

Keys at Their Fingertips:
A Study Supporting Development of a Resource Package
For the Teaching of Touch-Keyboarding Skills
in Upper Elementary Classrooms Equipped with Portable Keyboards

by
Gay Wiseman

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“First things first...”

a maxim often expressed by my maternal grandmother

Hazel “Pat” Morris

in the way she lived her life

which inspired my educational shift in focus

from the power of computer technology for learning,

to the fostering of skills which underlie and enable that power.

~ • ~

This project is dedicated to Grandma, and to *all* my mothers.

I am greatly blessed by the love and support of wonderful mothers

who understand priorities.

ABSTRACT

This research project was designed to gather information to be used in the production of curriculum resources to support the teaching of touch-keyboarding in upper elementary classrooms. Portable keyboards (sometimes called “smart keyboards” or “mini-laptops”) have become available in recent years which both permit and necessitate a shift in instructional routines to foster student mastery of touch-keyboarding skills before the development of hard-to-break “hunt and peck” habits. The package of teaching materials produced as a result of this research is intended to serve as a companion piece to increasingly ubiquitous classroom keyboarding tools by providing touch-keyboarding curriculum support for elementary classroom teachers.

Methods used to gather data included: a literature review focusing on elementary level keyboarding instructional methods; a survey of upper elementary teachers to learn what curriculum components they would consider most important for keyboarding instruction support; and a focus group discussion involving both keyboarding instruction experts and classroom teachers who are already using these portable keyboarding tools with elementary students. From this data the researcher produced a curriculum package entitled *First Things first: A Teacher’s Guide for Integrating Touch-Keyboarding Instruction in the Elementary Classroom*. The package includes: lesson plans for the initial phases of keyboarding instruction; blackline masters for overhead transparencies, worksheets and practice materials; assessment and record-keeping tools; and a planning guide for integrating keyboarding practice into classroom routines through practical application of the skill in writing projects for other school subject areas.

The final research component was a pilot case study which looked at one implementation of this product in an elementary classroom situation. The case study resulted in recommendations for further research and testing of the product.

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CHAPTER 1

INTRODUCTION

Introduction

Young children are using computers increasingly, just as is the general population (Hoggatt, 1998). Many software programs used by children require them to enter text (Binderup, 1988). Some young children will write their very first words and sentences on a computer, and they will likely continue to use computer technology for writing throughout their schooling and beyond (Owsten and Wideman, 1997, p. 202). “There is no longer a question as to whether elementary school students will be using microcomputers. The question remaining is, ‘Will elementary school students be taught keyboarding so they can operate the microcomputers efficiently?’ ” (Sormunen, Adams, Berg, & Prigge, 1989, p. 6). This research project was designed to inform the production of resources to facilitate the teaching of keyboarding skills in upper elementary school classrooms.

All school children should be given opportunity and support for developing proper and efficient keyboarding techniques before they are required to produce any quantity of work on a word processor (Alaska Department of Education, 1991, p. 2; Bartholome, 1997; Boyce, 1997, p. 3, Gillmon, 1991, p. 15; Saskatchewan Education, 1991). This training should not be neglected until children have developed bad habits which will be very difficult for them to break (Alaska Department of Education, 1991, p. 34; Bartholome, 1997; Boyce (1997) p. 3; Frankeberger (1985) p. 41; McLean, 1995, p. 19, Saskatchewan Education, 1991). In many schools, this neglect is occurring (Binderup, 1988, p 41; Wetzel, (1985, p. 15). Some reasons are: (a) limited equipment due to its cost, (b) scheduling problems, (c) an inappropriate reliance on keyboarding tutorial software, and, (d) teachers unprepared for teaching the skill.

Equipment and scheduling impediments are connected; schools that do not have one computer per student must share the machines they do have. A common sharing pattern has been for computers to be located in a lab, with classes using the facility on a rotation schedule. This pattern can make it quite difficult to schedule and conduct the frequent, brief keyboarding sessions which experts recommend as most likely to be successful for skill building (Bartholome, 1997, p. 9; Boyce & Whitman, 1987, p. 11; Council for Keying Education, 1993; Gillmon, 1991, p. 14).

Another computer sharing pattern found commonly in elementary schools is the distribution of the equipment into classroom clusters. Several computers are located in each classroom where they are shared by students according to a regular rotation schedule or used as needed. In such situations, hands-on keyboard training sessions cannot be conducted with the entire class at once; either multiple training sessions must be held to accommodate all the students, or “dummy” keyboards (paper photocopies, or disconnected standard keyboards) are used by most of the students during training sessions. The class time required for repeating lessons with small groups is difficult to accommodate in the crowded elementary school program (Balajthy, 1986, p. 108; Olinzock, 1998, p. 24), and the use of dummy keyboards does not provide necessary kinesthetic feedback for students as they practice keystroking; experts do not recommend their use (Balajthy, 1986, p. 108; Boyce, 1997, p. 20; Boyce & Whitman, 1987, p. 10; Hering & Held, 1998, p. 3).

These difficulties are factors that may have given rise to the reliance on software tutorials for elementary keyboarding instruction that Russin describes (1995, p. 26). Though there are many software programs now available, some of them were designed with little regard to the pertinent principles of psychomotor skill development and can actually impede learning (Bartholome, 1997; Gillmon, 1991, p. 10); other programs are well-designed and do have a place in the keyboarding curriculum (Balajthy, 1988). But

no matter how well-designed, keyboarding instruction experts do not recommend complete reliance on any software program, especially during the critical initial learning period, because no software can (yet!) observe a learner's technique, eye direction, and posture (Bartholome, 1997, p. 7; Franklin, 1991, p. 124). Also, "software keyboarding instruction tends to measure short-term speed goals rather than the correct techniques needed to achieve long-term speed development" (Frankeberger, 1990, p. 14). Since keystroking technique, reliance on the sense of touch instead of vision, and correct body posture are the crucial foundations for ongoing skill development and prevention of keyboarding-related health problems, they should be the primary focus of the initial skill introduction period (Hering & Held, 1998). A live teacher, knowledgeable about both keyboarding technique fundamentals and the learning characteristics of the student group, will provide the best instructional environment for touch-keyboarding skill development (Alaska Department of Education, 1991, p. 3; Balajthy, 1988, p. 14). Bartholome, 1997; Franklin, 1991, p. 124; Boyce, 1997, p. 24; Council for Keying Education, 1993; Hering & Held, 1998, p. 1; McLean, 1995, p. 20; Morrison, 1986, p. 27).

Carolee Sormunen chaired a study in 1989, entitled *A National Study of Instructional Practices and Perceptions of Elementary School Teachers About Typewriting/Keyboarding*. Several of the recommendations resulting from that study are pertinent to the goals of this one. The researchers recommended in part that, "elementary schools should find ways to provide equipment on a one-to-one student ratio during times provided for keyboarding instruction" (Sormunen, et al., 1989, p. 51). Low-cost, battery-operated, durable, lightweight portable keyboards have recently become available which are ideal for use in classrooms. Text keyed on these units is displayed on an integral LCD screen, is automatically saved as long as needed, and can be uploaded to a computer (or, in some cases, directly to a printer) for editing, formatting, or for use in any other computer program. Since these portable keyboards have become available, the

equipment and scheduling constraints that have made elementary grade keyboarding instruction difficult to incorporate in the school program are diminishing. This project addresses the remaining needs for teacher preparation and appropriate instructional support materials. Most classroom teachers are not prepared to conduct training in keyboard skills (Balajthy, 1988, p. 4; Binderup, 1988, p. 31; Boyce, 1997, p. 14; Sormunen, et al., 1989, p. 40). This project will produce a prototype for materials to support classroom teachers in integrating keyboard skill training into their instructional programs using portable keyboards.

There are four important reasons for supporting and resourcing a classroom-based, teacher-managed model of keyboard skill training using portable keyboards:

1. This instructional model is highly cost-effective for schools (Barrett, 1994; Whitman & Martin, 1988). The use of inexpensive portable keyboards not only can provide all students with sufficient keyboard time in order to learn and use this vital communication skill, it also can prevent the time burden of text entry tasks from monopolizing the much more expensive complete computer systems a school owns. This frees that equipment for other kinds of uses. Also, students who touch-key efficiently can produce more work in less time, enabling them to get greater benefit out of all time they spend using any computer equipment.

2. This instructional model allows the best framework for skill development (Council for Keying Education, 1993, p. 14). Teacher-directed training as opposed to student self-directed learning using either books or software tutorials is the instructional model which recognizes the crucial importance of a human observer providing feedback and correction to students as the psychomotor skill foundations are built and reinforced (Morrison, 1986, p. 27). “Effective keyboarding instruction requires close monitoring and motivation by a knowledgeable instructor. This is most efficiently carried out in whole-class instruction in a room with sufficient electric typewriters or computers” (Balajthy,

1988, p. 41). A knowledgeable instructor will recognize and correct technique problems before they become habitual and limiting to future skill development. The classroom teacher is in the best position to create and maintain an environment in which ongoing skill development is the goal, rather than the completion of specific keyboarding tasks (Franklin, 1991, p. 124; Boyce, 1997, p. 14).

3. This instructional model fosters integration of keyboard skill development with the purposes for learning the skill. The physical and temporal separation of keying and word processing that characterizes lab-based or software-managed instructional models creates a detrimental impediment to the integral use of those skills throughout all the school subject areas (Saskatchewan Education, 1991).

Indeed, if initial training is to be reinforced effectively, the keyboard must be used in all curriculum subjects. As with any cross-curricular skill or dimension, it must be accepted as a responsibility of all staff members. This implies conscious acceptance of its worth as a life-skill for young people who will be living and working in a technological age, a recognition of its complexity, and a commitment to vigilance and supervision in the interests of the pupils' skill development. (Gillmon, 1991, p. 13)

4. This instructional model recognizes the crucial role of the classroom teacher in implementing an educational change. "When it comes to technology in education, you can create it, you can design it, you can produce it, you can legislate it. . . . But the bottom line is—the teachers are going to make it happen" (Goodloe, quoted in McIntosh, 1993, p. 3). The classroom teacher is with students daily and is therefore in the best position to continually monitor technique as skills are being developed and to tailor instructional patterns to the needs of individual students. The classroom teacher can weave appropriate keyboard uses regularly into assignments and projects arising from all curriculum areas so that skill development is ongoing and relevant. The classroom teacher can expect and require revision of word processed writing assignments as needed, which emphasizes quality and a process approach to writing (Balajthy, 1988, p. 41; Simic, 1994).

By the fourth grade, nearly all students have the attention span, the physical dexterity, the motivation, and the need for keyboarding skill all coming together (Boyce & Whitman, 1987, p. 2; McLean, 1995, p. 18); hence this project's objective to develop materials for use by teachers at the upper elementary grades, fourth through sixth. Postponing keyboarding instruction beyond that time will result in many students developing hunt-and-peck habits which will be very difficult for them to overcome (Binderup, 1988; Boyce, 1997, p. 2; McLean, 1995, p. 19).

In 1989, approximately 90% of elementary teachers reported that their teacher education programs had not prepared them to teach their students touch-keyboarding (Sormunen, et al., p. 47). Fourth grade teacher Diane Binderup, spoke for many of her colleagues when she wrote:

The problem is that most of us who teach in self-contained elementary classrooms never thought we would be called upon to teach something such as typing. That was an area reserved for a few high school and vocational teachers. Even though we are increasingly aware of the necessity to teach keyboarding, we haven't the faintest idea of how to begin! (1988, p. 31)

This project aims to provide support material to help upper elementary teachers bring touch-keyboarding instruction into the pattern of their classroom programs by taking advantage of the low cost availability and scheduling flexibility that portable keyboards provide. If elementary students are not taught to touch-key effectively and instead use those increasingly ubiquitous keyboards with improper technique, they will form rigid and persistent habits which will impede their future skill development (Waner, Behymer, & McCrary, 1992, pp. 27-28). However, if teachers implement effective keyboard skill training where and when their students need it, the lifelong advantage students will accrue through efficient use of computers will be well worth the effort on the part of all educators involved.

Problem Statement

Teachers in upper elementary grades lack an instructional plan and a package of appropriate tools and resources for teaching computer keyboarding skills utilizing low cost portable keyboards within the classroom setting.

