists upper body backwards and shifts weight to foot on side of throwing arm during backswing, c. steps with leg on side opposite throwing arm, d. twists upper body forward after shifting weight to foot opposite throwing arm, e. snaps wrist in process of releasing ball.

Appendix K

Game Performance Template

SOCCER ***Cover***

Period:	3
Semester:	Fall
Teacher:	Harowitz

	Student name	Score
	Smith, Tommy	**4**
1	Humphries, Kevin	5
2	Malone,Jeb	4
3	Hart, May	5
4	Hernandez, Juan	3
5	Kinison, Sam	2
6	James, Jesse	1
7	Borders,Jake	4
8	Braza, Havier	3
9	Southers,Rhonda	2
10	Biden, Joe	1
11	Nardi, Bill	4
12	Armstrong, Neil	3
13	Elder, Katie	2
14	Moore, Mandy	1
15	Jones, Sarah	4
16	Parnavik, Jesper	3
17	Knight, Phil	2
18	Tank,Tiger	1
19	Svenson, Annika	4
20	Loren, Sophia	3
21	Guitierrez, Raoul	2
22	Guido, Isabel	1
23	Grossman, Pam	4
24	Jones, James	3
25	van het Geer, Bastian	2
26	Graff, Evan	1
27	Malone, Alyssa	4
28	Coffer, Courtney	3
29	Svetznova, Jack	2
30	0	1
31	0	4
32	0	3
33	0	2
34	Sarah	1
35	0	4
36	0	3
37	0	1
38	0	3
39	0	4
40	0	3
41	0	2
42	0	1
43	0	2
44	0	3
45	0	4

6. Mastery: Always delays opponents; Shadows teammates & opponent; Adjusts & anticipates the position/direction of ball and teammates.

5. Competent: Demonstrates some attempt to delay opponents & shadowing of teammate & opponent; Begins adjusting & anticipating the position or direction of ball & teammates.

4. Emerging: At times will attempt to delay opponents & shadow teammates & opponent; Mostly reactive in adjusting & anticipating the position/direction of ball & teammates.

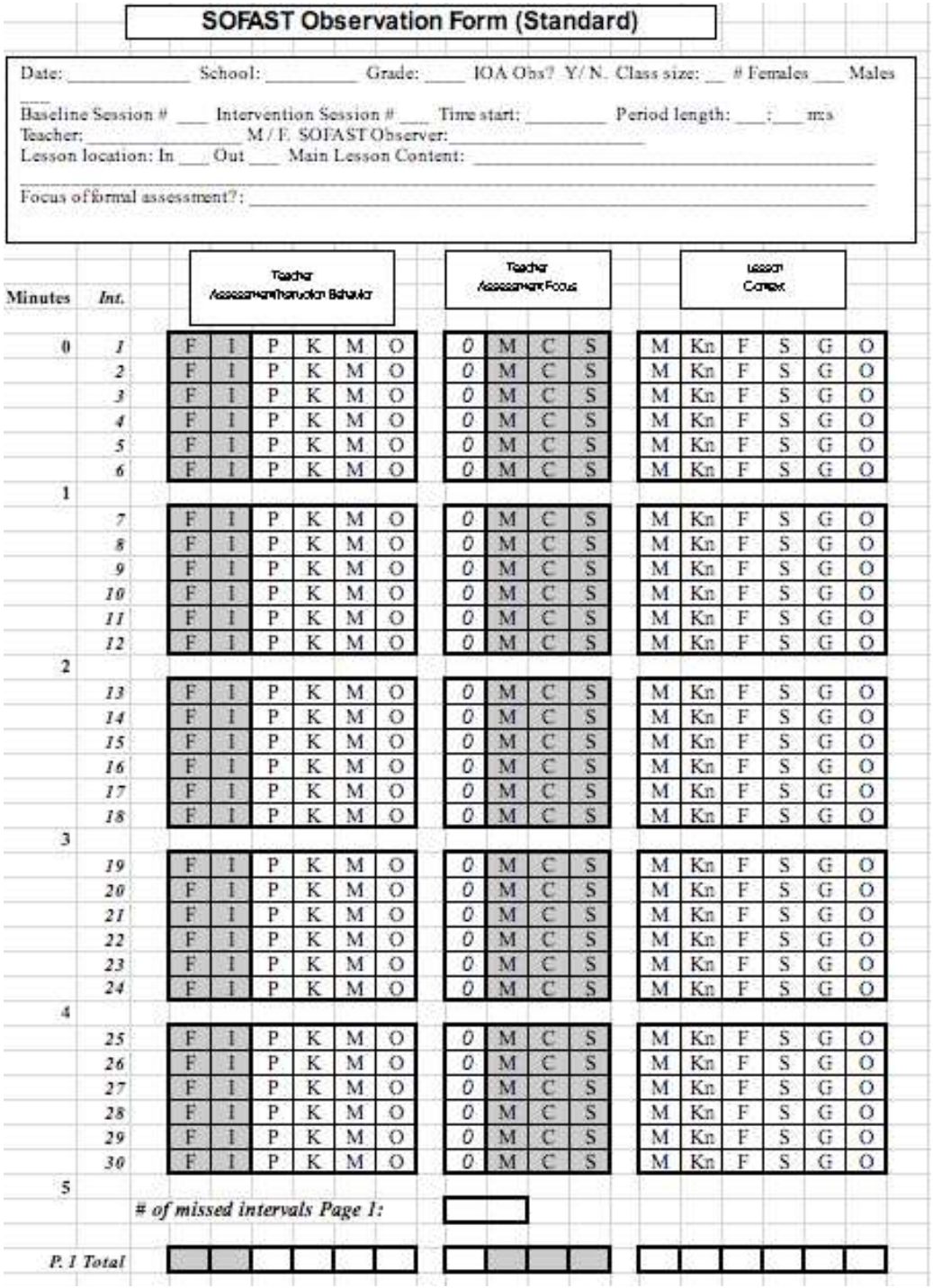
3. Coping: Few attempts to delay opponents & shadow teammate & opponent; Reactive in adjusting and limiting anticipation of the position or direction of ball &

