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THE IMPLEMENTATION OF TECHNOLOGY INTO THE CURRICULA OF SELECTED INDEPENDENT PIANO STUDIOS

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By

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THE IMPLEMENTATION OF TECHNOLOGY INTO THE CURRICULA OF SELECTED INDEPENDENT PIANO STUDIOS

A DOCUMENT APPROVED FOR THE
SCHOOL OF MUSIC

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ABSTRACT

THE IMPLEMENTATION OF TECHNOLOGY INTO THE CURRICULA OF SELECTED INDEPENDENT PIANO STUDIOS

By: May Wuey Tsao-Lim

Major Professor: Dr. Jane Magrath
Co-Major Professor: Dr. Barbara Fast

The primary purpose of this exploratory study was to examine the extent to which selected independent piano teachers with 12 or more pre-college students incorporated technology into their curricula including the use of computer and keyboard technologies, software, accompaniment disks (MIDI/CD), and the Internet. A secondary purpose was to provide information on teachers' attitudes toward the use of technologies in private piano curricula. The conclusions and recommendations presented, along with the annotated bibliography of Internet resources and a list of software program features, serve as a reference for independent piano teachers currently teaching with technology or interested in incorporating technology into their curricula.

A 51-item questionnaire was sent to 400 independent piano teachers from the Music Teachers National Association's (MTNA) membership list to seek information on the implementation of technology into their curricula. The survey covered topics such as the purposes and methods of using different types of technology, successes and limitations in the use of technology, and factors hindering the incorporation of technology into independent piano studios.

Of the 225 returned surveys, 76 independent piano teachers with 12 or more students reported using one or more forms of technology in their curricula: 47 used computers in their teaching, 47 used keyboard technology, 44 used accompaniment disks,

and 16 used the Internet for teaching. Sixty-two percent of the 76 teachers employed two or more forms of technology in their studios. Digital keyboard technology was the primary teaching tool for 36% of the 47 keyboard users. Computer-assisted instruction software received much wider usage (91% of 47 computer users) than notation, sequencing, and accompaniment application software (51%). Although 93% of 47 teachers had Internet access, only 36% taught with the technology. Most of the 76 teachers reported the positive pedagogical impact of technology use in their curricula and listed workshops/seminars and colleagues as the foremost resources for acquiring knowledge on music technology.

Future research could benefit from further investigation of the pedagogical use of digital reproducing pianos and accompaniment disks, as well as the achievement of students who are involved in curricula that incorporate various forms of technology.

THE IMPLEMENTATION OF TECHNOLOGY INTO THE CURRICULA OF SELECTED INDEPENDENT PIANO STUDIOS

CHAPTER I

INTRODUCTION

Introduction

In recent decades, advancements in computer technology have changed the lifestyles of many people. Listening to an infinite supply of music is possible through MP3 files and the iPod; watching movies or making home videos is common on DVD-R players and digital cameras; accessing vast amounts of information is realistic with high-speed Internet and broadband wireless technology. These possibilities appear in the everyday lives of many people and are now becoming viable tools in the field of education, especially in independent piano studios.

Computers, with their increasing speed and efficiency, continue to be effective tools for both music students and teachers. From the 1960s to the twenty-first century, advancement in the portability and sophistication of computers has continuously evolved: large mainframe computers in the 1960s, "minicomputers" in the early 1970s, and "home" computers or personal computers (PCs) by the late 1970s.[1] Since the advent of early laptop computers in 1981,[2] computer portability and versatility has continued to

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[1] G. David Peters, "Convergence: Music Technology and Education," In *Basic Concepts in Music Education, II,* edited by Richard Colwell, 237-242. (Niwot, CO: University Press of Colorado, 1991).

[2] "Brief History of the Notebook Computer," [article on-line]; available from http://www.bizwaremagic.com/notebook-computer-history.htm; Internet; accessed 30 July 2005.

expand. By the early 2000s, students and teachers began using "notebook" computers for taking class notes and presenting workshops and lectures. Moreover, desktop computers have become much more affordable, giving students the opportunity to learn about music in their own homes.

In addition to portability, computer technology has also vastly improved in speed and storage capacity. Faster processing speed (in gigahertz) and larger memory storage capacity (in gigabytes) allow users to manipulate complex sound and visual files. Multimedia presentations in classrooms and workshop sessions involving text, audio, and/or video clips are now possible. CD-ROM technology established in the 1980s has led to more sophisticated DVD-ROM technology in 1997[3] offering larger storage capacity as well as higher video and audio qualities. Students can now learn about music on a CD-ROM at their leisure. Teachers can create, download, and copy information onto CDs or DVDs for students to take home. Student recitals become more memorable when they are saved onto a DVD for future viewing.

The increasing versatility of computers' features has led to refinements in the ability to record. For instance, the 2005 Macintosh iBook contains a recording feature that allows applied music teachers to record live performances for evaluation later. These sound files can be stored in a CD or DVD using the optional CD or DVD burners built into new computers. Some computer software also allows recording and evaluation of live student performances. For example, software programs such as *Digital Performer*®[4]

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[3] "DVD Introduction & History," [article on-line]; available from http://www.disctronics.co.uk/technology/dvdintro/dvd_intro.htm; Internet; accessed 30 July 2005.

[4] *Digital Performer® 5* [CD-ROM] (Cambridge, MA: Mark of the Unicorn, 2006).

or the more recently released *Cakewalk® Sonar Home Studio*[5] can assist in evaluating students' performances during their lessons. Various aspects of the performance such as velocity and attack/release of the keys provide information on dynamic nuances students do not normally hear themselves. Students can discuss and assess their own performances with their teachers using analysis tools available on such software.

Computer-assisted instruction emerged as an extension of programmed instruction in the 1960s.[6] The traditional approaches of computer-assisted instruction included drill-and-practice, tutorial, simulation/games, and multimedia/hypermedia.[7] As computer technology has improved, so have instructional programs. Currently, software publishers, taking advantage of advanced features offered on the newly developed computers, design programs that are highly interactive, motivating, and stimulating for students. Such programs are more eclectic in their designs, combining two or more of the traditional approaches; they are now accommodating different combinations of learning styles for students. For instance, Harmonic Vision's *Music Ace*[8] series includes tutorials that impart new knowledge, drills that reinforce learned concepts, a "doodle pad" that encourages creative thinking, and games that challenge the student. Learning music theory or history should never be a tedious task and students can challenge themselves through different instructional approaches.

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[5] *Cakewalk® Sonar Home Studio Version 4* [CD-ROM] (Boston, MA: Twelve Tone Systems, Inc., 2006).

[6] Jack A. Taylor, *CMR Report X-4: Introduction to Computers and Computer Based Instruction in Music* (Tallahassee, FL: CMR Press, 1981), 27.

[7] William L. Berz and Judith Bowman, *Applications of Research in Music Technology* (Reston, Virginia: Music Educators National Conference, 1994), 7-13.

[8] *Music Ace* and *Music Ace 2* [CD-ROM] (Chicago, IL: Harmonic Vision Inc., 1996 and 1999).

Computers now are extremely user-friendly and the educational philosophy underlying software designs is able to meet most pedagogical needs. The new generation of children is highly aware of new technologies such as video and computer games. Many children as young as five are able to navigate through many programs without much assistance from their teachers. Students are often attracted to the colorful graphics and the animation featured in instructional programs; they are eager to participate in the highly interactive environment and are excited, for example, about new information delivered by a cartoon character. Electronic Courseware Systems (ECS) Media's *Adventures in Musicland*[9] features familiar fairy-tale characters to guide young students through animation and sounds in learning music fundamentals skills. Also, the character Maestro Max and the bubbly notes in Harmonic Visions' *Music Ace* series, and colorful animal characters and the sing-along children's songs in the Town4Kids' *MiDisaurus*[10] series elicit excitement and enthusiasm in students.

While most of the computer-assisted instructional software programs focus on reinforcing music fundamentals concepts such as theory and ear training, some programs provide venues for student composition and music appreciation/music history. Morton Subotnick's *Making Music*[11] series introduces young students to the world of composition; *Sibelius Compass*[12] provides structured lessons for older students in composition. Other programs with composition components include *Music Ace* and Tom

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[9] George F. Litterst and others, *Adventures in Musicland* [CD-ROM] (Champaign, IL: ECS Media, 1990).

[10] *MiDisaurus: The Music Prodigy Kit* [CD-ROM] (Redmond, WA: Town4Kids Inc., 1998).

[11] Morton Subotnick, *Making Music* and *Making More Music* [CD-ROMs] (New York, NY: Viva Media LLC, 1995 and 1998).

[12] *Sibelius Compass* [CD-ROM] (Walnut Creek, CA: Sibelius Software Ltd., 2004).

Snyder Production's *Juilliard Music Adventure*.[13] Students can also explore and learn about instruments of bands and orchestras in the interactive encyclopedia *Sibelius Instruments*.[14] The knowledge of music composers as well as their lives and works is equally important to music fundamentals and composition in developing a well-rounded musician. Multimedia software such as Voyager's *CD Companion Series*[15] features selected composers' works such as Stravinsky's *Rite of Spring* and Beethoven's *Ninth Symphony*. Younger students can also enjoy similar programs such as *Pianomouse Meets the Great Composers*[16] and *MiDisaurus Composers*.[17] Such highly interactive programs make learning music history a vivid and exciting experience.