Objectives

This project will result in a teacher-friendly, research-based package of information, teaching tools, and instructional resources for supporting classroom keyboard skill instruction in the upper elementary grades. The materials will be specifically designed for use with portable keyboards.

A pilot case study of one teacher's experience using the product to initiate keyboarding instruction will be conducted to identify areas of weakness both in content and in design. This will serve as a guide for further development of the package, and will also help to identify methods for more extensive and comprehensive testing of the product's effectiveness in future.

Research Questions

The following research questions will be explored in order to meet the project objectives:

1. What curricular components will upper elementary teachers expect to find in an instructional materials package for teaching keyboarding? Responses to this question will help determine the elements to be included.
2. How should this package be organized and structured so as to be most useful and accessible to teachers? Responses to this question will help determine the format of the package materials.
3. What do upper elementary teachers already know or believe about teaching keyboarding to students at their grade level? Responses to this question will focus the

literature review on areas where teachers express gaps in information.

4. What background information, specific teaching tools, and learning resources should be included in this package? Responses to this question will help determine the instructional content and teaching tools to be included in the package.

5. How effective is a prototype of the planned package when implemented in a classroom situation? This question will provide crucial feedback for further development.

Significance

There are several elements of social significance in this project. First, it will provide tools to help schools and teachers be responsive to evolving educational purposes relative to written communications. The use of the computer keyboard has become a fundamental communication skill for everyone (Hoggatt, 1998), and writing instruction adapted to the use of keyboards will better prepare students (Gillmon (1991).

Secondly, now that these economical portable keyboards are available, it is feasible and appropriate to make touch-keyboard training a priority for all children, not just for those whose families or school districts can afford expensive computers in high ratios. These keyboards can now be had at a cost of less than \$75 per student per year. The resource package produced as a result of this project is intended to serve as a companion piece to that equipment—a teacher's guide to integrating touch-keyboard skill instruction into any upper elementary classroom so equipped.

Thirdly, the use of low cost portable keyboards for keyboard training and student writing tasks has an important side benefit for schools. By removing those time intensive tasks from the time schedule for the other computer systems that a school may have, different uses can be made of those other computers. This can maximize the benefits from a school's computer investment (Barrett, 1994).

The classroom use of portable keyboards has the potential to spread the benefits of computer technology to many more students than is possible with reliance on expensive multipurpose computers alone. As with most technological innovations in schools, the key to successful implementation is in the active involvement and enthusiastic participation of teachers (McIntosh, 1993). This project aims to support such teacher involvement.

Assumptions

These assumptions underlie this study:

1. The skill of keyboarding will continue to be important for students, even though voice recognition and pen-based input technologies will undoubtedly improve (Bartholome, 1997; Highland, 1997; McKenzie, 1993; Wiggs, 1993).
2. Bad habits of keying input are difficult to break, and become a limiting factor in later computer use (Bartholome, 1997; Boyce, 1997; Condon, Hoggatt & Weston, 1989; Frankeberger, 1985; McLean, 1995, p. 19; Waner, Behymer & McCrary, 1992).
3. Most elementary classroom teachers have never received methods instruction for teaching touch-keyboarding (Balajthy, 1988, p. 40; Becker, 1994; Davison & Kochmann, 1996; Office of Technology Assessment, 1995; Sormunen, et al. 1989).
4. Software packages designed to teach keyboarding are only helpful to the degree to which a student is individually motivated to learn, and can effectively evaluate his or her own performance; for most students, and for the most effective use of school time, active teacher involvement in the instruction is crucial to success (Alaska Department of Education, 1991, pp. 11, 29; Balajthy, 1988, p. 41; Bartholome, 1997; Franklin, 1991, p. 124; Gillmon, 1991, p. 10).

Scope and Limitations

The intent of this project was to provide teachers with resources to facilitate bringing keyboard training within the scope of the typical upper elementary classroom program now that technological innovations have made this financially feasible for most schools. As technological advances continue however, the specifics of implementation in classrooms will also continue to evolve, perhaps limiting the usefulness of the materials produced by this study. The project takes place in a time of rapid technological change. Even 2 or 3 years from now, the importance of this topic may be minimized by increasing uses of other data input methods. However it is unlikely that keyboard input will become entirely unimportant for the time period during which current elementary school students will need to produce written work (Bartholome, 1997; Highland, 1997; McKenzie, 1993; Wiggs, 1993). It is probable that strong keyboard skills, once developed, will continue to be of benefit to students throughout their lives.

Though keyboard training can certainly take place in a school computer lab setting, this project focuses on training conducted within the classroom by the classroom teacher (rather than by a specialist) for reasons discussed in the introduction section.

The survey of upper elementary teachers covered a geographical area of Placer County California, and the results may not be generalizable to other populations. Also, the low response rate on the teacher survey (21%) may not constitute a large enough sample to permit generalizations.

Measures of student learning and skill development were not taken during the trial implementation of the program. Rather, the pilot case study looked only at one teacher's experience using the materials to initiate a program of keyboarding skills instruction. This data should not be considered conclusive or generalizable. It was intended to identify areas for improvement as a part of the design process. The instructional plan and package of materials produced during this study must be considered a work-in-progress; its

rigorous and objective testing in a variety of settings was not possible within the time frame of the project.

Some items in the teacher survey may have been too narrowly defined, limiting the value of the responses.

Definition of Terms

Automaticity: the level of keyboarding skill at which no conscious thought to keystroking technique is required; the practitioner is able to devote his or her attention to the content of the writing, rather than procedure (Gillmon, 1991, p. 10).

Carpal tunnel syndrome: a serious nerve disorder of the wrists, sometimes caused or aggravated by keying with the wrists under stress (National Institute for Occupational Safety and Health, 1997; Perkins, 1992, p. 29).

Home row, home keys: the middle row of keys on the *universal*, or *QWERTY* keyboard. Eight keys in this row provide the base positions for the fingertips in the touch method of keyboarding (Bartholome & Long, 1985, p. 5).

Hunt-and-peck: an inexact and inefficient method of keying which relies on visually locating the keys, and usually only employs two fingers and the thumb of each hand.

Improper technique (see also hunt-and-peck and proper technique): keyboarding habits which are likely to result in a low cap on typing speed improvement, and/or are prone to cause physical injury over time such as repetitive stress syndrome, carpal tunnel injury, neck strain, eye strain (Perkins, 1992).

Keyboarding, keying, typing: terms are used interchangeably in this document to refer to the process of entering data into a computer system by means of a keyboard

Portable keyboard: a stand-alone, platform-independent keyboard which serves as a text entry device, storing many pages of text which can later be transferred to a

computer via a cable or an infrared connection for subsequent editing, formatting and printing. Sometimes these are called *smart keyboards* or *mini laptops* though they must be distinguished from laptop computers because they do not run standard software; they are for text entry only (though some models do offer features such as spell check and typing timers). They are lightweight and durable because they have no moving parts. Most run on AA batteries (with a recyclable option) so no cords or power plugs are required. They are easy to transport in a backpack, or to store in a student desk.

Proper technique: a method of keyboarding which both minimizes the risk of physical injuries to the practitioner and opens a path to lifelong improvement in keying speed and accuracy through skill application.

Psychomotor skill: a skill that requires a combination of mental and muscle activity.

QWERTY keyboard: the keyboard layout in most common use today, sometimes called the “universal” keyboard. It is named for the first six letters in the layout.

Touch-keyboarding, touch-keying; touch-typing: these terms are used interchangeably to refer to keyboarding technique which relies on kinesthetic feedback; the practitioner strikes the keys by feel, needing little reliance on visual access to the keys or fingers (Sormunen et al., 1989, p. 4).

Upper elementary level: 4th, 5th, 6th grades in the United States education system.

Writing process (or process writing): an approach to written composition that recognizes phases for the different activities of writing such as idea generation, drafting, revising, editing, and polishing.

CHAPTER 2

LITERATURE REVIEW

A Brief History of Keyboarding Instruction

There has been a great quantity of research conducted and published on methods of keyboarding instruction since the “Type-writer” was first marketed as a commercial product by the Remington Company in 1873. It took about 25 years from the introduction of the typewriter for the *touch method* of typing to become the accepted standard. In 1888, Frank McGurrin had demonstrated in a typing contest the superiority of the skill he’d developed by typing with all 10 fingers, rather than just two or four. McGurrin was the first touch typist; he had memorized the keyboard layout and he gained great speed advantage by being able to keep his eyes on the copy material while typing, rather than having to look back and forth from copy to keys. His proficiency was a convincing demonstration of the concept of learning to type by training the fingers to memorized key locations (Gentner & Norman, 1984, p. 71).

Prior to the mid 1980s when personal computers became prevalent in homes and schools, typing skills were rarely taught before the secondary school level. High school students took typing courses for personal needs, to prepare themselves for college, or, most often, as preparation for office employment. Typing classes were offered through a school’s business department, and the curriculum included instruction in the proper formatting of typical business documents.

Early personal computers relied entirely on keyboard input, and skill at typing became important for many more people. At this time however, computers were still primarily a tool for scientific and business users. It was not until the mid 1980s and the innovation of mouse input technology that the number of computer owners and users began to skyrocket. The advantages of computer technology in many spheres of human

endeavor, ranging far from scientific data analysis and business applications, became increasingly apparent. When personal computers began to be linked together through the Internet in the 1990s, they rapidly became a primary communication tool, and the keyboard remains the most efficient text entry device for Internet communications.

During the 1930s, several landmark studies demonstrated the value of typewriting for learning in the elementary grades (Haefner, 1932; Wood & Freeman, 1932). Interestingly, in those studies, touch-keyboarding skill was not taught in conjunction with typewriter use. Students were left to their own devices and typed in a hunt-and-peck manner. Yet these controlled studies did provide evidence that the use of typewriters helped advance student learning accomplishments in many subject areas. Despite the learning advantages, the difficulties of high equipment cost, equipment space requirements, and typewriter noise in the classroom are reasons why the innovation did not take hold at that time.

When computers became common in elementary classrooms in the 1980s, they were not initially used for word processing. Most were used for software which required single key responses. The interest in training elementary students to use computers as a tool for language development revived when word processing technology became widespread in the late 1980s, and gained momentum throughout the 1990s. It has become quite apparent that the student who cannot operate the keyboard efficiently is unable to take full advantage of the power of computer technology (Wetzel, 1985). Middle and high school teachers have noted that it is very difficult to teach touch-keyboarding to students who have established hunt-and-peck habits through word processor use prior to keyboarding instruction. The need to train students in touch-keyboarding has shifted down to the elementary school level, not only to enable students to become efficient computer users earlier and to gain the learning advantages from keyboard use which have been demonstrated in numerous studies, but also to prevent the development of bad habits

which will impede learning, and which may result in physical health problems over the long term.

Though many educators have recognized the need for earlier touch-keyboarding instruction (Binderup, 1988, p. 31), it has proven just as difficult to actually implement it using computers as it was in the 1930s with typewriters. Implementation problems are diminishing, however, as new equipment is developed which can make keyboard access ubiquitous and convenient.

Computer technology and production are now approaching a level where it is both possible and practical to provide portable computing for all students. The potential of this paradigm shift from computer learning as a center-based activity, to computer learning as an integrated part of everyday life is likely to be, in its importance for education, akin to the shift from the early paradigm of reading as an activity that took place only in centers of learning, to reading as an activity that has become an integral part of everyday life. (Fung, Hennessy, & O'Shea, 1998, p. 110)

The practical and physical impediments to elementary school keyboard training have diminished, and new technologies will likely continue to minimize the difficulties of implementation. The focus is shifting to instructional methods, particularly as relate to elementary grade students. The next section presents a synthesis from the literature on how best to train children to touch-key.

Characteristics of Effective Keyboarding Instruction in Elementary Grades

One purpose of this review was to identify crucial characteristics of effective elementary keyboarding instructional programs. Though one can find controversial views on all aspects of keyboarding instruction methodology, most of the literature emphasizes the importance of the following elements:

1. Scheduling of the initial instructional course is “just in time”. It takes place just before students have regular need of the skill, so that they will not have developed bad technique habits prior to receiving instruction, but not before they are developmentally

ready, and also not before they will have sufficient ongoing and regular need and opportunity to use the skill (Alaska Department of Education, 1991, p. 2; Balajthy, 1986, p. 86; Bartholome, 1997, p. 4; Boyce, 1997, p. 3; Hering & Held, 1998; Jackson & Berg, 1986, p. 8; Waner, Behymer & McCrary, 1992).