2. Surviving: No attempt to delay opponents & shadow teammate & opponent; Does not adjust or anticipate the position/direction of ball &

1. Struggling: Only has eyes for the ball; Seeks out and moves to opponent with ball when teammates are already attacking ball (i.e., no shadowing); Does not see action around and away from ball.

Appendix L

SOFAST Observation Form



SOFAST Observation Form (Standard)

Date: _____ School: _____ Grade: ____ IOA Obs? Y/ N. Class size: __ # Females ___ Males ___

Baseline Session # ___ Intervention Session # ___ Time start: _____ Period length: ___:___ mn

Teacher: _____ M / F. SOFAST Observer: _____

Lesson location: In ___ Out ___ Main Lesson Content: _____

Focus of formal assessment?: _____

Minutes	Int.	Teacher Assessment/Intervention Behavior						Teacher Assessment Focus				Lesson Context					
0	1	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	2	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	3	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	4	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	5	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	6	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
1																	
	7	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	8	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	9	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	10	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	11	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	12	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
2																	
	13	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	14	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	15	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	16	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	17	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	18	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
3																	
	19	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	20	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	21	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	22	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	23	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	24	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
4																	
	25	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	26	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	27	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	28	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	29	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
	30	F	I	P	K	M	O	0	M	C	S	M	Kn	F	S	G	O
5																	
	# of missed intervals Page 1:																
P. 1 Total																	

Appendix M

Qualitative Coding Scheme

Code Index	Theme	Sub-Theme	Description
LP	Learning Process	Obstacles	Identified as obstacles related to first-year teaching experiences, dealing with fear and anxiety, and concerns about using the technology while teaching
		Time	Included references dealing with increased or decreased time to complete tasks
		Scanning	Relating to the process of scanning students in class. Included difficulties, ease, increasing or decreasing.
		Experience	Includes the experience of the mentor teacher with using a PDA. Also refers to participants' lack of experience with teaching, using technology, and performing assessments.
		Use of PDA	Includes information related to learning how to use the device, syncing, practice, new templates
ATT	Attitude	Comfort/Anxiety	Identified as statements pertaining to the participants' comfort and anxiety with using technology, and teaching.
		Interest	Includes statements related to lack of interest, increased interest, PDA as a novelty factor,

			initiative with device, confidence in using, and value of using.
		Ease	Identified how the ease of use affects participants' attitudes toward device.
ATT	Attitude	Students'	Reaction of students affecting attitude of participants. Also in reference to the number of students being assessed – may be a motivational or discouraging factor.
		Mentor	Use of, modeling of, and promotion of the PDA by the mentor teacher, and its effect on the participant.
TECH	Technology	Device	Contained information pertaining to the hardware (size, weight, syncing), the operating features (battery, letter recognizer, keyboard, navigation commands, buttons).
		Alternatives	Potential alternatives to using the device. These included a Tablet PC and paper/pencil.
		School	Contained comments related to the technology of the school where placed.
		Obstacles	Related to the device itself, limitations of the technology, limitations of the school, issues with batteries and memory.
		Excel	Identified through comments related to worksheets, formulas, preset templates, and rubrics.