In addition to computer-assisted instructional programs, software publishers provide music educators with notation software such as *Finale*®[18] and *Sibelius*[19] that allows students to compose, edit, and print their own compositions. Music teachers can customize theory or composition projects for individual students. Sequencing software such as *Master Tracks Pro*,[20] *Power Tracks Pro*,[21] *Super Duper Music Looper*®,[22] and

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[13] *Juilliard Music Adventure* [CD-ROM] (Watertown, MA: Tom Snyder Productions, Inc., 1995).

[14] *Sibelius Instruments* [CD-ROM] (Walnut Creek, CA: Sibelius Software Ltd., 2003).

[15] Robert Winter and others, *CD Companion Series* [CD-ROM] (Santa Monica, CA: Voyager, 1990-94). This series, sometimes called *Classical Music Series* and *Music Companion Series*.

[16] *Pianomouse Meets the Great Composers: Volume 1* [CD-ROM] (Granite Bay, CA: Pianomouse.com, 2000).

[17] *MiDisaurus: The Great Composers and Their Music* [CD-ROM] (Redmond, WA: Town4Kids Inc., 1998).

[18] *Finale® 2006* [CD-ROM] (Eden Prairie, MN: MakeMusic! Inc., 2006).

[19] *Sibelius 4* [CD-ROM] (Walnut Creek, CA: Sibelius Software Ltd., 2005).

[20] *Master Tracks Pro 6.8.3* [CD-ROM] (Chatham, NJ: GVOX, 2003).

[21] *Power Tracks Pro 11* [CD-ROM] (Victoria, B.C., Canada: PG Music Inc., 2006).

GarageBand™[23] provides sound mixing and editing as well as recording and playback features. These programs allow multi-track recording, editing downloaded MIDI files, and mixing songs using a variety of styles and instruments. With these programs, teachers can create accompaniments upon which students would improvise or use for practice purposes.

Practicing long hours on a solo instrument can be a lonely experience; software publishers and music educators have offered a solution to this problem by developing intelligent accompaniment technology. For example, *SmartMusic*®[24] provides accompaniments that actually listen to students' performances and react instantaneously to tempo fluctuations. Programs that allow students to practice along with customized or newly written accompaniments in a multi-timbral environment include *SmartMusic*® *Studio*,[25] *Band-in-a-Box*,[26] and *Home Concert Xtreme*.[27] This interactive experience allows the soloist to play with a virtual band or orchestra while the accompaniment provides a sense of drama and serves as a patient and consistent ensemble partner. These programs help students develop better listening skills and achieve more solid performances through slow practicing.

In addition to these experience-heightening programs, teachers and students also benefited from the emergence of MIDI (Musical Instrument Digital Interface) in the early

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[22] *Super Duper Music Looper*® [CD-ROM] (Sony Media Software, Inc., 2005).

[23] *GarageBand*™ *3* [CD-ROM] (Cupertino, CA: Apple Computer, Inc., 2006).

[24] *SmartMusic*®, a product of MakeMusic! Inc., is an intelligent accompaniment technology.

[25] *SmartMusic*® *Studio 7.1* [CD-ROM] (Eden Prairie, MN: MakeMusic! Inc., 2002).

[26] *Band-in-a-Box 2006* [CD-ROM] (Victoria, B.C., Canada: PG Music Inc., 2006).

[27] *Home Concert Xtreme* [CD-ROM] (Rehoboth, MA: Time Warp Technologies, Ltd., 2006).

1980s. MIDI technology allowed computers to communicate with other electronic instruments. Manufacturers of electronic instruments began to adopt and standardize MIDI format, contributing to the development of MIDI-compatible instruments. Many software programs recognize standard MIDI files and become more effective and powerful educational tools when connected to MIDI instruments. With highly affordable MIDI keyboards, independent piano teachers can now set up computer workstations that allow the easy incorporation of composing and improvising activities into studio curricula.

Keyboard technology has advanced along with the development of computer technology and music application software. Since the first monophonic synthesizers, "Minimoogs," in the early 1960s and the first Oberheim polyphonic keyboards in the late 1970s, keyboard technology has advanced to 256-voice polyphonic digital pianos in the 2000s. Digital sampling, the groundbreaking keyboard technology that emerged in the 1980s, facilitated the replication of many sounds of acoustic musical instruments. The palette of samples in advanced digital pianos can reach nearly 900 sounds. Standard features such as drum kits, multiple timbres, and an array of accompaniment styles, enhance sequencing and improvising opportunities. Other typical features include onboard sequencers, built-in metronomes, internal memory drives, user-friendly touch screens, and 3.5" floppy disk drives and/or CD-drives that play standard MIDI files and/or audio-CDs. With these extraordinary features, students can change the tempo and dynamics of the sequences while they practice and even transcribe a piece of piano music into an orchestral score.

At the turn of the millennium, keyboard technology evolved with highly complex and versatile features. When these instruments interface with computer technology, students can create, arrange, edit, and record their own compositions onto a CD while looking at the colorful diagrams on the computer screen. Alone, these new pianos can be powerful tools for students and teachers. The combination of the acoustic piano mechanism and fiber optic technology allows exact replication of performances such as key releases, touch velocity, dynamics, and pedal movements. Yamaha's "reproducing pianos"[28] such as Disklavier are examples of such state-of-the-art keyboard technology. Teaching and practicing on these pianos provide fun, stimulating, and productive experiences.

The advent of the Internet also extends the possibilities of the digital piano. Teachers and students can expand their song file libraries by downloading MIDI files from the Internet into their keyboards. Students can now participate in a piano competition without their physical presence through the combination of real-time videoconferencing and the "player piano"[29] feature on Yamaha Disklavier. This opens the door to an avenue where music students and teachers are provided with boundless learning and creativity opportunities.

The Internet provides an effective means of communication for piano teachers. In addition to the widespread use of e-mails for communication, independent teachers can now easily develop their own webpages to post lesson schedules and newsletters for parents, announce upcoming events, and showcase student projects and performances.

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[28] Laura Beauchamp and Barbara Fast, "Teach and Practice on a Reproducing Piano," *Piano and Keyboard*, no.193 (July/August 1998): 38-40.

[29] Player piano is a feature on digital reproducing pianos that displays the key and pedal movements during the playback of standard MIDI files.

Teachers can also discuss and share knowledge on specific topics with other professionals in the same field by subscribing to listservs or forums on the Internet.

The Internet also serves as a research tool for music educators. Reading software reviews, purchasing music, and solving teaching-related problems at teachers' leisure can occur online through the Internet. Professional music organizations such as Music Teachers National Association (MTNA) and The National Association for Music Education (MENC) provide links to resources useful for piano teachers. Web-based periodicals such as *Piano Pedagogy Forum*[30] feature insights on piano pedagogy for both college and independent piano teachers. In addition, music instrument manufacturers, music publishers, and online music stores publish web-based newsletters on piano instruction and information on the new trends of teaching using the most recent keyboard technology.

Furthermore, the Internet functions as a valuable learning tool with online games, puzzles, and drills that reinforce music theory, aural skills, and history. Teachers can assign listening and writing projects using MIDI and MP3 files as well as copious sites on classical composers. Such valuable pedagogical aids are downloadable for no or little cost. Some software publishers offer free downloadable programs such as *Finale*® *NotePad*®[31] and *Sibelius Scorch*[32] for students and teachers to write, edit, and print

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[30] *Piano Pedagogy Forum*, supported by the University of South Carolina School of Music, publishes web-based articles on piano pedagogy issues. [jounal on-line]; available from http://www.music.sc.edu/ea/Keyboard/PPF/; Internet.

[31] *Finale® NotePad® 2006* [CD-ROM and Freeware] (Eden Prairie, MN: MakeMusic! Inc., 2006). Available from http://www.finalemusic.com/notepad/

[32] *Sibelius Scorch* [Freeware] (Walnut Creek, CA: Sibelius Software Ltd., 1999). Available from http://www.sibelius.com/products/scorch/

music. For adult learners, online interactive piano lessons offer the opportunity to learn the necessary skills at their leisure.

In summary, the benefits of using advancements such as the computer, keyboard technology, and the Internet in independent piano studios are numerous. The various designs of computer-assisted instructional software offer teachers a wide variety of options in devising innovative lesson plans that can accommodate the different learning styles of students. Students learn a wide variety of music skills at their own pace in a non-intimidating environment, and are motivated by immediate and consistent feedback offered by the software. The multitude of MIDI-generated sounds on digital keyboards allows students to accompany or arrange a piece of music. Free music education websites offer a wide variety of musical activities to motivate students' learning as well as teaching tips and solutions that enhance instructors' approaches.