2. Instruction periods are brief but frequent (Alaska Department of Education, 1991, p. 34; Gillmon, 1991, p. 14; West, 1986, p. 83). West refers to this scheduling pattern as distributed versus massed. “A law of diminishing returns applies; the longer stroking skills practice is continued without change to a different activity, the less there is to show for the added practice” (West, 1986, p. 83).

3. Initial introduction of the letter and major punctuation keys is covered as quickly as possible, so that students begin practice using real language patterns early in the learning process (Alaska Department of Education, 1991, p. 2; Balajthy, 1986, p. 198; Condon & LaBarre, 1990, p. 31; McLean, 1995, p. 27-28; Ober, 1996; West, 1974, p. 6).

4. The instructor understands how psychomotor skills are developed, is able to demonstrate (model) proper touch-keyboarding technique, and to recognize technique problems needing correction (Alaska Department of Education, 1991, p. 17; Boyce, 1997; Boyce & Whitman, 1987, p. 5; Hering & Held, 1998; McLean, 1995). Boyce & Whitman state that it is not absolutely crucial that the elementary grade keyboarding instructor be personally skilled in touch-keying (1987, p. 5), but he or she must understand and be able to articulate why proper technique is important, and must be able to recognize technique pitfalls and correct them immediately so that they do not impede student progress. McLean says that, at the minimum, the instructor should “be competent at keyboarding, have some understanding of the developmental needs of elementary school children, and understand the rudiments of keyboarding instruction” (1995, p. 20).

Instructors should recognize the three phases of skill development common to all psychomotor learning. The first phase is cognitive, in which the rules are learned; the

second phase (the longest phase) is a gradual process of building association between the thought stimulus and the muscle action; the third phase is when a stimulus gives rise to the appropriate muscle response automatically, requiring no conscious thought (Gillmon, 1991, p. 10; Olinzock, 1998, p. 25). Consistent monitoring of student technique is crucial to prevent skill slippage until automaticity is attained. (Boyce, 1997).

5. Evaluation and assessment of learning progress emphasizes technique over speed or accuracy. Proper technique lays the foundation for ongoing skill development and is important for physical health maintenance. (Hering & Held, 1998, Hoggatt, Mann & Mastin, 1988; Perkins, 1992). This is the main reason why the active involvement of a knowledgeable instructor is crucial during the early learning period. “Evaluation must focus on correct technique, the critical teaching/learning component of beginning keyboarding, through observation of students *as they key*” (Jackson & Berg, 1986, p. 11).

6. Motivational incentives are connected conceptually with the goals for the class (Hoggatt, Mann, & Mastin, 1988, p. 39). Some keyboarding instructors make the point that motivation is not an issue when teaching elementary students to key.

There is a difference between teaching adolescents and fourth-, fifth-, and sixth-graders. The elementary school children are eager to learn—they like using a computer—and they want to be accurate. Motivation in the elementary school is not a problem. (Morrison, 1986. p. 27)

Providing incentives (such as simply allowing students to print some of their practice exercises, allowing them time to type letters to friends or heroes, and awarding certificates of competence in keyboarding skill at a special ceremony) can be helpful motivators with elementary grade students. But, “the best motivation is an enthusiastic teacher!” (Alaska Department of Education, 1991, p. 37). “The teacher’s genuine desire to see his or her students succeed is a powerful motivational technique” (Schade, 1999, p. 38).

7. Instruction is individualized (McLean, 1995, p. 36). One way some teachers do

this is to use a student's own handwriting speed as their initial touch-keyboarding speed goal, rather than an arbitrary words per minute standard (Miller, Smith, Fidanque, & Sullivan, 2000, p. 11; Wetzel, 1985, p. 16).

Keyboarding Ergonomics and Physical Health Concerns

The increasing prevalence of physical injuries and lasting disabilities caused by such seemingly simple motions as keystroking and mouse-clicking has necessitated instruction in physical health issues related to computer use as part of keyboard training. (National Institute for Occupational Safety and Health, 1997). "At every stage of their instruction, students must be taught to practice and maintain proper finger, hand, wrist, arm, and body position in order to remain healthy and productive" (Ober, 1993, p. 37). The importance of establishing proper touch-keyboarding technique is not only to assure keyboarding productivity; it is important for the prevention of repetitive motion injuries (Hering & Held, 1998). "There is mounting evidence that alignment of the keyboard with the edge of the desk so that the wrists are not resting on any surface will ensure that wrist problems are less likely to develop" (Boyce, 1997, p. 20).

The Literature Review as Foundation

Information gathered from this review of literature on keyboarding instruction identified key concerns which should be addressed in any keyboarding curriculum. It also identified specific topics to be addressed in the subsequent focus group discussion. The curriculum package produced as a result of this research project was built on the foundation provided by this analysis of the published work of others in the field.

CHAPTER 3

METHODS

Overview of the Methods

Several research methods were used to determine the form and content of a product that would likely be both useful and actually used in implementing keyboard skills instruction with portable keyboards in upper elementary classrooms. In addition to a review of literature, these other methods were employed: a written survey of a geographic sampling of upper elementary classroom teachers; a virtual focus group discussion involving both keyboarding instruction experts and classroom teachers who teach keyboarding to their own students; a content analysis of commercial resources for classroom keyboarding instruction; and a pilot case study of one teacher's use of the prototype product.

Written Survey

Teachers of upper elementary grade students were surveyed to determine these things: (a) what resources they consider to be most important in a keyboarding curriculum, and, conversely, what resources would they not make use of, even if they had them; (b) what form and organization of the product would be most useful to them; (c) what attitudes and beliefs they hold about keyboarding instruction in general, keyboarding instruction methods, and the skill's importance for their own students; and, (d) the current status of keyboarding instruction at their schools.

Participants and Process

The sample population was geographically-based; all 4th, 5th, and 6th grade public school teachers in the region of Placer County, California, east of the city of

Rocklin, were requested to participate through an invitation sent to school principals. A prior phone contact with the school office was made to confirm the name and mailing address which should be used for sending the materials to each principal. This phone call also ascertained the number of teachers at the target grades in each school for whom survey forms would be provided. An information letter to the principal describing the project, a response postcard to be returned by participating schools to the researcher, and the actual survey instruments were then mailed to each principal for distribution at the school site. These items are included in Appendix A. Teachers were also provided with a postpaid pre-addressed return envelope and were asked to mail their survey forms back to the researcher within one week of receiving them.

Survey Instrument

The survey instrument, designed to take less than ten minutes to complete, consisted of one page with items on both the front and back. It was tested by four elementary teachers outside the sample population; all four of the testers completed the entire survey in either seven or eight minutes. A note attached to the instrument asked teachers in the sample population to give priority to the items on the first side if they did not have time to respond to all questions.

These types of items were included, presented in the order of their importance to the study:

1. A list of possible resources and tools for teaching keyboarding, which respondents were asked to prioritize. There was an option to add items to the list, and a request that they line through any items on the list they would *not* use even if provided.
2. A multiple choice question about the preferred format of those resources.
3. A section of opinion statements, for which the respondents were asked to indicate agreement, disagreement, or no opinion. Respondents were requested to write in

additional information to clarify their responses if they wished, and space was allowed for such commentary.

4. Multiple choice questions about whether and how keyboarding is currently being taught in their school. Though this last question was not identified as a research question in the project proposal, it was asked in order to provide context that might illuminate other responses made in the survey.

Virtual Focus Group

This Internet-enabled variant of a focus group discussion brought together, via the medium of email, a roughly equal mix of keyboarding instruction experts and upper elementary teachers, all of whom had some experience teaching touch-keyboarding to elementary school students using portable keyboards. The purpose of the discussion was to identify elements which should be included in a resource package for teachers who are new to teaching the skill, or who are new to the use of portable keyboards for classroom keyboarding instruction. Questions addressed these topics:

1. Teacher preparation for initiating a program of keyboarding instruction.
2. How keyboarding “fits” in the classroom program at the upper elementary level.
3. Physical health matters related to keyboarding in general, portable keyboards specifically.
4. Traditional and alternative keyboarding instructional methodologies suitable for elementary students using portable keyboards.
5. Keyboarding skill assessment—importance, methods, and tools.
6. Methods for helping hunt-and-peck typists learn to touch-key.
7. Error correction instruction.
8. Peer monitoring of technique.

9. Classroom management routines and tips for using portable keyboards.

Participants were encouraged to bring up relevant matters not introduced by the researcher, so other topics did enter the dialogue as well. The questions asked of the group are provided in their entirety in Appendix B.

The Participants

The researcher invited participation for this phase of the study from a database of 72 individuals who were identified during the literature review process. They were all

- authors of contemporary published work in the field, or,
- authors of Web sites or curriculum material on keyboarding instruction, or,
- authors of significant contributions to internet listserves or discussion groups on keyboarding instruction topics, or,
- recommended by others as experts in the field, or,
- recommended by others as active practitioners of elementary level keyboarding instruction using portable keyboards.

An email address was obtainable from the source of the reference for 28 of these potential participants. These people were sent an email message which described the project and invited their participation. The text of this invitation message is included in Appendix B . Since the focus group was to be conducted entirely via email technology, this means of soliciting participation screened out any persons who were not using this medium and whom, therefore, would not be able to participate even if they were willing and qualified in all other respects.

The initial invitation message described the study process and the time commitment that would be expected of participants. It also asked potential participants to reply to questions about their amount of experience with each of several qualification factors, the grade levels they had taught, the approximate total numbers of students they

had taught, as well as their own willingness and ability to participate. These questions were asked in order to provide the researcher with quantitative data regarding the collective experience of the group, and also to provide a basis for ranking the participants if more than twelve individuals met the minimal qualifications. Just eleven qualified respondents replied to the invitations indicating their ability and willingness to participate, so the ranking system was not required and was not implemented.

The Process

The focus group discussion took place over the period between September 24, 1999 and October 15, 1999. The researcher posed a series of five questions, one at a time, via email messages. Participants were requested to email their responses to the researcher within three days of receiving each question. The researcher then compiled a summary of the responses and shared it with the group before posing the next question. Comments and discussion on prior questions and responses were encouraged throughout the discussion period.

Participants' identities were not known to each other. Email messages were sent out with the researcher's own address in the "To:" line, and all the participants' addresses listed in the "Bcc:" (blind carbon copy) address line. Each individual's comments remained anonymous throughout the discussion, since they were sent to the researcher before being shared with the group in the form of the summaries. This moderated discussion process was used to prevent any possibility of unhelpful or distracting comments from detouring the discourse from its purpose.

At the conclusion of the dialogue, the researcher used spreadsheet software to collate and tally comments made on each topic discussed. A narrative description of the data is provided in Chapter 4.

Content Analysis

This research component was intended to provide teachers and school decision-makers with information on keyboarding instruction tools and resources which might supplement the resource package produced as a result of this project. The researcher used the World Wide Web to identify some current sources of portable keyboards and keyboarding curriculum material. Software tutorials for keyboarding instruction were not included in this analysis because most software requires a full computer system, and cannot be run on the portable keyboards with which this project is concerned. Some recent models of portable keyboards do provide keyboarding tutorial software as an option. This option is noted in the list of features for those models, though the quality of the software has not been reviewed.

The following data was gathered for each portable keyboard identified: (a) cost per student per year (determined by dividing the price per machine when purchased in a quantity of 25, divided by the number of years covered by the manufacturer's warranty); (b) type of power source; (c) list of features beyond the basic text entry and uploading capability; and (d) supplier contact information.

The following data was gathered for several keyboarding curriculum products suitable for classroom use with portable keyboards: (a) cost of purchasing the program for a class of 25, (b) supplier contact information, and (b) a point rating. Points were assigned by the researcher for each of the following characteristics which the literature review and focus group research components had identified as crucial features of effective instructional programs:

1. Quick introduction of all the letter and major punctuation keys, followed by extensive practice involving typical grade level language patterns.
2. Effective presentation of posture and technique fundamentals
3. Emphasis on technique over speed or accuracy.