Appendix N

Z-scores for Individual Survey Items in Each of the Four Factors

Table 2 Wilcoxon Test Statistics for the PTATHT Survey Handheld Computer Comfort/Anxiety Factor (1, 4, 6, 9, 12, 14, 15, 16)

Comparison	Item							
	1	4	6	9	12	14	15	16
Pre – Mid	-1.633	-.816	-2.333*	.000	-1.511	-1.342	-1.134	-1.414
Mid – Post	-1.134	-1.414	.000	.000	-.707	.000	-.816	.000
Pre – Post	-1.414	.000	-2.333*	.000	-1.414	-1.342	-1.000	-1.000
*p < .05								

Table 3 Wilcoxon Test Statistics for the PTATHT Survey Handheld Computer Comfort/Anxiety Factor (18, 22, 24, 28, 30, 33, 40, 41)

Comparison	Item							
	18	22	24	28	30	33	40	41
Pre – Mid	-.816	-1.342	-1.414	-.577	-.577	-.577	.000	-1.656
Mid – Post	-1.414	-.577	-.577	-1.414	.000	-.447	-.577	-.816
Pre – Post	-1.300	-1.414	-.577	-1.732	-.577	-1.414	-1.000	-1.300
*p < .05								

Table 4 Wilcoxon Test Statistics for the PTATHT Survey Handheld Computer Liking Factor (2, 7, 11, 19, 25, 27)

Comparison	Item					
	2	7	11	19	25	27
Pre – Mid	-2.121*	.000	-1.890	-.447	-.816	-.577
Mid – Post	-.577	-1.732	-.577	-.378	-.447	-1.414
Pre – Post	-2.070*	-1.342	-1.414	-.816	-.577	-1.732
*p < .05						

Table 5 Wilcoxon Test Statistics for the PTATHT Survey Handheld Computer Liking Factor (31, 35, 36, 37, 42)

Comparison	Item				
	31	35	36	37	42
Pre – Mid	-1.342	-1.518	-.272	-2.041*	-1.089
Mid – Post	-.577	.000	.000	-1.857	-.577
Pre – Post	-1.414	-1.890	-.447	-1.732	-1.414
*p < .05					

Table 6 Wilcoxon Test Statistics for the PTATHT Survey Handheld Computer Usefulness Factor (3, 8, 13, 17, 21)

Comparison	Item				
	3	8	13	17	21
Pre – Mid	-1.000	-1.732	-1.414	-.477	-.577
Mid – Post	-.577	.000	-.816	-1.342	-.577
Pre – Post	-1.414	-1.732	-.816	-1.518	.000
*p < .05					

Table 7 Wilcoxon Test Statistics for the PTATHT Survey Handheld Computer Usefulness Factor (23, 32, 34, 38, 44)

Comparison	Item				
	23	32	34	38	44
Pre – Mid	.000	-1.000	-1.667	-1.089	-1.732
Mid – Post	-.577	-.447	-1.000	-.577	-1.414
Pre – Post	-.577	-1.000	-1.342	-.816	-2.236*
*p < .05					

Table 8 Wilcoxon Test Statistics for the PTATHT Survey Learning Activities Related to Handheld Computer Factor (5, 10, 20, 26)

Comparison	Item			
	5	10	20	26
Pre – Mid	-1.633	-1.414	-.816	.000
Mid – Post	.000	-1.000	-.447	-.577
Pre – Post	-1.890	-1.000	.000	-.577
*p < .05				

Table 9 Wilcoxon Test Statistics for the PTATHT Survey Learning Activities Related to Handheld Computer Factor (29, 39, 43, 45)

Comparison	Item			
	29	39	43	45
Pre – Mid	-.447	-1.134	-.736	-2.070*
Mid – Post	.000	-.378	-1.000	-.447
Pre – Post	-.577	-1.732	-1.633	-1.179
*p < .05				