Rationale

The increase in the awareness of evolving technology is apparent among music educators; however, its widespread adoption in private piano studios has been slow. Teachers need to keep abreast of the advancements to impart a wealth of knowledge to students in an organized manner. Therefore, research in the use of the latest technology in teaching music is important for independent piano teachers.

Although many studies have investigated the implementation of computer technology in the curricula of K-12 schools and colleges, relatively few studies have examined the implementation of technology in the private studio. In 1986, Dennis[33]

[33] Pamela Richardson Dennis, "A Manual for the Use of the Computer as an Instructional Tool in the Private Piano Studio" (M.C.M. thesis, The Southern Baptist Theological Seminary, 1986).

provided independent piano teachers with information on the availability and use of computer teaching materials. Young[34] surveyed selected independent piano teachers and investigated the ways that computer and keyboard technologies were used in their studios. While other technology research projects related to the applied studio exist, none of them has investigated the use of the Internet in piano curricula. Research studies on the implementation of the latest available technology in the independent piano studio are lacking.

The integration of technology into a curriculum can be expensive. Despite the decline in cost of computer and keyboard technology, some piano teachers have a difficult time keeping up with the rapidly evolving models. Maintaining an up-to-date technology studio might not be possible for some, especially for teachers who maintain small studios. Although free hands-on training is made more readily available to piano teachers at music technology workshops such as MTNA's "Technology Tracks" and The National Conference on Keyboard Pedagogy's "Technology Hubs," expenses incurred in traveling and lodging arrangements can be viewed as luxurious expenditures.

Adopting technology can also be a time-consuming task. Learning the features available on the newest keyboards or software can be a burden to teachers who already have busy schedules. Additionally, they must develop new lesson plans as well as innovative teaching techniques to use the technology. Following implementation, teachers need to supervise or monitor students' activities at the keyboard and/or computer. The dissemination of information of the evolving technology is more available

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[34] Barbara G. Young, "The Use of Computer and Keyboard Technology in Selected Independent Piano Studios" (D.M.A. document, The University of Oklahoma, 1990).

to piano teachers via the proliferation of journals, books, and the Internet; however, accessing a specific piece of information from this extensive range of sources can be a long process. Searching on the Internet, although effective, can be inefficient if piano teachers are unaware of the available resource sites and/or are inept at the computer.

In the past decade, the use of the Internet as a tool for teaching and research has become common in the curricula of K-12 and colleges; however, the extent of such application in the applied piano studio is uncertain. Many articles and books have provided classroom teachers with valuable resources on the Internet as well as methods of incorporating the Internet into their curricula. Although similar topics are available in some piano journals, research on the use of the Internet in piano studio curricula is evidently lacking.

Indeed, few studies on the incorporation of technology in independent piano studios exist; none of these is current. The most recent available study that surveys piano teachers on how they use technology in their studios dates back to 1990.[35] Moreover, this survey did not include the use of the Internet or accompaniment disks. While these studies probably seemed pedagogically sound to piano teachers at the time, their information has become outdated.

Many independent piano teachers realize the importance of nurturing children to become well-rounded musicians at the early stages of their learning. This possibility can be multiplied if technologies are employed as supplemental tools in piano studios. At the same time, teachers need to understand how to manage vast amounts of technological information in an organized manner. They must set specific goals before implementation

[35] Young, "The Use of Computer" (1990).

and receive directions on how to integrate technology into their curricula for maximum results.

Purpose of the Study

The primary purpose of this study was to examine the extent to which selected independent piano teachers incorporated technology into their curricula, including the use of computers, software, keyboards, accompaniment disks (MIDI/CD), and the Internet. A secondary purpose was to provide information on teachers' attitudes toward the use of technology in private piano curricula. This research can thus serve as an exploratory study as well as a reference for independent piano teachers who are currently teaching with technology or are interested in incorporating technology into their studios.

Additionally, the author determined through surveys what were the most commonly used computer and/or keyboard technologies in selected independent piano studios. The author also investigated how independent piano teachers made use of the rich resources on the Internet in their teaching. Lists of computer-assisted instructional software and application programs (available in 2006) as well as an annotated bibliography of websites useful for piano teachers are included in this study (see Appendices F, G, H, and I).

Procedures

The author administered a survey to investigate the implementation of technology in the curricula of selected independent piano studios. This survey sought to identify the methods by which private piano teachers employed technology in their teaching. Since

the Music Teachers National Association (MTNA) is the professional association for music teachers in the United States, the author selected survey subjects from its member pool of 24,000 independent and collegiate music teachers from 50 states and the District of Columbia of the United States of America. Four hundred independent piano teachers were systematically chosen as the potential sample for this study by selecting the first 400 names of MTNA's alphabetically ordered membership list.

Prior to surveying the large pool of subjects, a preliminary version of the questionnaire was submitted to a panel of five piano teachers with doctoral degrees in piano or piano pedagogy to critique and provide comments on face validity (see Appendix B). A revision of the questionnaire was made based upon feedback collected from the pilot study. The revised questionnaire was then sent out to the selected 400 subjects accompanied by a cover letter explaining the purpose of the study and the deadline for returning it. The survey subjects were given three weeks to return the questionnaire. A follow-up postcard was sent to the subjects at the end of the second week to serve as a reminder to complete and return the questionnaire on time. Only data from teachers with 12 or more pre-college students were considered in the survey analysis. Copies of the questionnaire, cover letter, and follow-up letter appear in Appendices A, D, and E.

The 51-item questionnaire included close-ended and open-ended questions and was divided into six parts: computer, music software, keyboard technology, accompaniment disks (MIDI/CD), Internet, and teacher's attitude toward use of technology. Within each part, the author sought to identify the strategies used by independent piano teachers to structure and organize the use of technology within their

curricula. Many close-ended questions allowed multiple answers; thus, the compounding data in these questions sometimes yielded percentages greater than 100.

In Parts I and II, the author determined the extent to which computers were used in conjunction with traditional piano lessons in independent piano studios. The author gathered such information on the duration and scheduling of computer work as well as supervision and instruction of computer use. The author also gathered information on the use of two categories of music software: computer-assisted instruction (CAI) and application software. In the initial portion of Part II of the questionnaire, the author examined how independent piano teachers structured the use of instructional software programs such as the *Music Ace* series, *MiDisaurus* series, and Alfred's *Essentials of Music Theory*[36] around the traditional piano lesson. The author also determined ways in which teachers took advantage of the unique features of different application software such as *Finale*® and *Band-in-a-Box* to enhance student learning. Surveyed teachers provided information such as titles of their favorite programs and computer projects that inspired students.

Parts III and IV included questions on the types of keyboard technology that were employed as well as the use of accompaniment disks. Information about the ways surveyed teachers used built-in functions available on the instruments to enhance student learning was acquired. The author also determined if and how surveyed teachers used MIDI or CD accompaniment disks with their students.

In Part V of the questionnaire, the author determined whether Internet use occurred in independent piano curricula. In addition, the author investigated how

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[36] *Essentials of Music Theory 2.0* [CD-ROM] (Van Nuys, CA: Alfred Publishing Co., Inc., 2003).

surveyed teachers used the Internet for teaching and research. Surveyed teachers were encouraged to list websites that they had found to be motivating and/or useful for their students.

Finally, the concluding part of the questionnaire solicited the teachers' attitudes toward adopting technology in their curricula. In this section, the author sought information on how technology had helped students and teachers in their learning and instructional approaches. The drawbacks, if any, of the use of technology in piano curricula as well as other factors that inhibited teachers in incorporating technology in their studios were gathered.

Based upon the information collected from the questionnaire and the author's research on selected computer programs, recommended lists of the most frequently used and pedagogically sound music software are featured in Appendices F, G and H. Additionally, Appendix I provides an annotated bibliography of selected Internet websites offering valuable resources to teaching music skills such as theory, ear training, music appreciation, and composition. Important and useful websites that broaden the teacher's awareness of pedagogical approach and resources are also included (see Appendix I).

Limitations

This study did not discuss the computer and keyboard hardware requirements and model series; the applications of technology for teaching purposes only were investigated. To this end, administrative uses of technology in the independent piano studios were not considered in this study. The discussion of the Internet was limited to

listing resources related to teaching piano that were available to independent piano teachers. Only MTNA members who maintained a minimum of 12 pre-college students in their independent piano studios were qualified for this study.

Development of the Remainder of the Document

Chapter Two of this study reviews related literature on the following subjects: the history of computer technology and its impact on music instruction; the history of keyboard technology and its impact on music instruction; the history of the computer-assisted instruction in music; research on the implementation of technology in the independent piano studio, K-12, and college music curricula; and finally, resources for piano teachers.