4. Appropriate content and presentation for students in the upper elementary grades.
5. Motivational incentives pertinent to learning goals.
6. Inclusion of material on physical health concerns relative to keyboarding.
7. A pattern of brief, frequent lessons.

No attempt was made to be exhaustively complete in identifying and comparing all available models of keyboards and curriculum materials. The purposes of this analysis were to provide information that would enable potential users to recognize features they should compare when considering a purchase, and also to provide contact information for suppliers.

Pilot Case Study

After the literature review, the teacher survey, and the focus group discussion had been completed, the researcher produced a touch-keyboarding curriculum package based on information gathered during those research phases. This prototype package, entitled *First Things First: A Teacher's Guide for Integrating Touch-Keyboard Training in the Elementary Classroom*, was then subjected to a pilot case study as a usability test. This was intended to provide feedback both on the instructional content of the materials and on its organizational and design features.

The design of the case study specified that the subject teacher meet these criteria:

1. Must be currently employed as a 4th, 5th, or 6th grade teacher in a school geographically near the principal researcher so that interviews could be easily arranged.
2. Must have little or no experience teaching keyboarding.
3. Must have access to a class set of portable keyboards for student use during the case study period.

4. Must be in a position to initiate a program of keyboarding instruction during the time period required by the study.

A teacher who met these requirements was recommended by a colleague in the Sacramento region *Computer Using Educators* affiliate group. That potential subject was contacted via email. She agreed to participate, obtained the support of her school administration, and signed the consent statement (included in Appendix C) on February 4th, 2000, when the project materials were delivered to her by the researcher. The identity of the subject will be held confidential by the researcher as promised in the consent document, but is available to the Walden University project committee for verification purposes as may be required.

As part of the consent process, the subject agreed to: (a) spend a minimum of one hour reviewing the materials prior to initiating the program of instruction; (b) make notes about any errors found in the materials, of questions which might arise while reviewing the package, and of the amount of time spent preparing for instruction; (c) become comfortable with the operation of the portable keyboards to be used by students during the program; (d) initiate touch-keyboarding instruction using the materials; and (e) meet with the researcher on two occasions at a consensual time and place for interviews of approximately 30 minutes duration.

The data collected in the case study was of these types:

1. Answers to questions asked by the researcher in the two interviews. (The interview questions are included in Appendix C.)

2. Descriptions of the subject's ability to correctly demonstrate various touch-keyboarding techniques.

2. Descriptions of the ease or difficulty with which the subject located various parts of the package when requested.

The subject was provided in advance with a form for keeping notes while reviewing the materials (“Reviewer’s notes”, included in Appendix C). This form also described the tasks the subject would be asked to demonstrate for the researcher.

Summary

These data gathering methods, taken together, were intended to provide the researcher with the a design blueprint for a touch-keyboarding curriculum package for the elementary classroom. The written survey of teachers was employed primarily to gather information about the form and organization of the product that would be most useful to its intended users. The focus group discussion was employed to determine the informational content that should be included in the product, adding the perspective of active practitioners, familiar with the features of the new portable keyboards, to the information synthesized from the relevant literature on keyboarding instruction. The content analyses assembled data on current models of portable keyboards, and on currently available teacher-directed keyboarding curricula, as additional resources for users of the product. Once the prototype curriculum package was created, the pilot case study was employed as a usability test.

CHAPTER 4

RESULTS

Results from the Teacher Survey

Survey instruments were sent to the principals of 19 schools identified in initial phone calls as willing to participate. The total number of 4th, 5th and 6th grade teachers at these 19 schools equaled 151. Of this potential sample population, 32 teachers returned completed surveys, for a response rate of 21%. All of these respondents completed both sides of the survey instrument.

Teachers' Preferences for Keyboarding Instruction Resources

In the first section of the survey, teachers were asked to imagine that their school had decided to implement keyboarding instruction for all students at their grade level and had acquired portable keyboards for each student in that grade. They were asked to choose five items from a list of 14 resources which they thought would help prepare them to begin implementing keyboarding instruction with their own students during the subsequent school term. Space was provided for respondents to list additional resources they would find helpful. Next, teachers were asked to line through any of the listed items which they would not use even if they were provided. Finally, they were asked to identify the one item which would be most useful to them if they could only have one.

Figure 1 illustrates the collective responses to this portion of the survey. Each resource item is listed on the left, as it was described in the survey instrument. The length of the white portion of the bar to the right of the axis indicates the number of teachers who selected that item as one of their five choices. A shaded portion at the far right end of a bar indicates the number of teachers who prioritized that item as the one they would choose if they could only have one. The solid bar to the left of the vertical axis shows the number of teachers who lined out the item, indicating they would not use the item even if

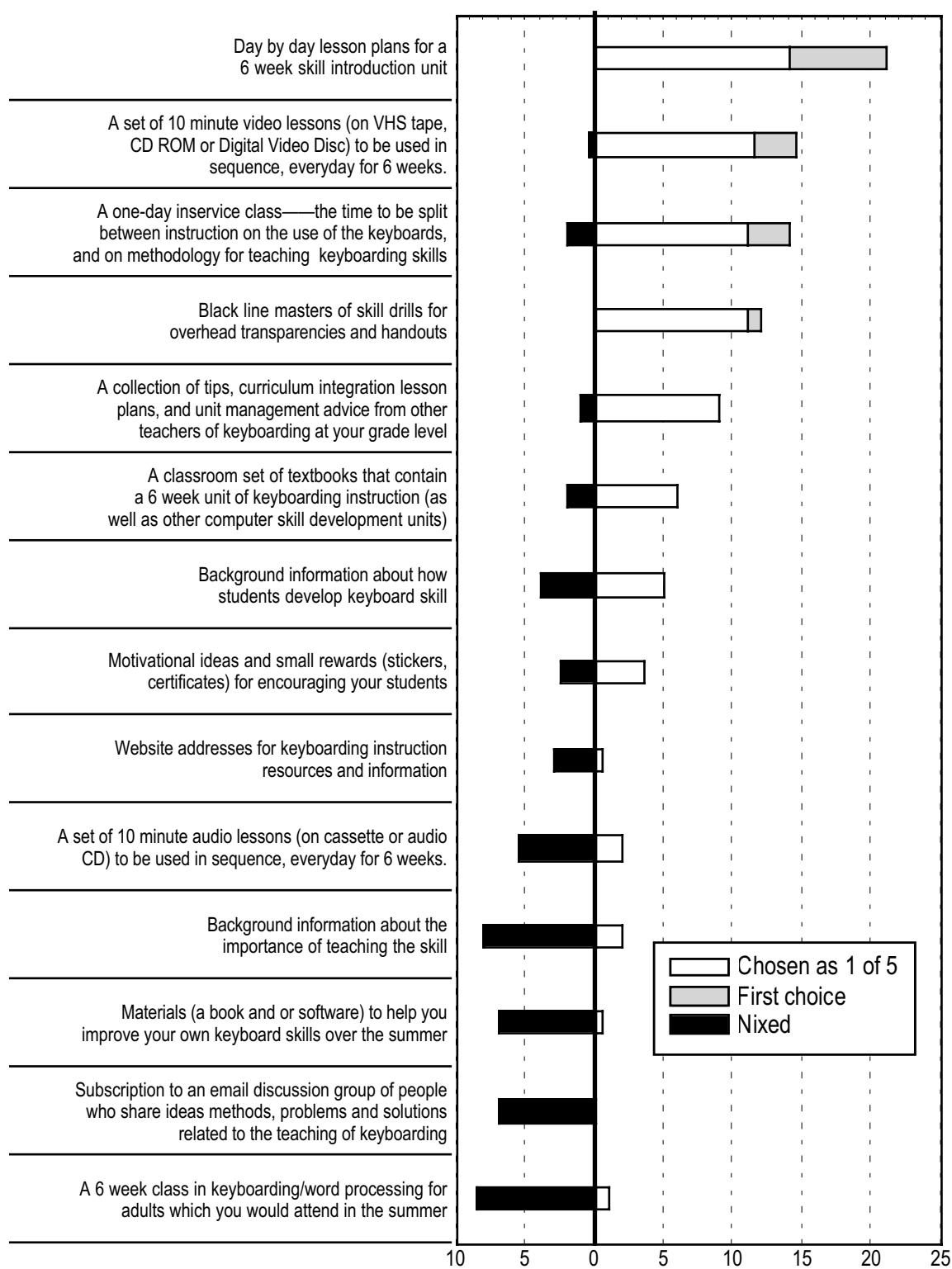


Figure 1. This chart depicts the sampled teachers' preferences for touch-keyboarding instructional resources. The dark vertical line is the axis.

it was provided to them.

Items which were written-in by respondents are not depicted in Figure 1 but are listed here, just as written:

1. a specialist to teach this class (ha ha—joke)
2. a shorter keyboarding class—say 3 weeks—would be more practical for me
[Marks on the form indicate this teacher is referring to the length of the class for adults, rather than the length of instruction for students.]
3. guide for grading or computer-generated scoring
4. a qualified instructor!
5. set grade level expectations & overall goals
6. competencies?
7. computers that all work

Teachers were next asked to select which of three formats for keyboarding instructional materials they would prefer. No option for suggesting other possible formats, or for modifying those listed, was explicitly given in this item, which may limit the usefulness of the data. The breakdown of responses is shown in Table 1.

Table 1

Teachers' Preferences Regarding the Format of Keyboarding Instruction Materials

Format Preference	Total	Total
Binder organized with tabbed sections	21	66%
CD ROM with printable files (including audio or video lesson segments for classroom presentation)	3	9%
Set of floppy discs with printable files, and a preprinted description of the contents with index to the disc files	8	25%
Total	32	100%

Teachers' Opinions on Keyboarding Instruction Topics

The next section of the survey asked teachers to express opinions about aspects of keyboarding instruction. Respondents were asked to indicate agreement or disagreement with each of nine statements; they were asked to leave an item response space blank if they had no opinion about it. 32 teachers completed this portion of the survey. The statements and responses are depicted in Figure 2.

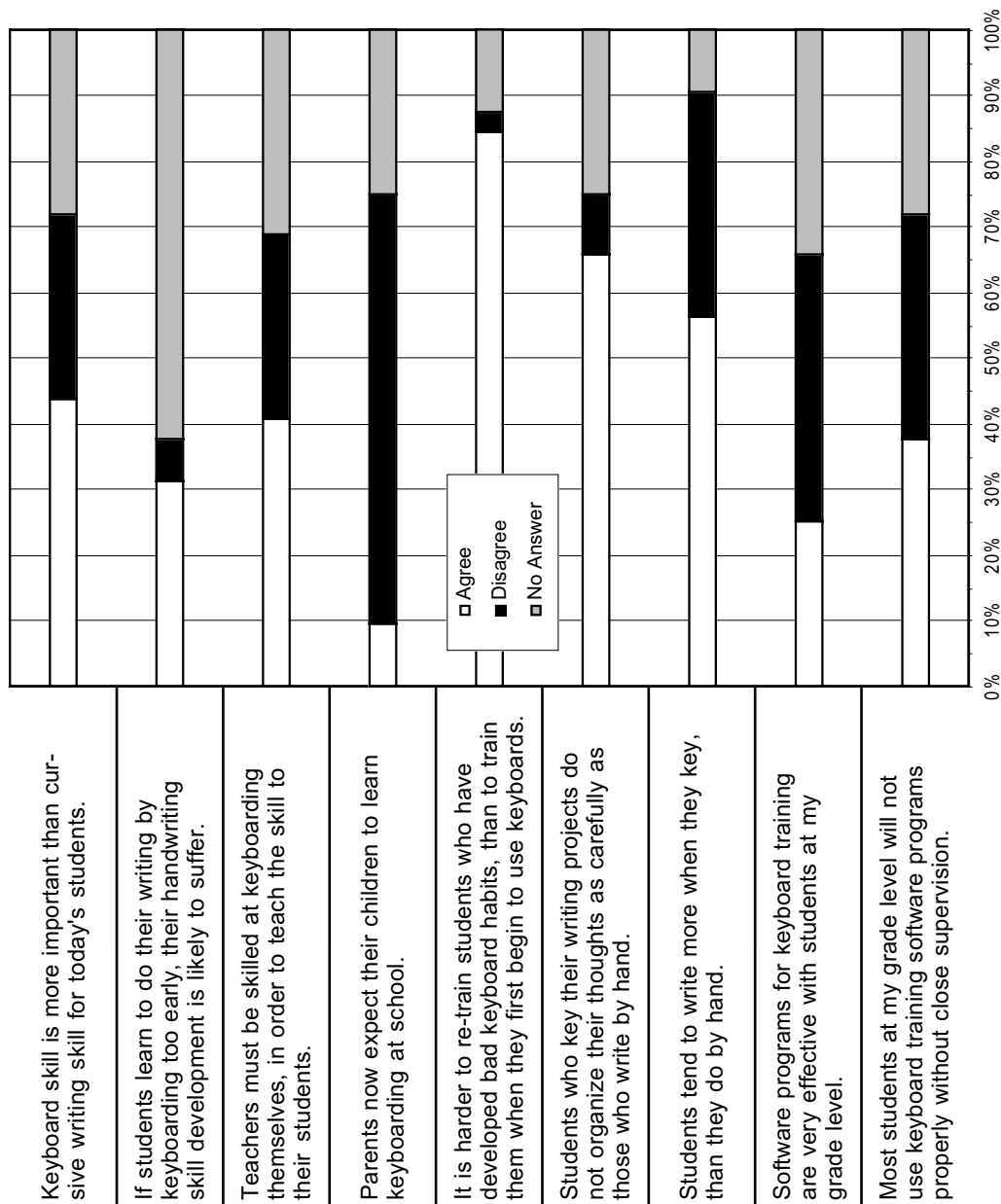


Figure 2. Results from the opinion portion of the teacher survey.

Results from the Virtual Focus Group Discussion

The full text of the questions posed to the focus group is in Appendix B. The data from the discussion presented here is organized according to the list of topics as was described in Chapter 3. Each section recounts the data which addressed that topic, whether it came from a direct response to the related question or at some other point in the discussion. The group participants are referred to by code numbers to preserve anonymity.

Teacher Preparation for Keyboarding Instruction

The first question asked whether teachers who do not personally touch-key can effectively teach the skill to their students, and if so, what preparation, background information or support materials they should have. Eight of the eleven group members responded to this question. All but one said that a teacher who does not touch-key personally can effectively teach the skill, but they emphasized that training is necessary. “I am familiar with a great number of situations like this—in all cases, the teacher without mastery of touch-keying was as effective as those who did have mastery.” (VFG expert #2, email, September 26, 1999).

The one dissenting opinion focused on the term *effectively*. That person made the point that teachers who are required to teach keyboarding will lack a crucial enthusiasm, even if they do receive training. “The teacher may be able to teach the class, but not ‘effectively’ in my opinion.... Teaching keyboarding should be done by a teacher who is enthused about the skill, and is able to do the skill well” (VFG expert #3, email, September 26, 1999). This respondent recommended that specialists be employed to teach keyboarding.

Other group members responded to that point of view by asserting that classroom teachers not only can teach the skill, but they are the best people to teach their students keyboarding. These points were made in their responses:

- Classroom teachers are used to teaching beginning skills of all kinds to students at their grade level; keyboarding shouldn't be considered exceptional. "Teaching keyboarding is a challenge, but no more so than teaching them to do anything else. Actually it's easier than many things that we teach. It's full of rote memory/practice and really involves no higher level thinking skills" (VFG expert #5, email, October 12, 1999).

- The classroom teacher will be on hand to provide the necessary follow up monitoring of technique after the initial instruction period. Ongoing, consistent technique monitoring is crucial until automaticity is attained, and the classroom teacher is in the best position to provide that routinely (VFG expert #9, email, September 27, 1999).

- A teacher who is not personally skilled in keyboarding can turn that deficiency into an instructional positive by modeling the learning process for students. One teacher pointed out that the learning process is basically the same for people of all ages, that students are motivated by the idea that they are learning an adult skill such as keyboarding, and that by learning along with her students she was more empathetic to their struggles.

I was able to anticipate points when frustrations would peak or discouragement set in. I regularly kept my students updated on my own typing speed and accuracy so they could see that it went up, down, and developed plateaus just as theirs did. (VFG expert #8, email, September 26, 1999)

- Two people mentioned that teachers with poor skills can be highly effective in motivating their students to learn, because they understand on a personal level the need for better skills, and also understand how important it is to develop a foundation of proper technique which will allow for ongoing skill development (VFG expert #11, email, September 25, 1999; VFG expert #2, email, September 27, 1999).

Recommendations for the training a teacher should have before teaching keyboarding emphasized that it should impart an understanding of the importance of proper technique. Specific approaches for learning about technique ranged widely however. Several recommended self-training to touch-key using a software tutorial (*Type*

To Learn, and *Typing Tutor* were mentioned specifically); others stressed the importance of having a live teacher to model, observe, and correct technique during the learning process; one person recommended enrollment in a graduate level methods course; several recommended keyboarding instruction workshops available to teachers as inservice training (a program mentioned specifically is offered by Learning Concepts Institute of Eugene, OR.); one person recommended observation of skilled keyboarders; one person recommended the guidance provided in the *Elementary/Middle School Keyboarding Strategies Guide*, published by the National Business Educators Association. Several people mentioned that it is important for teachers to understand how psychomotor skills in general are developed; they stressed that teacher training should include that information.

Two keyboarding textbooks designed for elementary age students (*Paws Presents Computer Keyboarding, 2nd Edition*, published by South-Western Publishing Co., and *I Can Keyboard*, published by Glencoe/McGraw-Hill) and two software programs (*Type To Learn* from Sunburst, and *Typing Tutor*, from Simon & Schuster) specifically designed for this age group were recommended. Both of the texts are out of print, but both of the software programs are currently available. One complete keyboarding curriculum package which includes texts, software, assessment material, and an instructional video was also recommended (*Almena Keyboarding*, currently marketed under the name *Typin's Cool*, and published by Typin's Cool of Ottawa, Ontario, Canada).

Accommodating Keyboarding Instruction Within the Classroom Program

The second question asked respondents to explain how keyboarding instruction can be fit into the crowded elementary school program. Nine of the eleven group members responded to this question.

Most of the respondents said that time should come from the Language Arts/ Writing curriculum, because that is where the most time benefits will be gained once

keyboard skills are established. One teacher elaborated, pointing out some side benefits of keyboarding instruction that are especially relevant to the Language Arts curriculum:

Keyboarding should be a part of the language arts program as much as learning to print or write in cursive is. Whatever time is used up learning to keyboard at the beginning of the year is more than made up for by the end of the year. I have found that as students learn to keyboard, they begin to pay more attention to spacing between words and sentences in their handwriting. Margins and paragraph indentations also become more apparent. . . . They begin noticing formatting conventions in various print and electronic media. As students use more word processing, spelling tends to improve as spell checkers will repeatedly highlight a misspelled word. Having to choose between several choices repeatedly tends to help more visual students memorize spelling of their more commonly misspelled words. (VFG expert #8, email, October 4, 1999)

Another teacher includes keyboarding instruction in spelling lessons.

When it became a part of my spelling lesson each week then I didn't have to find the extra time to put it into the day. I don't leave out anything, I just use a different method of teaching in that subject. This way I integrate [it] into the already existing curriculum. (VFG expert #4, email, October 6, 1999)

Others also mentioned that keyboarding instruction should be integrated within the other school subject areas. One person pointed out that the use of technology is now required under many state standards, and time spent learning to keyboard meets the technology content requirements (VFG expert #11, email, September 29, 1999). Another person wrote of a district that used Social Studies lesson time for initial keyboarding instruction since students would later use their keying skills for their reports in that subject area (VFG expert #7, email, September 28, 1999). Another suggested that all computer time should be designated for keyboarding instruction until students reach an acceptable level of skill (VFG expert #1, email, September 28, 1999). Several stressed that the time needed to establish keyboarding skill is not significant when considered in light of the time saved on writing tasks once skills are developed.

There was also this related comment:

Based on my experience, the real concern is not the time to teach the skill. The time to prepare to teach—is the real issue. Most of the teachers I have interviewed talk about the time it takes to “find” materials they need in teaching. (VFG expert #9, email, September 27, 1999)

The writer went on to say that a good inservice program for training teachers to teach keyboarding should provide all the necessary teaching materials and this would eliminate that problem.

Physical Health Concerns Related to Keyboarding

Eight of the eleven group members shared thoughts on this topic. All eight stressed the importance of proper posture when learning to keyboard. Several people pointed out that during the initial learning period, consistent positioning of the body is crucial to developing accuracy, and to instilling habits of body positioning that will not lead to later health problems such as carpal tunnel syndrome. “Keyboarding MUST be learned by using good techniques—including using a DESK (period)” (VFG expert #2, email, October 1, 1999).

Three of the eight said that once a student has learned to touch-key, occasional keying in unconventional positions for short periods (sitting on the floor, in a beanbag chair, or with the keyboard on the lap) is not a problem.

Two people said they teach their students exercises which will help them avoid repetitive stress injuries from keyboard use, and one of them includes instruction in maintaining vision health and in minimizing the spread of infections which may result from sharing of keyboards:

Midway through the first lesson I ask students to turn off keyboards, turn chairs towards me and lead them in several exercises to relax muscles such as letting arms hang straight down and shaking the hands loosely, single shoulder rolls, double shoulder rolls, slow neck rolls, slow twist and stretch from the waist/hips, and a seated waist curl til hands are flat on floor. They are then free to stretch as needed as long as keyboarding is primary activity. As they realize that these breaks are in their control, students complain less and within several sessions can type for 30 to 40 min. I also encourage them to change to a long distance visual

focus every 10 minutes or so for 20 or 30 seconds. We also discuss how many people use the keyboards and the importance of handwashing to prevent the spread of germs. (VFG expert #8, email, October 4, 1999)

Keyboarding Instruction Methodologies for Elementary Students and Portable Keyboards

The group was asked about the keyboarding instruction methods they had used with elementary students. By way of introducing this topic, several methods were briefly described. The first was the most common method of teaching the letter keys in which the home row letters are taught first, and the other letters are introduced a few at a time over six to ten weeks, with practice material each session limited to those keys already introduced. Alternative methods introduce the letters by *finger zone stairsteps* (diagonal columns of keys operated by a single finger), by rows, or by alphabetical order; these alternative methods typically introduce the letters at a faster pace, sometimes using mnemonic devices to help students remember the fingering patterns.

The group was asked to share any personal experience they have had teaching keyboarding with any of the alternative instructional methods, and if they had none, to share the pacing and sequence of letter key introduction with which they have had most success with elementary age students. They were then asked to recommend an ideal schedule for an introductory course of keyboarding, assuming equipment was available in the classroom for use any time.

Eight of the group members contributed their thoughts on this topic. Only one of them had personal experience with an approach other than the traditional one. That teacher uses a keyboarding curriculum package centered around a video program which introduces the keyboard layout and letter fingering in a single lesson (repeated several times as needed) using a mnemonic story to help kids memorize everything (VFG expert #4, email, October 6, 1999). That package also includes a variety of reinforcement and skill-building tools and strategies to be used after the video introduction.

All other contributors on this topic reported using the traditional pattern of letter introduction with the home row keys taught in the first lesson or two, and other letters introduced usually at the rate of two per lesson, though the order of introducing them varied. Several people recommended specific texts or curriculum material. One contributor was quite adamant that the most-used letters be introduced first, and he shared information on the frequency of letter use in “typical correspondence” (VFG expert #9, emails, October 5, 1999 and October 9, 1999).

Several people described the pattern they use in teaching each new letter, emphasized the importance of practice on the common letter combinations and words, and stressed the crucial role of frequent review of previously introduced letters.

One contributor suggested that one consideration for selecting an instruction methodology is a teacher’s preference. “Traditional introduction of keys is most well known and offers great confidence to the teacher. Other methods work. A key element in the learning process is teacher confidence” (VFG expert #2, email, October 6, 1999).

Recommended schedules for keyboarding instruction ranged widely among the six people who commented, from 20 minutes a day three times a week to 45 minutes every day. Five of these six respondents recommended frequent sessions, from three to five per week. The sixth reported she uses a 40 minute period once a week throughout the school year. Early in the school year the time is devoted entirely to keyboarding lessons; after students have learned all the keys, the time is split between skill-building drills and keying of spelling lessons.