The results of the collected data from the returned questionnaires are presented in Chapter Three, followed by interpretations of the data in Chapter Four. The spreadsheet program, *Microsoft Excel*, was used to generate statistics for the close-ended responses to the questionnaire. Open-ended responses were transcribed and coded for response trends. The concluding chapter, Chapter Five, summarizes these findings and provides recommendations to independent piano teachers for using technology more productively in their studios. Lists of the most effective and frequently used software programs and accompaniment disks, an annotated bibliography of Internet resources for music teachers, and finally, addresses of software publishers are presented in the appendices of the document.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

The development of computer and keyboard technology as well as the evolution of computer-assisted instructional software have significantly impacted music education. Research studies on the integration of these technologies into music curricula at different levels – public K-12, college, and private – reveal the advantages of technology use as well as the considerable interest in and growing use of technology among music educators. Books, journals, and the Internet have provided important literature on the implementation of technology into curricula, the application of the Internet in teaching, resource guides, and valuable websites on the Internet. This chapter provides a brief history of technologies relevant to music instruction and their impacts; the development of computer-assisted instruction in music; a review of related literature on the integration of technology into music curricula; and finally, an examination of resources available on the Internet.

A History of Technology and Its Impact on Music Instruction

Computer Technology

Computer technology emerged in the field of music education during the post-Sputnik era. In 1958-9, International Business Machines (IBM) and System Development Corporation (SDC) conducted projects on extending branching capabilities

of teaching machines.[37] This research sparked the beginning of computer-assisted instruction. Although computers were introduced into classrooms in the late 1950s, the use of computers in music education did not occur until the late 1960s. The development and application of technology in music education were expensive, and computer equipment was unaffordable to many schools. Only a limited number of large-scale university campuses already equipped with mainframe computers could afford to conduct research on computer-based music instruction during this time.[38]

Early research was dominated by feasibility studies in which the development and/or the implementation of specific applications were examined.[39] The focus of the majority of these projects lay principally in the teaching of music fundamentals: dictation, ear training, and harmony.[40] Among the first projects were those by Kuhn and Allvin (Stanford University) for developing a curriculum using computers to teach sight-singing, Deihl (Pennsylvania State University) for using an IBM computer to teach instrumental materials, Hultberg (State University of New York-Potsdam) for developing music fundamentals drills, and Peters (University of Illinois) for developing the PLATO (Programmed Logic for Automated Teaching Operations) system that focused on pitch discrimination and music performance.[41]

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[37] Michael Allan Arenson, "A Model for the First Steps in the Development of Computer-Assisted Instruction Materials in Music Theory" (Ph.D. diss., Ohio State University, 1976), 3.

[38] G. David Peters, "Music Software and Emerging Technology," *Music Educators Journal* 79, no.3 (November 1992): 22.

[39] Berz and Bowman, 4.

[40] Taylor, *CMR Report X-4*, 39.

[41] Peters, "Convergence," 239-240.

In the early to mid 1970s, as mainframe computers improved in quality and speed, smaller computers or "minicomputers" were born. In 1973, in an effort to improve aural perception skills, Hofstetter (University of Delaware) designed the first complete ear training and music theory program, based on the GUIDO (Graded Units of Interactive Dictation Operations) system. Other researchers included Wittlich (Indiana University), Placek (University of Georgia), and Taylor (Florida State University).[42] Their implementations of computers in music curricula signified the first actual delivery of music instruction through computer-assisted programs.

Many schools and universities began to realize the potential and advantages of using computers in music education. In 1975, Hofstetter and others formed the National Consortium for Computer-Based Music Instruction (NCCBMI), presently known as the Association for Technology in Music Instruction (ATMI),[43] to address the increasing speed in the evolution of newer and improved computer technology as well as the growing wealth of knowledge that needed to be learned. The purpose of this professional association is to provide an environment for the developers and users of computer-based music instruction to exchange ideas, to establish music courseware, and to offer consultations to new users of computer-based music instruction.[44]

In the mid to late 1970s, personal computers (PCs) or "microcomputers" offering more portability than their predecessors evolved. Improved features such as graphic

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[42] Peters, "Convergence," 241.

[43] William R. Higgins, *Resource Guide to Computer Applications in Music Education for the Macintosh, MS-DOS/Windows & APPLE II Series Microcomputers* (Grantham, Pennsylvannia: Messiah College, 1994), 5.

[44] Kenon D. Renfrow, "The Development and Evaluation of Objectives for Educating Graduate Piano Pedagogy Students to Use Computer and Keyboard Technology" (Ph.D. diss., The University of Oklahoma, 1991), 38.

characters, computer-generated sound, and analog-to-digital conversion enhanced the quality of computer-based music instruction.[45] In 1977, the Apple Computer Company became the first to introduce computers to music educators while Atari, Commodore, and IBM followed quickly.[46]

In the late 1970s to early 1980s, university faculties continued to research computer-assisted instruction in music. The Center for Music Research (CMR) at Florida State University, an environment for computer-based music research, developed and implemented a new computer-based instructional system called MEDICI (Melodic Dictation Computerized Instruction) in its undergraduate music program.[47]

During the same period, two major developments occurred in computer technology: MIDI (Musical Instrument Digital Interface) and CD-ROM (compact disc-read only memory) came into being. Developed initially in 1983, MIDI is a universal computer language employed to transmit information between electronic instruments and computers.[48] A year later, CD-ROM technology emerged with the capability to store audio and other data files in a digital format. Peripheral equipment such as CD-ROMs and audio CDs became useful tools in computer-based music instruction.

Computer technology became more refined in the late 1980s and the 1990s as Apple Macintosh, IBM PCs, Atari, and Commodore Amiga became the four standard

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[45] Peters, "Convergence," 241-42.

[46] Renfrow, 22.

[47] John M. Eddins, "A Brief History of Computer-Assisted Instruction in Music," *Journal of the College Music Symposium* 21, no.2 (1981): 13-4.

[48] Thomas Rudolph, *Teaching Music with Technology,* 2nd ed. (Chicago, IL: GIA Publications, Inc., 2004), 54.

computer platforms.[49] Apple released the Macintosh personal computer that first employed the Graphic User Interface (GUI). This new interface allowed the computer to display black characters, icons, mouse, keyboard, pull-down menus, and graphics on a white screen.[50] The processing speed of this generation of computers increased considerably, thus lessening the operation time for the user. New features allowed computer-assisted software to become motivational for students and an efficient tool for teaching.

In the last decade, the "supercomputer," high performance computing technology, and the widespread use of the Internet began to allow copying audio, movie, and data files onto CD or DVD and accessing streaming audio files such as MP3 and others. These new resources provided music educators a highly interactive multimedia teaching environment. Music educators and students now take advantage of the Internet to access valuable information on the Internet. Distant learning music courses are available online. Computer-assisted instruction in music is continuing to grow with the available new technology resources and the influence of computer technology and the Internet on music education is infinite.

Keyboard Technology

Keyboard technology grew along with the development of computer technology and music applications. The first electronic keyboards, or synthesizers, were developed

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[49] David Mash, *Computer and the Music Educator,* ed. Andrew Calvo (Menlo Park, CA: Digidesign Inc., 1991), 7.

[50] George J. Hess, Jr., "Dictation Tutor: The Effectiveness of a Curriculum-Specific Tutorial in the Acquisition of Aural Discrimination Skills at the College Level" (D.A. diss., The University of Northern Colorado, 1994), 21-22.

in the 1950s when RCA Electronic Music Synthesizer built the first analog synthesizer.[51] These instruments, however, were expensive, cumbersome, and had little potential for teaching piano applications.[52] In 1963, Moog and Deutsch built the first monophonic synthesizers, the "Minimoogs." Offering more portability and lower cost, these smaller-sized synthesizers were made more widely available to composers as well as performers.[53]

In the late 1970s, Oberheim manufactured the first polyphonic keyboard[54] in which digital sound synthesis technologies merged with computer programs, allowing computers to generate four, eight, or even sixteen voice sound examples simultaneously.[55] In addition to the polyphonic feature, these digital keyboards were touch sensitive and had programmable memory.[56]

In the early 1980s, digital sampling evolved which proved to be a major revolution in technology. This ground-breaking technology allowed synthesizers to replicate sounds of acoustic musical instruments, thus broadening the palette of musical sounds available on the keyboard.[57] MIDI synthesizers were one of the early keyboards that were capable of generating high-quality sound examples.[58] In the mid 1980s, the first MIDI piano or reproducing piano was introduced. The MIDI piano, not a digital piano, is

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[51] Mash, *Computer and the Music Educator*, 2.

[52] Renfrow, 21.

[53] Sam Holland, "Synthesizers: A Primer for Teachers," *Clavier* 23, no.10 (December 1984): 44-5.

[54] Renfrow, 21-2.

[55] Peters, "Convergence," 242.

[56] Mash, *Computer and the Music Educator*, 4-5.

[57] Ibid., 5.

[58] Peters, "Convergence," 242.

an instrument that combines a conventional acoustic piano with MIDI technology. Specialized sensors in the MIDI piano convert all information such as notes, duration, key velocity, and pedal controls of a performance into MIDI data. These data can be stored for future playback.[59]

By the early 1990s, digital pianos were developed that could simulate sounds of acoustic pianos using digital samples of acoustic piano sounds, synthesized piano sounds, or a combination of both. Such pianos are velocity-sensitive and have features that include onboard speaker and amplifier, onboard digital sequencer, and MIDI In- and Out-ports.[60] At the turn of the new millennium, digital pianos continued to improve in their versatility and multimedia capability. In addition to standard features such as internal hard drive, built-in sequencer, and onboard CD drive, most high-end digital pianos have easy-to-navigate touch screens, MIDI and PC connections, a "player piano" system, karaoke sing-along, and CD software compatibility. Internet access became even more efficient on the Yamaha Clavinova series (CVP 300 and above). These instruments allow access to the Internet from an LCD display, enabling the user to download favorite song and accompaniment files for immediate use.