Keyboarding Skill Assessment: Importance and Methods

Six group members made comments on this topic. These six had quite a range of different opinion and experiences. One teacher said she does not assess her students skill development at all; she says they are already “pretty competitive” and seem to have enough personal motivation to keep improving. She tries to “downplay the competition part and emphasize the improvement. Speed is not the goal. Comfort and ease with writing is. Keyboarding is a tool to help them with their writing” (VFG expert #5, email, October 12, 1999).

Another person agreed in part, but disagreed about the importance of emphasizing speed. “ ‘Grading’ for keyboarding is unnecessary and inappropriate. Building speed is vital” (VFG expert #2, email, October 11, 1999). This person suggested using a pattern of repeated, 15-30 second speed drills, from which students can easily assess their own progress.

Another person suggested assessing only for technique (rather than for speed and/or accuracy) during the first weeks of instruction. He recommended the use of technique assessment charts which are found in many keyboarding instruction materials, and which “allow for self-assessment, assessment by other students, and assessment by the teacher” (VFG expert #1, email, October 11, 1999). Another respondent to this topic said he finds that if timed writings are introduced before five or six weeks of instruction, students will “get frustrated with too much pressure and make too many errors” (VFG expert #7, email, October 11, 1999).

A different approach to assessment was provided by a teacher who gets her class to set their class goal, for instance: “completing 15 lessons at 10 wpm with 85% accuracy by June.” She also encourages individual students to set personal goals. She includes progress reports with students’ report cards, showing the lessons the student has completed with the speed and accuracy scores they’ve achieved (VFG expert #8, email, October 7, 1999).

Helping Hunt-and-Peck Typists Learn to Touch-Key

Four individuals contributed ideas on the topic of teaching keyboarding to students who have established hunt-and-peck habits prior to instruction. All respondents in some way emphasized that it is not instructional techniques that are needed to help this group. The challenge is a motivational one. Students must choose to change their habits, or any instructional techniques will be minimally effective. Once students choose to change, they must then accept some personal responsibility for the hard work the change will require.

Here's how one teacher explains all this to students:

I like to begin with a little history of how the "qwerty" keyboard came to be. Then I like to compare other skills like "finger counting" instead of memorizing math facts, printing to cursive writing, riding a tricycle as opposed to a two wheeler. All of the lower skill levels achieve the result desired, all take effort to move to the next level, and the second level is easier and more efficient once mastered. (VFG expert #8, email, October 10, 1999)

Here's how another respondent advises teachers to help their students take responsibility for their own learning:

Involve students in the process. Show them how to tape a piece of paper over the keys, and then place their fingers on the correct keys under the paper. Give them the responsibility for using this method until they believe they have mastered the touch method. Tell them that they are responsible for taping paper over the keys at any time in the future if they begin to look at the keys again. (VFG expert #2, email, October 11, 1999)

Another person suggested that the teacher should take an uncompromising attitude regarding technique, and not allow students to key if they persist in the hunt-and-peck method once touch-keying has been taught. He suggests that the teacher should simply turn off or remove the keyboard until the student agrees to use proper technique. He goes on to say that if students are reverting to hunt-and-peck habits, it may be because they feel under pressure to reach greater speed or accuracy levels. The teacher should place the greater emphasis on proper technique (VFG expert #8, email, October 11,

1999). Another teacher also recommended de-emphasizing accuracy with these students, until they establish correct fingering patterns:

I give them “permission” to make as many mistakes as they need in order to memorize the location of a letter. I think that the process of making mistakes is necessary to ultimately learn letter location. Once the accuracy is learned the speed can be easily increased. (VFG expert #8, email, October 11, 1999)

Error Correction Procedures During Learning Stages

Six people responded to a question which asked whether learners who are keying for a project (as opposed to practicing keyboarding for its own sake) should be taught to correct errors immediately when they notice them, or hold all corrections until after keying in the work. Three of the six respondents to this topic recommend that students be instructed not to correct errors when noticed, either because it slows the keying process or because it breaks concentration. One person points out that doing the corrections as a follow up step after completing the keying should be encouraged in part because it provides an opportunity for the student to look for and make other improvements to the writing as well as simple keying error corrections (VFG expert #9, email, October 11, 1999).

Two other respondents recommended the opposite approach. They stated that students should be taught to correct errors immediately upon noticing them; that efficient error correction should be taught as a fundamental technique. One stated that immediately after making an error is the most efficient time to correct it (VFG expert #2, email, October 11, 1999). The other emphasized that accuracy no longer means keying without making errors; it now includes noticing and correcting the errors that are made (VFG expert #1, email, October 11, 1999).

This expert provided this context for her opinion:

Historically in traditional classes using typewriters, students were taught to continue typing whenever an error was made and were penalized heavily for each error. This was due to the amount of time it took to correct an error (if indeed it was possible to correct). The limitations of traditional typewriters are no longer an issue with today's keyboarding equipment. (VFG expert #2, email, October 11, 1999)

The sixth respondent on this topic said, "As far as I'm concerned, WHEN they do it is not as important as THAT they DO it." (VFG expert #5, email, October 12, 1999)

Several respondents on both sides of this issue brought up the use of spell checkers as an error correction tool, and said they would advise students about when to correct errors based in part on whether or not a spell check feature was available to them.

Peer Monitoring of Technique

Three people spoke up on this topic, with three different opinions. One said that peer monitoring for keyboarding technique works quite well as one method of helping students develop their skills. She recommends that students pair up and one observes the other on a specific technique (such as eyes on copy, or fingers returning to home position) during a short timed drill. The observers then "describe what was good and what needed improvement" and then the two switch roles. "This is recommended because students learn how to identify specific areas of improvement, and they more readily adapt to using good techniques themselves" (VFG expert #2, email, October 11, 1999).

Another respondent said she does not recommend peer-monitoring, for two reasons: first, because it tends to interfere with the keyboarder's concentration which affects performance adversely; and second, because students are not always clear on proper technique and they may then advise their peers incorrectly (VFG expert #8, email, October 10, 1999).

The third respondent on this topic said peer-monitoring of technique and posture could be useful if done clandestinely from a distance so that the keyboarder was unaware of the other student's observation. Knowledge of being observed would make the

keyboarder too self-conscious and inhibit optimum performance which could be counterproductive to learning (VFG expert #9, email, October 11, 1999).

Classroom Management Routines and Tips for Using Portable Keyboards

Five people shared ideas about the systems they've used for labeling, transporting, and sharing portable keyboards, for blocking visual access to the letters on the keys, for keeping track of student files, for conducting keyboarding lessons, for motivating students, and for celebrating student achievements.

Results of the Content Analysis

Portable Keyboards and Touch-Keyboarding Curricula for the Classroom

The market in portable computing equipment is evolving rapidly, and findings from this research component will likely be obsolete by the time this work can be shared. For example, since this project was initiated in March 1999, there has been a major change in features offered by some of the portable keyboard manufacturers—an infrared uplink option is now available for many models which allows text to be transferred from the portable keyboard to a computer word processor (or directly to a printer) without the use of a physical cable connection. This significant advance in ease-of-use has changed the criteria for features that a school should consider when planning a purchase. Also, significant evolution in portable computer technology may make text-entry-only devices less of a bargain for school use soon, and other models may need to be included for the data to be most useful.

The tables which follow summarize the data from this analysis.

Model of Portable Keyboard	Cost each, based on purchase of 25	Years of warranty coverage	Cost per year under warranty	Power source	Compatibility	Features beyond basic text entry capability
AlphaSmart 3000	\$185	3	\$61.67	(3) AA batteries; auto-off feature to preserve battery life; nicad battery pack and AC adapter available.	PC/Mac/USB	Spellcheck; typing timer; cut/copy/paste within and between files; auto save of 12 files totalling approximately 100 pages; keyword search; non-English language support; password protection; alternate keyboard layouts supported (Dvorak, single hand). A
AlphaSmart 3000 IR	\$220	3	\$73.33	(3) AA batteries (auto-off feature to preserve battery life); nicad battery pack and AC adapter available.	PC/Mac/USB	Same as 3000, but infrared file transfer is included.
Intelligent Peripheral Devices, Inc. / 20380 Town Center Lane, Suite 270 / Cupertino, CA 95014 Sales: (888) 274-0680 • Fax: (408) 252-9409 • Email: info@alphasmart.com • http://www.alphasmart.com						
CalcuScribe "Uno"	\$220	3	\$73.33	(3) AA batteries; nicad battery pack and AC adapter available at extra cost.	PC/Mac, but cables are additional cost	10-key keypad and calculator functions incorporated in unit; lid/screen on hinge which folds down over the keyboard. Accessories available (additional cost); Infrared file transfer capability; case.
CalcuScribe "Duo"	\$260	3	\$86.67	(3) AA batteries; nicad batteries and AC adapter available at extra cost.	PC/Mac, but cables are additional cost	Same as Uno but offers an additional screen mode; 8 lines of 80 characters as well as the 4 lines of 40 characters that the Uno model supports.
CalcuScribe / 98 Cervantes Blvd., Suite #1 / San Francisco, CA 94123 (415) 923-1024 • Fax: 415-923-1025 • Email: info@calcuscribe.com • http://www.calcuscribe.com						
DreamWriter T100	\$209	3	\$69.67	Rechargeable battery system provides 8 hours power, requires 4 hours to recharge; Nicad battery pack and AC adapter available	PC/Mac	Spellcheck; some text formatting; installed typing tutor software; cut/copy/paste; search and replace; non-English language support; calculator; clock; math drill software installed; stores approximately 40 pages in up to 128 named files. Accessories a
DreamWriter T400/IR	\$245	3	\$81.67	Rechargeable battery system provides 8 hours power, requires 4 hours to recharge; Nicad battery pack and AC adapter available	PC/Mac	Spellcheck; some text formatting; installed typing tutor software; cut/copy/paste; search and replace; non-English language support; calculator; clock; math drill software installed; stores approximately 100 pages in up to 128 named files; password pro
NTS Computer Systems Ltd. / 11491 Kingston Street / Maple Ridge, British Columbia / Canada V2X 0Y6 (800) 663-7163 • Fax: (604) 465-3323 • Email: info@dreamwriter.com • http://www.dreamwriter.com/						

Figure 3. Portable keyboards reviewed by the researcher for cost and feature comparisons in April 2000. Contined on next page.

Model of Portable Keyboard	Cost each, based on purchase of 25	Years of warranty coverage	Cost/yr under warranty	Power source	Compatibility	Features beyond basic text entry capability
Laser PC-6	\$290	3	\$66.67	(4) AA batteries; Ni-MH rechargeable battery pack and AC adapter available at extra cost	PC/Mac (iMac interface is extra)	Case and AC adaptor are included in price; Dual screen modes (8 lines by 80 characters or 4 lines by 40 characters); cut/paste, some additional formatting options; stores up to 100 pages of text in up to 45 named files; spellcheck, typing tutor, calend
Perfect Solutions Software, Inc. / 15950 Schweizer Court / West Palm Beach, FL 33414-7128 (800) 884-1184 • Fax: (561) 790-0108 • Email: perfect@gate.net • http://www.perfectsolutions.com/notebook.htm						
QuickPad IR	\$189	3	\$63.00	(4) AA batteries; Ni-MH rechargeable battery pack and AC adapter available at extra cost	PC/Mac (iMac interface is extra)	Spellcheck; stores up to 70 pages of text in up to 250 named files in up to 10 folders; password protection for folders; non-English language support; calculator; price includes infrared send/receive capability and case. Accessories available (additional c
QuickPAD Technology Corp. / 620B Clyde Ave. / Mountain View, CA 94043 (800) 373-8181 • Fax: (650) 964-2426 • Email: sales@quickpad.com • http://www.quickpad.com/index_m.htm						

Figure 3. Portable keyboards reviewed by the researcher for cost and feature comparisons, April 2000. (Continued from previous page.)

Teacher-directed elementary keyboarding curricula	Cost, when purchased for a class of 25	All letter and punctuation keys are taught quickly	Technique & posture well presented	Technique is emphasized over speed and accuracy	Motivators are intrinsic	Text and graphics suitable for the age group	Ergonomic and health concerns are well presented	Brief, frequent lessons	TOTAL POINTS
<i>Diana King Method: Keyboarding Skills</i>	\$203	2	1	2	2	2	0	2	11
Comments:	Posture and technique illustrations are not included, but would greatly help the inexperienced trainer and learners. Encourages vocalization as an aid to learning. Teaches 2 spaces after terminal punctuation (inappropriate for word processor keyboarding).								
More information:	<i>Educators Publishing Service, Inc.</i> / 31 Smith Place / Cambridge, MA 02138-1089 (800) 225-5750; Fax: (617) 547-0412 • http://www.epsbooks.com								
<i>Herzog System (Elementary Fast-Track)</i>	\$325	2	2	1	2	1	2	2	12
Comments:	Price includes tactile "hub key sensors" for 25 stations, teacher pack, and a license to make 25 copies of the student book. Use of all CAPS in initial lessons is puzzling. Design of book and use of term "On Line" should be updated for modern students. Continues to teach 2 spaces after terminal punctuation and 5 spaces for indent (holdovers from typewriter keyboarding, inappropriate for word processors).								
More information:	<i>HERZOG Keyboarding</i> / 1433 E. Broadway / Tucson, AZ 85719 / Phone: (520) 792-2550; Fax: (520) 792-2551								
<i>Keyboard Success</i>	\$247	0	2	2	2	2	0	2	10
Comments:	Emphasizes individual goals based on handwriting speed. Many good features, but takes 29 lessons to introduce all keys.								
More information:	<i>International Society for Technology in Education</i> / 480 Chamelton St. / Eugene, OR 97401-2626 (800) 336-5191; Fax: (541) 302-3778 • Email: cust_svc@iste.org • http://www.iste.org								
<i>Touch Typing in Ten Hours!</i>	\$195	0	2	0	2	2	2	2	10
Comments:	Encourages vocalization as an aid to learning. Cost is for a school site license; permits unlimited copying of both teacher and student manual.								
More information:	<i>Touch Typing in Ten Hours!</i> by Dolores Lisman / 2520 Toledo St. / Bellingham, WA 98226 / (360) 671-4326								
<i>Typin's Cool</i>	\$715	2	1	2	2	2	0	2	11
Comments:	Provides a video to introduce all letter and punctuation keys by finger columns and uses a mnemonic story to aid recall. Materials include the instructional video, a teacher-training video, teaching guide and assessment materials, a software component, and 25 student books. Cost is for a school site license; schools are permitted (and encouraged) to recoup the program's cost by reselling copies of the software and books. Teaches 2 spaces after terminal punctuation (inappropriate for word processor keyboarding).								
More information:	<i>Typin's Cool</i> / 251 Laurier Avenue West, Suite 203 / Ottawa, Ontario CANADA K1P 5J6 (800) 267-2587 Email: mail@typins-cool.com • http://typins-cool.com								

Figure 4. Keyboarding curriculum materials reviewed and compared by the researcher in April 2000. Points were assigned in each category according to this scale: Poor = 0; acceptable = 1; excellent = 2.

Results from the Pilot Case Study

The literature review, teacher survey, and focus group discussion provided a wealth of information which the researcher drew from in creating a resource package to support classroom touch-keyboarding instruction. Once this prototype package was assembled, it was submitted to a pilot test in a public school classroom.

The first of the two scheduled interviews with this teacher was conducted on February 18, 2000. By this date the subject had initiated the program with her class of 28 sixth grade students, had completed the phase one (conceptual introduction) portion of the program, and had just begun phase two (the fingering boot camp). The first 28 minutes of the interview were recorded for researcher reference and study verification purposes. The recording was then discontinued because a group of primary students in an after-school program came into the room at that point, and it became too noisy for recording. The researcher made written notes throughout the interview, and following is a summary of the subject's responses based on those written notes. The teacher added relevant comments beyond the material covered by the planned questions, and those are also included in this summary.

The subject had spent one hour reviewing the materials prior to initiating the instruction. She felt that this amount of preparation time had been adequate. She commented that the materials were clear, and that one hour had seemed sufficient. She further commented that curriculum materials she uses in some other subject areas require more time to assimilate than these materials required. It should be noted here that though this teacher had never taught keyboarding previously, she does touch-type herself.

The subject had not noticed errors in the materials, though she did ask for clarification of how to use the scoring guide for the handwriting speed assessment. No information on how to use this guide was included in the package, so this was noted as an omission to be corrected.

Regarding the organization of the materials, the subject reported being able to find

specific items when needed. She also demonstrated this; when asked to refer to the scoring guide for the handwriting speed assessment she found it easily, and also quickly located the mnemonic poem when asked to do so.

Did the teacher feel confident about initiating the instruction? On a scale of zero to five the subject described feeling “about three and a half” after reading through the materials. (A rating of five was defined as enthusiastic and unhesitating; zero was defined as having so little confidence that instruction was not initiated.)

The teacher described her students as having no touch-keyboarding ability before the program was started. Since students had been using the portable keyboards for occasional writing tasks before this program began, some of the students had become fairly adept at two finger hunt-and-peck typing; none had made significant progress learning to touch-key, even though some had used a software tutorial program during weekly visits to the school computer lab.

The subject was asked if she had made use of each of these specific resources from the prototype package, and her responses are indicated:

- Weekly planner section? Yes.
- Parent letter? Yes.
- Wall chart? Yes.
- Fingering poem? Yes. The teacher commented that some of the 6th grade

students thought the poem to be rather childish but that she believed that it was a good tool for learning and she intended to have them all memorize it “whether they thought it silly or not.” She said they’d tried to “rap it up a bit” (the poem) to make it more fun to learn.

Is the teacher able to demonstrate proper keyboarding technique to students? (e.g., curved fingers resting lightly in home base position; correct body, arm, and leg posture; correct finger reaches; correct shift key technique; a quick chicken-peck keystroke action.) Yes, the teacher spontaneously demonstrated keyboarding as she talked about the

instruction, and she did demonstrate proper technique in all respects. Here again it should be noted that this teacher was a competent touch-typist before beginning this program.

The teacher mentioned making use of the blank keyboards to allow students to practice fingering at times beyond those when they had the keyboards available at their desks. This was an unintended use for the blank keyboard master. It had been provided for use in assessing students' ability to recall key locations after the second phase of the program. No information regarding the use of that blank keyboard master had been provided in the package however. This is an omission which should be corrected in future.

The second interview was conducted on April 1st, 2000. This was later than had been intended because of schedule conflicts which had intervened, but the delay was perhaps fortuitous. By the time of the second interview, students had been integrating their keyboard skills into their writing tasks for a full month. According to the total hours of keyboarding time which the teacher had noted on the weekly planner pages, students had accumulated 12 hours of keyboarding beyond the "boot camp" week. They were now routinely using the portable keyboards to complete their required daily language lessons.

At the point when they had accumulated ten hours of keyboard time the class had done a timed writing to determine their keyboarding speed rates. Several of the students had reached 25 to 30 words per minute, but the teacher estimated that the average speed was around 12 words per minute at ten hours. Some students had thought they were keying faster than the speed at which they tested and mentioned feeling disappointed.

The teacher reported that, on the whole, students' motivation to improve their skills remained high. She also reported little need to correct technique problems at this point; students had become habituated to proper posture and keystroking. She mentioned that some students continue to watch their fingers and must still be reminded not to do that. She also mentioned her observation that students' use of vocalization as they keyed seemed to disappear about the same time she realized she did not need to monitor and

correct technique constantly any longer.

One new student had joined the class after the boot camp training week had concluded. The teacher assigned a willing classmate to guide the new student through the boot camp lessons so that he could begin to key his language lessons also. This seemed to be working fairly well; the new student was strongly motivated by observing his classmates' keying skills, and was making good progress at the time of this interview.

The teacher reported that she will definitely use this program again. She feels it is proving successful with her students, and she believes the integral model is the only possible way she can incorporate touch-keyboarding instruction in her classroom/school situation. Several times during the interviews she mentioned that finding the time in the school day is the biggest problem she faces.

Other teachers in her school are intrigued, and have been following her class's progress with interest. She has asked for (and received) permission to share the materials with them.

CHAPTER 5

DISCUSSION

How Research Results Determined the Product Form and Content

The objective for this project was to produce a package of resources to support the teaching of touch-keyboarding by upper elementary classroom teachers who have portable keyboards for student use in their classrooms. The declared intent was that this curriculum package be teacher-friendly, meaning that it should be presented in a format which teachers would likely be comfortable using. This chapter will describe how the prototype resource package, *First Things First: A Teacher's Guide for Integrating Touch-Keyboard Training in the Elementary Classroom* (see Appendix D) was shaped in response to the research findings. Hereafter, the product name will be abbreviated to FTF.

The first research question sought to ascertain what elements teachers would expect a keyboarding instruction curriculum package to include. A written survey was conducted of a sample of teachers to answer this question. The results, presented in Chapter 4 and graphically illustrated in Figure 1, revealed that these are the five resources most expected by the teachers surveyed (in order of priority):

1. Day by day lesson plans for a six week skill introduction unit.
2. A set of 10 minute video lessons (on VHS tape, CD ROM or Digital Video Disc) to be used in sequence every day for six weeks.
3. Black line masters of skill drills for transparencies and handouts.
4. A one day inservice class, covering both the operation and management of the keyboards in the classroom environment, and touch-keyboarding instruction methods.
5. Tips, curriculum integration lesson plans and unit management advice from other teachers who have successfully implemented keyboarding instruction in the elementary classroom using portable keyboards.

Three of these resource types (items 1, 3 and 5 above) were developed and included in the FTF curriculum package. The video component and inservice training could not be implemented within the time frame and budget of this project, though they define areas for further development of the product.

Several of the write-in suggestions for resources dealt with learning goals and evaluation of student learning progress. These areas are addressed in the prototype package and resources are included.

This first section of the teacher survey also identified resources which these teachers said they would not use even if they had them. This data caused the researcher to significantly revise preliminary plans for the resource package, which had included internet components such as a website and an email discussion/support group. At this time such resources would evidently not be valued or exploited by the intended users of these materials. The researcher nevertheless initiated development of a website and launched an email discussion group in support of the project objectives; these are referenced in FTF in the Additional Resources section. They may prove more valuable to teachers after they begin implementing keyboarding instruction than they did at the time of the survey. The website format allows for updating of material as needed and it is hoped that the email discussion group will not only provide some support for teachers implementing touch-keyboarding instruction in their classrooms, but will also provide a feedback loop to the researcher for further development of the product.

The second research question asked how a keyboarding instruction resource package should be formatted and organized so as to be most useful to teachers. The survey data in response to that question (Table 1) indicated that print material in binder format was preferred by a wide margin over the other media choices suggested. The binder format then, organized with tabbed dividers corresponding to the resources which the surveyed teachers had identified as most important to them, was fixed upon for the

physical structure of FTF.

The third research question addressed by the teacher survey was intended to identify areas where teachers either lack pertinent knowledge, or hold misconceptions related to keyboarding skill and instruction. The data gleaned from this part of the survey was not definitive but is thought-provoking, and suggests areas in which further research inquiry could guide teachers. Since the data resulting from the survey section about resources had indicated that a large percentage of the surveyed teachers would not use “background information” even if it was provided (see Figure 1), the researcher minimized and condensed the informational and reference material to be included within FTF. Deciding what information must be included and what information teachers would perhaps only find burdensome was a difficult process. The degree of indispensability of particular information was decided based in part on the literature review, and in part on the data gathered from the virtual focus group discussion. The introduction section of the prototype product now provides only enough keyboarding instruction background information to prepare a teacher to plan, schedule, and implement instruction sessions. Some pertinent facts, informed opinions, and research findings were included subtly in the form of side-bars and quotes which were sprinkled throughout the materials. These were intended both to affirm and inform teachers’ instructional efforts, while being easy to assimilate piecemeal. The researcher recognizes that the reason teachers said they would not use background information was not probed.

The fourth research question was addressed both with the literature review and in the focus group discussion; it aimed to determine the essential components of a successful elementary level touch-keyboarding instructional program, specifically as conducted in the classroom environment, by the classroom teacher, using portable keyboards. The data gathered was used in two ways: it helped determine the content of the FTF instructional material, and it helped determine the necessary elements of

background information teachers must have to be successful in teaching touch-keyboarding.