Keyboard technology has continued to evolve in the last decade. Yamaha, one of the leading digital piano manufacturers, combined the mechanism of the acoustic piano with fiber optic technology in its Disklavier. The built-in optical sensors allow the recording of each hammer action and pedal movement to produce exact replications of

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[59] Sam Holland, *Teaching Toward Tomorrow: A Music Teacher's Primer for Using Electronic Keyboards, Computers, and MIDI in the Studio* (Loveland, OH: Debut Music Systems, 1993), 7.

[60] Ibid., 2-4.

the notes, rhythm, dynamics, articulation, and pedaling of a performance.[61] The versatility of such digital reproducing acoustic pianos[62] has continually expanded. For example, Yamaha's Disklavier Pro series is quite digitally sophisticated in its SmartKey™ practicing and CueTime™ accompanying features. Disklavier Mark IV, embracing similar features, has evolved a wireless feature controlled by a PDA-style pocket remote. It can also replay a videotaped piano performance on the instrument and display the video image on any television or monitor.

The advancement of computer technology has directly influenced the development of keyboard technology. Computers, MIDI-compatible keyboards, and digital pianos continue to drop in cost and become more efficient and versatile. They are appearing more frequently in many independent studios and homes. Independent piano teachers are now taking advantage of the remarkable features available on digital pianos to motivate students to practice and to be more creative. With technologies made more widely available to students and music educators, courseware developers continue to fulfill the pedagogical needs of music educators.

A History of Computer-Assisted Instruction in Music

Research in the development and implementation of computer-assisted music instruction in the 1960s-70s led to the expansion of courseware development in the early 1980s. The first companies to publish computer-assisted music programs were Micro

[61] Michael D. Sharp, "Facing the Music: Using the Yamaha Disklavier and MIDI Sequencing in the Applied Piano Studio," in *Proceedings of the Fourth International Technological Directions in Music Learning Conference. TDML,* 1997. [journal on-line]; available from http://music.utsa.edu:16080/tdml/conf-IV/IV-Sharp/IV-Sharp.html; Internet; accessed 8 July 2005.

[62] Often referred as 'digital acoustic piano' or 'computer-age "player" piano' on Yamaha's website. Available from http://www.yamaha.com

Music Inc. Software Library (later taken over by Temporal Acuity Products), developed by Williams and Schrader, and Electronic Courseware Systems by Peters and Eddins.[63] The foci of early programs were to teach specific fundamental skills such as theory and ear training.

Computer-assisted instruction emerged in the 1960s as an extension of the programmed instruction of the 1950s and in conjunction with the evolution of the computer.[64] The term, computer-assisted instruction (CAI), is typically used interchangeably with computer-based instruction (CBI) or computer-based music instruction (CBMI). Basically, the term refers to instructions in which computer programs are employed to assist with teaching and learning processes. The primary purpose of the computer-assisted instructional software is to teach. The scope is usually narrow and well-defined.

In the early stages of the development of computer-assisted instructional software, two opposite learning approaches in its design were identified. These approaches are based on theories of behavioral psychologists such as Skinner and Gagné, and on theories of developmental psychologists such as Piaget. The first approach relies heavily on feedback and reinforcement, two main aspects of programmed instruction, and usually results in a highly structured and teacher-centered learning environment.[65] Software programs following this orientation allow students to learn a small amount of music

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[63] Higgins, 5.

[64] Taylor, *CMR Report X-4*, 27.

[65] Robin S. Stevens, "Computers in Music Education: The Current 'State of the Art' and 'Future Directions and Opportunities' Revisited," in *Computer Technology and Music Education: The Australian Beginning*: *Proceedings of a Symposium entitled "Utilising Computer Technology for Music Teaching and Learning," held as part of the ANZAAS Festival of Science-1985 (The Fifty-Fifth Congress of the Australian Association for the Advancement of Science) Monash University, Victoria, August 29, 1985,* ed. Robin S. Stevens (Victoria, Australia: Deakin University, 1987), 16, 18.

information and skills one at a time and provide immediate feedback to their responses.[66] On the other hand, the developmental approach promotes flexible and non-linear thinking in student learning. This generally results in an environment that emphasizes interactions between the student and the computer as well as between the student and the teacher.[67]

Computer-assisted programs are generally categorized into four instructional modes based on their educational characteristics. These modes are drill-and-practice, tutorial, simulation/games, and multimedia/hypermedia. In the early stages of the development of computer-assisted instructional programs, the foremost approach in software design drew upon repetitive drills. The purpose of drill-and-practice programs is to reinforce concepts learned in the lesson and to provide exercises for practicing specific skills such as note recognition and rhythm identification. An early example is Hofstetter's GUIDO program in which graded instructional units reinforced concepts learned such as intervals, chord qualities, harmonies, and rhythm.[68]

In the late 1970s and the 1980s, due to limited availability of advanced programming tools, software programs were lacking in musical quality and effectiveness. Simple subject matter such as music fundamentals and music theory became primary learning topics. In the following decade, however, as programming techniques improved, a greater variety of topics was incorporated into drill-and-practice software programs to cover broader areas in music education and music history.[69] In the early 1990s, drill-and-

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[66] Sam Reese, "Music Technology: Tools for Extending and Sharing Minds," *American Music Teacher* 43 no.6 (June/July 1994): 12-13, 90.

[67] Stevens, 16, 18.

[68] Rudolph, 78.

[69] Peters, "Convergence," 243.

practice programs began to offer more flexible options allowing users to adjust the content and pace. They offered comprehensive approaches with multiple tasks, online tutoring for music concepts, and flexible learning environments.[70]

A similar instructional mode that branches out from drill-and-practice is the tutorial. In tutorial programs, a specific concept is introduced and explained to students on the computer screen. Each new concept is presented in a sequential pattern that leads the students through various steps and levels of knowledge, from basic to more advanced information. In these programs, students often can select a level of difficulty for the presentation of material.[71] In early tutorial programs, the presentation of information was determined solely by the computer. However, when the CD-ROM was incorporated into tutorial programs, students could choose the content, sequence, and mode of presentation (text, verbal presentation, music, animation, or pictures).[72]

With the increasing popularity of computer games in the past decade and a half, students have become interested in simulation and gaming technology. Music software developers, taking advantage of students' interests in this area, design instructional software that emphasizes interaction between the student and the computer. Key features of simulation programs include interactive platforms that allow manipulation of aural and visual images, frequent use of MIDI instruments as an input device, and flexible

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[70] David Brian Williams and Peter Richard Webster, *Experiencing Music Technology,* 3rd ed. (Belmont, CA: Thomson Higher Education, 2006), 409.

[71] "Computer-Assisted Instruction in Music," *Teaching Music* 1, no.6 (June 1996): 34.

[72] Berz and Bowman, 7-8.

frameworks that provide users with creative control.[73] Interactive games, often integrated into simulation programs, are fun to play and highly motivational for students.

The final category of instructional software design includes the multimedia or hypermedia programs. These programs allow users considerable freedom in navigating and manipulating their contents by mixing a variety of media such as audio CDs, videodiscs, and MIDI devices. Hypermedia programs are generally intended for a single student use.[74] Such programs emphasize exploration and discovery rather than specific skill development. They stimulate creative thinking by encouraging students to modify and manipulate musical material, and to observe the changes in musical qualities. This type of learning, emphasizing the importance of social interaction, originates from Piaget's learning theory.[75] With the use of texts, sounds, and graphics in the software design, the hypermedia or multimedia programs promote non-linear exploration that accommodates different learning styles in students.[76] Examples of such programs are Mozart's *The Magic Flute* (Warner New Media) and Beethoven's *Ninth Symphony* (The Voyager).[77]

The different instructional modes in computer-assisted software design offer music educators invaluable resources in devising lesson plans to accommodate different learning styles in students. This variety of programs, when used in combination with

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[73] Williams and Webster, 409.

[74] Berz and Bowman, 39-40.

[75] Reese, "Music Technology," 13, 90.

[76] Williams and Webster, 409.

[77] Stevens, 24-5.

carefully drawn lesson plans, can become powerful teaching tools for music educators and motivating tools for students.

Research on the Integration of Technology into Music Curricula

Many researchers have taken interest in evolving technology and its application in music instruction. Areas of study include the emergence of technology in music instruction, the feasibility of computer systems and programs, and the effectiveness of technology, sometimes comparing it with traditional teacher-student methods. Most research focuses on one of three music instructional settings: K-12 (public schools), college, or private. With few exceptions, results in all of these populations uphold the benefits of computer instruction.

The Use of Technology in Public Schools

Studies have demonstrated the enduring use of technology in public schools. Some studies focus on the historical background of the role of technology in music instruction, while others concentrate on its effectiveness in teaching note reading, ear training, composition, tonal memory, rhythm, and music fundamental skills. The results are varied: some findings show significant gains in student achievement using computer-assisted instruction; others demonstrate that the traditional classroom method was equally or more effective.

In 2003, Loszewski[78] presented an overview of the roles of technology in K-12 music instruction since 1900. He traced the first occurrences of multimedia tools such as radios, televisions, videotape recorders/players, portable cameras, and other modern advancements in the American public schools. In addition to describing specific technologies, Loszewski explained how past and present music educators broadened student experiences and supplemented presentation of complicated subject matter with these modern devices.

Hesser,[79] Isaak,[80] and Holland[81] compared the effectiveness of two instructional methods, computer-assisted and conventional, for teaching note-reading skills. Hesser investigated whether the use of computer programs would enhance elementary students' note-reading skills. Her findings indicated that computer-assisted instruction provided a more positive learning environment than a conventional approach and could be more beneficial in reinforcing basic music reading skills. On the other hand, Isaak found no significant differences in student achievement and concluded that computerized exercises were just as effective as traditional methods for teaching elementary note-reading skills to elementary children. In a study of high school students by Holland, those who studied

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[78] Timothy P. Loszewski, "A Historical Overview of the Roles of Technology in American K-12 Public School Music Instruction from 1900 to the Present" (M.M.E. thesis, Eastern Michigan University, 2003).

[79] Lois Annette Hesser, "Effectiveness of Computer Assisted Instruction in Developing Music Reading Skills at the Elementary Level" (Ed.D. diss., State University of New York at Albany, 1987).

[80] Troy Isaak, "The Effectiveness of Computerized Drill-and-Practice and Bisensory Input in Teaching Music Reading Skills to Elementary Students" (Ed.D. diss., The University of Northern Colorado, 1988).

[81] Marianne Holland, "The Effect of Computer Instruction on the Vertical/Horizontal Music Reading Skills of the Grand Staff for Students Enrolled in Senior High School Beginning Keyboard Classes" (Ph.D. diss., The University of South Carolina, 1987).

piano via music software and regular instructions at the keyboard did not have significant gains.

Kuribayashi[82] developed and evaluated a computer-based music reading program, *FlashNotes*. Prior to his study, Kuribayashi had successfully used this program with many private piano students for four years. In this experiment, Kuribayashi investigated how quickly and accurately children at different ages, six to eleven, recognized random melodic patterns using the computer. Kuribayashi concluded that chronological age and reading speed were related factors in the effectiveness of the program since findings showed that older students performed better in terms of accuracy and speed.

In 1988, King[83] determined the extent to which an eight-week computer-based course affected the achievement of seventh-grade students in three areas of music learning: aural acuity, auditory-visual discrimination, and knowledge of music notation. He examined commercially available software appropriate for the age and musical experience of junior high students and found that these could be a viable supplement to instruction and significantly more effective than the traditional teaching method alone.

Nelson[84] developed and evaluated a curriculum of sequential instruction in which seventh-grade students learned orchestration and music composition using computers. In three years of research, the students related better with and were more responsive to the computer instruction. Nelson claimed that the computer offered unique musical learning

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[82] Fumio Kuribayashi, "The Effects of Organized and Unorganized Pitch Structure on a Computer-Assisted Music Reading Task of Young Children" (Ph.D. diss., The University of Kansas, 1993).

[83] Richard Vern King, "The Effects of Computer-Assisted Music Instruction on Achievement of Seventh-Grade Students" (Ph.D. diss., The University of Illinois at Urbana-Champaign, 1988).

[84] Beth Johanna Pearce Nelson, "The Development of a Middle School General Music Curriculum: A Synthesis of Computer-Assisted Instruction and Music Learning Theory" (D.M.A. document, Eastman School of Music, The University of Rochester, 1988).

opportunities including more sophisticated feedback and student-directed learning. She also stated the use of computer-assisted instruction in a group setting produced interactions that propelled motivation and stimulated imaginative thoughts.

Investigations have revealed that computer instruction can also be a useful tool in developing tonal memory. Whiston[85] examined the effects of two software programs, *The Magical Musical Balloon Game*[86] and *Toney Listens to Music*,[87] as supplemental tools to develop tonal memory skills and aural perception of melodic movement with first-grade students. Her findings indicated that students could improve both skills with computer-assisted instructional software. In a similar study, Robinson[88] developed and evaluated a program for improving tonal memory in fourth-, sixth-, eighth-, and tenth-grade music students. However, the results of this study showed no significant gains in achievement.

Gilbert[89] observed greater effectiveness using the traditional classroom method than computer-assisted instruction in teaching meter and rhythm discrimination to fourth-, fifth-, and sixth-grade students. Research subjects participated in a self-paced computer program in which they created music following teacher-assigned rhythmic patterns and meters on MIDI keyboards. Findings revealed that students performed better when

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[85] Sandra Kristine Whiston, "The Development of Melodic Concepts in Elementary School Age Children Using Computer-Assisted Instruction as a Supplemental Tool" (Ph.D. diss., Ohio State University, 1986).

[86] *Magical Musical Balloon Game* [CD-ROM] (Bellevue, WA: Temporal Acuity Products Inc., 1990).

[87] Donna Brink Fox and David Williams, *Toney Listens to Music* [CD-ROM] (Bellevue, WA: Temporal Acuity Products Inc., 1990).

[88] Russell Lowell Robinson, "The Development and Evaluation of a Microcomputer-Assisted Music Instruction Program for the Improvement of Tonal Memory" (Ph.D. diss., The University of Miami, 1984).

[89] Linda Arms Gilbert, "The Effects of Computer-Assisted Keyboard Instruction on Meter Discrimination and Rhythm Discrimination of General Music Education Students in the Elementary School" (Ed.D. diss., Tennessee State University, 1997).

receiving the conventional approach to teaching. Gilbert deduced that computer-assisted keyboard instruction was less helpful due to the lack of student-student and student-teacher contacts.

On the other hand, Conant[90] demonstrated the usefulness of a computer-learning environment. She created and studied the effects of a computer program, *Music Construction Set*,[91] on the cognitive development of fifth- and sixth-grade children. The experimental group composed and harmonized their own melodies using computers and yielded positive results. Conant observed that seeing and hearing music simultaneously helped the students easily recognize textures and melodic contours. Similarly, Lee[92] developed and evaluated a music instructional program, *My Favorite Melodies*, that allowed young children to discriminate among diverse musical examples and to explore sounds by freely manipulating the elements of music. Positive findings indicated that children enjoyed exploring, testing, and experimenting with sounds using the program.

Although computer instruction might be more suited to the area of music fundamentals than traditional teaching, Dangelo[93] demonstrated otherwise. In his study, Dangelo investigated whether computer-based instruction better enhanced the understanding of basic music skills. Elementary school students ages eight to ten received short-term computer instruction in music fundamentals. Results of Dangelo's study

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[90] Barbara H. Conant, "A Study of Cognitive Processes of Children Creating Music in a Computer Learning Environment" (Ed.D. diss., The University of Massachusetts, 1988).

[91] *Music Construction Set* [CD-ROM] (San Mateo, CA: Electronics Arts Research, 1984).

[92] Yu-Wen Lee, "Teaching Young Children Music Fundamentals in a Computer Learning Environment" (Ed.D. diss., Teachers College, Columbia University, 1994).

[93] Eugene Michael Dangelo, "The Use of Computer Based Instruction in the Teaching of Music Fundamentals" (Ph.D. diss., The University of Pittsburgh, 1985).

indicated no significant differences in pre-/post-test scores between experimental and control groups.

The Use of Technology in Colleges and Universities

Research in the use of technology also focuses upon colleges and universities. Most of these studies examine the effectiveness of computer-assisted instruction as compared to conventional teaching methods. In addition to music fundamentals and ear training skills, many researchers have broadened their subject matter to include the effectiveness of hypermedia/multimedia programs and the use of technology in group piano curricula. While most studies provide positive outcomes, some reveal contradictory results.

Vaughn[94] and Hess[95] evaluated computer instruction in teaching aural skills to college freshman students. Vaughn studied whether computer-assisted instruction increased student ability to identify auditory stimuli at a different rate than that of the traditional methodology. Randomly selected students from Basic Musicianship classes at Oregon State University participated in this project. Findings indicated significant academic growth in the experimental group. Vaughn concluded that students saved considerable time developing ear training skills using the computer. Similarly, Hess found that computer-assisted instruction allowed students to work efficiently. In his 1994 study, Hess developed an ear training program to complement the freshman music theory

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[94] Arthur Clarence Vaughn, Jr., "A Study of the Contrast Between Computer-Assisted Instruction and the Traditional Teacher/Learner Method of Instruction in Basic Musicianship" (Ph.D. diss., Oregon State University, 1977).