Relevant learnings from the focus group discussion which were incorporated into FTF are:

1. Teachers who do not personally touch-key can successfully teach the skill to their elementary grade students. Some preparation is crucial. Teachers must understand and be able to articulate to their students the importance of developing proper techniques. They must understand how psychomotor skills are developed in order to create and maintain an appropriate learning environment for students.

2. Integration of touch-keyboarding skill development with other subjects is the key to finding sufficient time for skill development in the elementary classroom program.

3. Instruction in touch-keyboarding should make it clear to learners that proper posture and keystroking technique are important both for skill development, and for prevention of physical health problems such as carpal tunnel syndrome.

4. Student learning assessment at the elementary level should focus on technique, rather than speed or accuracy. Assigning grades for keyboarding progress is inappropriate at the elementary level.

5. Students who have already established hunt-and-peck habits have difficulty learning to touch-key. One way to help these students is to reduce any pressure to achieve speed or accuracy levels until technique fundamentals are firmly instilled.

6. Error correction techniques should be taught, but de-emphasized during practice times. When students are keying work which will be reviewed for content (rather than practicing keyboarding for its own sake) they should be expected to correct errors.

The final research question concerned the effectiveness of the product when implemented in a pilot case study. This occasioned a reflective look back over the entire

research project, with a view towards product improvement.

The purpose of the case study was to identify areas of strength and weakness in the prototype product in order to guide further development and testing. The case study did not attempt to assess the success of the program in terms of student learning outcomes. It addressed only the teacher's implementation of the program. Student learning results are indeed the underlying purpose; however assessment of that value is beyond the scope of this current project. "First things first" is the pertinent maxim here; teachers must begin to implement touch-keyboarding instruction before student learning can be meaningfully evaluated. As with all educational innovations, it takes time to gain comfort and familiarity with new tools, methods, and instructional objectives, and the researcher recognizes that facilitating widespread teacher implementation of touch-keyboarding instruction is only a first step down the road toward widespread student skill mastery.

The suggestions which follow are derived from the results of the case study, from comments made by the researcher's sponsoring university project committee, and from the information gained from the other research components regarding potential package elements which could not be implemented in the prototype package due to financial and time constraints.

Suggestions for Further Development of the Product

The teacher survey data indicated that many teachers would value having lessons provided in video format which they could play for students. Video lessons could also be helpful for independent review by individual students, and would provide an option for helping students catch up who miss a lesson.

However, video lessons could also be misused, and prove to be no more helpful for most students than reliance on software tutorials. Because it is of crucial importance

that a knowledgeable teacher monitor and guide student technique development (see Chapter 1), there is risk of sabotaging the program by providing entire lessons in video format. Some teachers might use such lessons to replace their own personal involvement in the instruction, in the same way some teachers currently use keyboarding tutorial software.

One possible solution would be to provide video clips which support the lessons with visual demonstrations of keystroking technique and posture problems, but in a nonlinear format. Nonlinear video clips could be accessed in any order, as needed, to support, rather than supplant, the lessons. This would be an excellent medium for showing students examples of people using keyboarding skills in many kinds of circumstances. Video would also permit an effective way to illustrate ergonomic concepts, and could include demonstrations of preventive exercises. These applications are quite different than providing complete lessons in a linear video format such as the VHS cassette. Evidence from the data gathered in the teacher survey may indicate that teachers would not value, or might not be able to utilize, nonlinear video material however. On the question which was asked of teachers about their preferred format for the keyboarding instruction materials (Table 1), most indicated a preference for the print material in a binder, over the option “a CD ROM with printable files, which also includes the audio or video lesson segments you can display on a large-screen attached to your classroom computer.” Since this question did not request a response as to whether or not the teacher has access to the requisite equipment for utilizing a nonlinear video format, there is no way to determine from this data whether teachers would have chosen it if it were truly an option they could make use of. The equipment required for presenting nonlinear video (such as a CD ROM or DVD player and a large-screen display) is less commonly found in the typical classroom than are VCRs.

Some models of portable keyboards are now being produced with keyboarding drill software installed, or available as an option. It might be useful to provide lesson plans and guidance for teachers that will enable their students to gain advantage from such software while still maintaining an emphasis on technique over speed or accuracy.

Participants in the virtual focus group discussion were in agreement that the most important preparation needed by the teacher new to keyboarding instruction is knowledge of proper touch-keyboarding technique and ability to articulate its importance. The surveyed teachers indicated they would like inservice training. A logical conclusion can be drawn that an inservice program to train teachers in keyboarding instruction methodology would be a valuable adjunct to this resource package.

A Walden University faculty reader recommended that teachers and parents be provided with more information regarding physical health issues related to keyboarding. Improper keystroking techniques and poor posture are known causes of repetitive stress injuries such as carpal tunnel syndrome (Hering and Held, 1998; National Institute for Occupational Safety and Health, 1997; Ober, 1993, p. 37) and this fact should be discussed with children as they learn to key. Frequent rest periods and special exercises can help prevent health problems, and the package should include exercise descriptions and resources for further information. This information should also be included in the letter to parents, so that they can spot and correct bad habits they may observe when their children key at home.

Other suggestions made by the case study subject and readers:

- Print instructions for using the blank keyboard master right on it.
- Provide explicit instructions for how to use the word count guide.
- Include masters for an invitation to parents to attend a program completion ceremony and for a certificate to be awarded to students.

- Include more tips for streamlining the process of uploading keyed material from the keyboards to computers or printers.
- Put the mnemonic poem to a catchy rhythm or melody.
- Suggest methods for instructing and assisting students who miss instructional periods (such as the peer-tutoring used in the case study for a student who joined the class after the boot camp).

Recommendations for Further Research

This study did not examine student learning achievement resulting from the use of the product, and that is the most obvious area for further research. Much more study should be done with a variety of teachers and classroom situations. The program has not yet been tested by a teacher who does not personally touch-key; that is another important area for further study.

These research questions are a few which could be asked in subsequent research projects:

1. Do students accomplish touch-keyboard mastery as a result of instruction using this program?
2. Will classroom teachers with no prior ability to touch-key be effective at training their students using this program?
4. Would the program be more effective with a video component?
5. Would the program be more effective with a teacher preparation inservice component?

Controversial Aspects of the Product

There are features of the FTF product that are not fully supported by data gathered during the project research. Some data was contradictory, and the researcher

allowed personal experience to influence product development where research data and published literature were not clearly definitive. Further objective research is needed in these areas.

As noted in Chapter 2, in the section *Characteristics of Effective Keyboarding Instruction in Elementary Grades*, much research supports a rapid introduction of fingering patterns; yet the most common interpretation of *rapid* in this context is a pattern of introducing two to three characters per lesson. At this rate it takes 11 to 16 lessons for students to be introduced to all 26 letters and the common punctuation marks. Some less common keyboarding instruction programs introduce keys more rapidly, sometimes using mnemonic tools to help students learn and recall fingering patterns (Herzog, 1990; King, 1986; Typin's Cool, 1999). In these methods, only four to six lessons are required for learning the fingering of the 26 letters and the major punctuation marks. Only one of the focus group participants had personal experience with any of these methods however, so the data from that portion of the research cannot be said to support such an instructional approach; nevertheless the researcher did design a five lesson boot camp approach to character introduction for the FTF package for these reasons:

1. A more rapid introduction of fingering techniques enables learners to use those correct techniques for all their keying much sooner in the learning process. This is increasingly important for students today, many of whom have liberal access to keyboards outside the lesson environment. Continual reversion to the hunt and peck manner of keying when they need characters which have not yet been introduced in lessons will impede development of the crucial reliance on kinesthetic cues.

2. The sooner students can properly key all characters, the sooner they can make productive use of the skill in other school subject areas. There is no evidence that a hastened introductory period harms the learning process if it is followed by monitored practice until automaticity is finally gained. "Early attention to real-life tasks results in

vastly superior proficiency at such tasks, at no cost whatever to stroking skills....

Excessive focus on stroking skills and sketchy, delayed treatment of realistic tasks in introductory keyboard courses are very wrong” (West, 1986, p. 80-81). However, it must be noted that West clarified his use of the word *early* in that passage to mean after 5 to 9 weeks of instruction, and after students are able to key at a speed of over 20 words per minute. The FTF instructional design moves students to “real-life tasks” much sooner; after just 3 hours of instruction. Most students will not be keying faster than 5 to 10 words per minute at this early stage.

3. The time and scheduling constraints common in many elementary school programs allow teachers little flexibility for accommodating a prolonged series of dedicated keyboarding lessons. The FTF model postulates that many of the hours of practice required to develop automaticity can be accomplished through application of the skill on any student writing task once the fundamental techniques have been established. This model is proposed as a way of insuring that students actually do receive sufficient keyboard practice time to attain automaticity. The FTF package includes a minimum of character practice drill material; instead the program provides tools to help teachers integrate keyboard use in student writing tasks arising from other subject areas that are already accommodated in the crowded elementary program, such as spelling and language arts lessons.

In conducting a comparison study to learn whether a software tutorial approach or teacher-directed lesson plan approach would prove most effective with third through sixth grade students, Lois Mayer Nichols compared the highly regarded software tutorial (*Type to Learn*) with the Diana King method (in which the teacher conducts the instruction, and students use any typewriter or word processing program). A test conducted at the end of the lessons showed a slightly higher speed for the software group (average 8.8 words per minute versus 7.2), though the software group made more errors (2.7 versus 1.5). The

most significant difference between the two programs however, was in the school time it took to complete the lessons.

Although Type to Learn students typed slightly faster, it took 21 weeks to complete the lessons and their accuracy was not as high as that of the Diana King students, whose lessons only took 12 weeks to complete. Based on the results of this study, it seems reasonable to recommend the Diana King approach to keyboarding instruction as an efficient and effective method. (Nichols, 1995, p. 24)

The FTF model is centered around the Diana King method, as described in her book, *Keyboarding Skills: All Grades* (1986). FTF adds a component of three preparatory lessons prior to the fingering instruction period, and then presents the core of the King method in a five lesson “fingering boot camp” sequence. The FTF program then departs from the King method by moving students to keyboarding practice arising from writing tasks in other school subject areas, rather than practice on the common words and phrases in King’s material. Therefore, the FTF program will require even less dedicated lesson time than Nichols study did, and it is hoped that the accomplishment of purposeful work using their new keyboarding skills may bolster student pride and motivation, which could lend importance to the purpose for the learning.

Another feature of the FTF program which may be controversial is that it introduces the letters in alphabetical order (as do the King and Herzog methods). Some researchers claim that the order of letter introduction is important, though there is no consensus on whether that order should be based on letter frequency in language, keyboard layout patterns (rows/columns), finger dominance, alphabetic order, or according to a “skip around” pattern; all have their proponents. Others state that the letter introduction order is unimportant to the learning process; that:

“What is important ... is that the keyboard be introduced in such a way as to provide an opportunity for students to key sentences as early as possible. Keying sentences permits transfer of learning to later sequences, develops chains more quickly, and provides better motivation. (McLean, 1995, p. 28)

The researcher could find no unequivocal evidence of the relative effectiveness of various letter introduction patterns with elementary age learners. The alphabetic order for letter introduction was adopted for FTF because that pattern is already quite familiar to both elementary students and teachers. A stated objective for this product is that it be “teacher-friendly”. One of the focus group experts did emphasize that teacher confidence is a “key element” in a successful instructional program (VFG expert #2, email, October 6, 1999). The comfortable, familiar alphabetic order may be a factor which will boost teacher confidence; and because it is already well known, it provides an established mnemonic base for the cognitive phase of learning the fingering patterns.

These instructional design features should be studied carefully in controlled research settings to determine their value as components of a touch-keyboarding instructional model to serve the learner circumstances and needs of these changing times. The researcher was emboldened to include the controversial elements in part by these comments made by a keyboarding teacher referring to the curriculum changes required during the 1980s shift in writing tools from typewriters to computers:

The teacher must weigh each change in teaching techniques carefully. Keep the best of the old but certainly don't be afraid to try new methods. It will be years before a formula for success is tested, proved, and published. Each teacher becomes a researcher. (Frankeberger, 1990, p. 24)

In the interests of students who will not remember a time before personal computers as writing tools, this project presents a model for keyboarding instruction as a basic literacy skill; a foundation skill to be solidly established in the elementary school classroom, upon which mastery of the computer as a tool for the mind may be built.

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