[95] George J. Hess, Jr., "Dictation Tutor: The Effectiveness of a Curriculum-Specific Tutorial in the Acquisition of Aural Discrimination Skills at the College Level" (D.A. document, The University of Northern Colorado, 1994).

curriculum. Students in the experimental group received only computer instructions. The results indicated that students developed slightly higher levels of aural skills than those who received traditional methods alone. Hess concluded that the computer program provided more consistent instruction and intrinsic motivation for students.

Some researchers studied the efficacy of computer instruction on university group piano students. In 1995, He[96] investigated the effects of two computer-based self-instructional programs (traditional approach program and game approach program) in teaching piano note-reading to adult students. According to He, both programs were equally effective in enhancing adult learners' note-reading skills but students in the game approach program demonstrated a slightly better performance. Results also demonstrated the importance and usefulness of the Internet in teaching music and delivering questionnaires and test materials. In a similar 2001 study, Hagen[97] created drills and play-along accompaniments using two different computer programs, *Finale*® and *Harmony*,[98] to help students improve their sight-playing skills. Results indicated that computer drills and accompaniment strategies were most effective for note recognition improvement while the traditional method was more useful for rhythm accuracy. Hagen concluded that computers may provide useful practice environments for all learners of various skills.

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[96] Judy Hui-Chieh He, "The Comparison of the Effects of Two Computer-Based Music Instruction Programs in Teaching Piano Note Reading to Adults Through Two Different Delivery Systems" (Ph.D. diss., The University of Illinois at Urbana-Champaign, 1995).

[97] Sara L. Hagen, "The Effects of Computer-Assisted Instruction and Cognitive Style on Sight Playing Among University Group Piano Students" (Ph.D. diss., Florida State University, 2001).

[98] Bowers and others, *Harmony* [CD-ROM] (Bellevue, WA: Temporal Acuity Products Inc., 1990).

Kuyper[99] and Jacobsen[100] studied the usefulness of computer-assisted instruction in music fundamentals; however, their findings supported different conclusions. Kuyper developed a computer-based teaching system called Music Instruction System in Theory-Iowa (MISTI). His research assessment confirmed that the system accommodated students with differing levels and proved to be a significant asset when used in an undergraduate teaching environment. In contrast, Jacobsen's study on the efficacy of computer-assisted drill-and-practice in teaching basics of music notation and rhythm exhibited the superiority of the traditional teaching method over computer-assisted instruction.

Studies of the effectiveness of multimedia technology in teaching yield mixed results. Lin[101] developed and investigated the use of computer-based music instruction incorporating an audio CD and a videodisc with selected undergraduate elementary education students. Positive results confirmed that such instruction involving hypermedia provided an appropriate and effective learning environment for teaching instrument recognition. Also, Lin stated that media-based instruction can be a great motivational tool. Fern[102] created and examined the use of a computer-based interactive CD-ROM program, *The Master Series – Miles Davis*. In interviews, Fern's research participants described the study's courseware as motivating and non-threatening.

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[99] Jon Quentin Kuyper, "MISTI: A Computer-Assisted Instruction System in Music Theory and Fundamentals" (Ph.D. diss., The University of Iowa, 1981).

[100] Jeffrey Richard Jacobsen, "Effectiveness of a Computer-Assisted Instruction Porgram in Music Fundamentals Applied to Instruction for Elementary Education Majors" (D.M.E. diss., The University of Northern Colorado, 1986).

[101] Sheau-Yuh Lin, "Investigation of the Effect of Teacher-Developed Computer-Based Music Instruction on Elementary Education Majors" (Ph.D. diss., The University of Illinois at Urbana-Champaign, 1994).

[102] James Lloyd Fern, Jr., "The Effectiveness of a Computer-Based Courseware Program for Teaching Jazz Improvisation" (D.M.A. document, The University of Southern California, 1995).

However, the results of two similar studies differed from Fern. Duitman[103] tested an instructional strategy incorporating music-related hypermedia into a college music appreciation course curriculum. Although the experimental subjects did not show significant improvement in their test scores when compared to the traditional group, they spent more time directly interacting with the music. Duitman concluded that hypermedia is a useful resource tool for a listening project. Similar results appeared in a study by Fortney,[104] who investigated the effects of music instruction via interactive audio CD-ROM technology on the music achievement of students with various learning styles. Findings indicated that learning styles had no impact on student achievement in an interactive environment.

The Use of Technology in Private Schools and Independent Studios

The assessment of technology and its application also occurs in private schools and studios. Some studies examine the value of computer instruction in private studios, question the effectiveness of self-taught programs, and evaluate group piano programs that incorporate technology. While most research yields positive results, a few reveal no significant value in using technology.

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[103] Henry Edgar Duitman, "Using Hypermedia to Enrich the Learning Experience of College Students in a Music Appreciation Course" (Ph.D. diss., Ohio State University, 1993).

[104] Patrick Michael Fortney, "Learning Style and Music Instruction via an Interactive Audio CD-ROM: An Exploratory Study" (Ph.D. diss., The University of Miami, 1993).

Young,[105] Kim,[106] and Simms[107] studied the impact of computer instruction on students in private studios. Young developed and evaluated a computer-assisted music theory curriculum to supplement elementary piano lessons. The experimental students using MIDI-compatible software showed significant gains in note reading, rhythm, harmony, terminology, score analysis, and ear training. In her qualitative study, Kim observed three intermediate violin students using instructional software to learn music history and theory. Findings revealed students gained knowledge of the music they played and related the historical and theoretical instruction to their repertoire. Kim concluded that the visual and aural effects of the computer programs motivated students and saved time, thus allowing them to practice more efficiently. In a similar study, Simms observed, described, and analyzed motivational characteristics of piano students before, during, and after the use of an educational computer game. Students using *Miracle® Piano Teaching System*[108] arcade games demonstrated gains in note-identification and note-playing skills on the keyboard. Simms concluded that educational computer games transformed an undesirable learning experience into a more enjoyable event, and encouraged intrinsic motivation to learn, depending on the student's personality.

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[105] Pai-Lin Young, "A Computer-Assisted Music Theory Curriculum for Young Piano Students" M.A.thesis, San Francisco State University, 1993).

[106] Sara Junghwa Kim, "An Exploratory Study to Incorporate Supplementary Computer-Assisted Historical and Theoretical Studies into Applied Music Instruction" (Ed.D. diss., Teachers College, Columbia University, 1996).

[107] Brenda Elise Simms, "The Effects of an Educational Computer Game on Motivation to Learn Basic Musical Skills: A Qualitative Study" (D.M.E. diss., The University of Northern Colorado, 1997).

[108] *Miracle® Piano Teaching System* [CD-ROM] (Novato, CA: Software Toolworks, Inc., 1991).

Some studies examined the effectiveness of self-taught piano programs. Rudolphy[109] compared the self-instructional method against traditional keyboard instruction. The experimental group received year one of a self-paced interactive program, *Piano Discovery System*,[110] involving a computer and keyboard; the control group, on the other hand, received traditional teacher instruction on an acoustic piano using Books 1A and 1B of *Alfred's Basic Piano Library*.[111] Despite the computer program's advantageous features such as the ability to provide individualized lessons, feedback, and ample practice opportunities, findings of the study indicated that self-taught instruction was not generally effective, especially at the elementary level. Rudolphy stated that constant teacher supervision was necessary to maintain student interest, correct mistakes, and offer guidance when students had problems understanding the presentation of the program.

Tomczak[112] compared the effects of two self-instructional approaches for learning simple performance skills. The experimental and control groups, both of whom had no prior keyboard instruction, received instruction with computer-generated feedback on performance accuracy using *Jump! Music Piano Discovery*®,[113] or received the identical instruction but without any comments from the computer. Tomczak concluded that

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[109] Sue Ann Rudolphy, "A Comparison of Computer-Assisted with Traditional Beginning Piano Instruction" (M.M.E. thesis, Cleveland State University, 1998).

[110] *Piano Discovery System Version 3.0* [CD-ROM] (Mountain View, CA: Jump! Music, 1997).

[111] Gayle Kowalchyk and E. L. Lancaster, *Alfred's Basic Piano Library*, Levels 1A-4, with CD/MIDI (Van Nuys, CA: Alfred Publishing Co., Inc., 1990-95).

[112] Larry Tomczak, "The Evaluation of Two Self-Instruction Learning Approaches Assessing Music Knowledge and Simple Music Keyboard Performance Skills" (Ed.D. diss, The University of Cincinnati, 1999).

[113] *Jump! Music Piano Discovery*® [CD-ROM] (Mountain View, CA: Jump! Music, 1997).

feedback of the program was rather rudimentary and too imprecise to enhance students' keyboard skills.

Conflicting results are apparent in some studies on the efficacy of keyboard and computer technologies in group piano curricula. Schender[114] studied the implementation of such technologies and their impacts on student testing and performance in a group piano curriculum for children and adults at a community music school. Positive findings of the study indicated that electronic keyboards and MIDI technology motivated students. Schender concluded that these technologies allowed students to hear their works in progress and provided them tools to be more creative. On the other hand, Bailey reported a different result.[115] He studied the effectiveness of using computer-based instruction with four-, five-, and six-year-old children in learning pitch, rhythm, and keyboard orientation skills. Findings revealed that despite children's improvement in the study, certain tasks were not adaptable to computer instruction. Bailey claimed that such tasks as singing, moving, and ensemble playing – all necessary to cultivate children's minds – might not be possible with computer-based instruction.

Some studies, although outdated, are important in the development of new software programs. In her 1987 research, Chew[116] proposed the development of an expert system to teach piano lessons, drawing upon musical knowledge and principles of

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[114] Marie Schender, "An Evaluation of the Effectiveness of a Group Piano Program Using Electronic Keyboard and Computer Technology" (Ed.D. diss., Columbia University, Teachers College, 1998).

[115] Darrell Lee Bailey, "The Effects of Computer-Based Instruction on Achievement of Four, Five and Six Year Old Children in the Yamaha Music Education System Primary One Course" (Ed.D. diss., The University of Illinois at Urbana-Champaign, 1989).

[116] Carol Chew, "The Creation of an Expert System for Teaching Piano Lessons" (M.S. thesis, The University of Central Florida, 1987).

artificial intelligence. The proposed system would work as a "programmed learning" experience for students, allowing them to work at their own pace, without the human teacher's assistance. Chew believed that the system could disseminate valuable information to a wider population than the expert humans could reach. In 1991, Rodríguez[117] showed teachers the potential of the HyperCard authoring system to teach concepts and creative reading skills in a more effective way. He created stacks[118] to use in conjunction with Book 1 of *Robert Pace Piano*.[119] Rodríguez believed that HyperCard provided an easy programming environment, allowing teachers to develop software for their curricula and students' needs.

Additional Studies on Music Technology

As researchers establish the effectiveness and feasibility of technology use in music curricula, some provide invaluable information on the subject of integrating technology in specific educational settings. These studies provide information such as evaluations of software, availability of teaching materials, as well as teachers' attitudes toward the use of technology. With such knowledge, piano teachers can better implement technology into their private studios.

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[117] Elvin Samuel Rodríguez, "The Use of HyperCard in the Development of Software for Creative Elementary Keyboard Activities" (Ed.D. diss., Teachers College, Columbia University, 1991).

[118] Stacks is a collection of information stored in the computer.

[119] Robert Pace, *Music for Piano*, Books 1-4 (New York, NY: Lee Roberts Music Publications, Inc., 1979-85).

Banks[120] reviewed selected pre-college music computer programs and correlated their activities with those of *Alfred's Basic Piano Library* lesson books. She provided a chart that illustrated the correlation of activities between two sources and established an excellent model that included practical information on integrating computer lessons into piano curricula. In another study, Chao[121] provided critical information on the strengths and weaknesses of software and other multimedia technology. This exploratory study served to educate music educators, especially class piano teachers, regarding the availability of technological supplementary aids for students, including music software and videos. Chao found that both software and videos provided an environment in which student interaction with multimedia could foster a lifelong interest in music.

Some studies provided such well-organized information that they served as valuable manuals for music educators on contemporary technology. Dennis[122] evaluated available computer materials for teaching music, determined their applicability in the private piano studio, and educated teachers on their availability and use. She described the equipment and suggested the ergonomics of setting up a private piano studio incorporating computer technology. Dennis also listed positive features of computer-assisted instruction and provided checklists for evaluating programs and purchasing hardware and software. DeFusco[123] and Hurt[124] also developed similar manuals. DeFusco

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[120] Donna Whitten Banks, "The Correlation of Selected Pre-College Music Computer Programs with the Alfred Basic Piano Library" (D.M.A. document, The University of Oklahoma, 1990).

[121] Soon-Eng Lim Chao, "An Examination of Music Software and Music Videos for College Beginning Class Piano Students" (D.M.A. document, The University of Memphis, 1997).

[122] Pamela Richardson Dennis, "A Manual for the Use of the Computer as an Instructional Tool in the Private Piano Studio" (M.C.M. thesis, The Southern Baptist Theological Seminary, 1986).

[123] Edward John DeFusco, "Computer-Assisted Music Instruction: A Manual for Music Teachers" (M.A. thesis, Rhode Island College, 1987).

created an informational package of resources and guidelines to help music teachers incorporate computers into their curricula as a teaching tool in the classroom, rehearsal room, and studio. Similarly, Hurt constructed a list that included software packages, courseware manufacturers, industries, organizations, and individuals contributing to the development of products geared to aid computer-based music instruction.

Some researchers surveyed and interviewed music educators on their implementation of technology into curricula as well as attitudes toward the use of technology. Although some surveys focused on the integration of technology in private studios, Barbara Young[125] was the only researcher who investigated how selected independent piano teachers used technology in their curricula. In addition to survey questionnaires, Young interviewed several private piano teachers to obtain detailed information on setting up studios. Through her interviews, Young revealed that Apple computers were the most commonly used computer platform in the 1980s, and that teachers used software primarily to reinforce concepts such as music fundamentals, note reading, and ear training. However, Young did not investigate the use of accompaniment disks and the Internet.

In general, studies have shown positive attitudes in music educators toward the use of technology in music curricula. Bianchi[126] identified dominant factors motivating teachers to initiate the integration of technology into their curricula. According to her

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[124] James M. Hurt, "Computer-Based Music Instruction: A Resource Guide for Music Educators" (M.S. thesis, Tennessee State University, 1993).

[125] Barbara G. Young, "The Use of Computer and Keyboard Technology in Selected Independent Piano Studios" (D.M.A. document, The University of Oklahoma, 1990).

[126] Pamela A. Bianchi, "The Identification of Factors Motivating Teachers to Integrate Technology with the Curriculum" (Ed.D. diss., The University of La Verne, 1996).

survey, music educators viewed technology as a means to improve teaching practices and help students learn. Whatley[127] and Stell[128] also conducted similar surveys. Whatley investigated teachers' attitudes toward technology use along with their needs for technology training. The majority of respondents agreed strongly that computers made the classroom a more effective learning environment and they believed that technology should be used to supplement, tutor, and reinforce concepts and skills. In her survey, Stell revealed that computer-assisted instruction enabled educators to motivate and engage more students with diverse learning styles in creative and analytical learning.

Regenmorter[129] surveyed the full-time music faculty at American River College regarding their use of and interest in specific technologies for instructional purposes. Based on his survey, Regenmorter provided recommendations and specific strategies on how to effect the integration. In another study, Renfrow[130] established the need for educating graduate piano pedagogy students on the use of computer and keyboard technologies. Based on his research and survey of institutions that offer similar programs, Renfrow concluded that graduate piano pedagogy students should learn how to teach functional skills and to manipulate equipment for the purposes of sound creation and exploration using computer and keyboard technology.

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[127] Brian C. Whatley, "Technology Use by Music Educators in Eastern North Carolina" (M.M. thesis, East Carolina University, 1998).

[128] Betty Kathryn Rounds Stell, "Technology: Its Use and Impact upon Secondary Music Instruction in a Midwestern Urban Public School District" (Ph.D. diss., The University of Illinois at Urbana-Champaign, 1999).

[129] Merlyn Van Regenmorter, "Integrating Technology into the Music Curriculum of a California Community College" (M.A. thesis, California State University Dominguez Hills, 1998).

[130] Kenon Dean Renfrow, "The Development and Evaluation of Objectives for Educating Graduate Piano Pedagogy Students to Use Computer and Keyboard Technology" (Ph.D. diss., The University of Oklahoma, 1991).

In 2002, Ruthmann[131] established a theoretical framework drawn from various views on music teaching and learning to provide a psychological and philosophical foundation for implementing technology into curricula. Based on the constructivist approach, he established a theoretical framework as a basis for the technology integration. Similarly, Bieneman[132] investigated resources pertaining to the use of technology in music education and developed lesson plans using technology as a tool to teach music concepts to fifth-grade students. She also delineated websites that support educational technology for K-12 teachers.

Books: Music Technology and Its Application

Sources other than dissertations offer invaluable insights on the development of technology and its application to music educators. Areas of focus include the development of computers and instructional software and the implementation of technology into the curriculum. Some scholars concentrate their attention on the Internet. Others provide quick reference or resource guides for the busy teacher.

The Development and Integration of Technology in Teaching Curricula

The knowledge of how computer and keyboard technologies, as well as computer-assisted instruction evolved is pertinent because it provides the foundation on which

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[131] Stephen Alexander Ruthmann, "Technology in General Music Education: A Constructivist Approach Grounded in an Experience-Based Philosophy of Music Education" (M.M. thesis, Oakland University, 2002).

[132] Kristen Bieneman, "Integrating Technology into the Fifth-Grade Elementary Music Classroom" (M.M.E. thesis, The University of Wisconsin-Milwaukee, 2003).

piano teachers integrate technology into their curricula. In his work, Peters[133] discusses the historical development of computers and synthesizers at length. He traces how communication, audio, and computer developments have merged together to define a new music technology. Also, Peters illustrates the development of computer-based instruction in music as well as the effects of music instructional software on student learning, especially performance, composition, and listening skills. In his report for the Florida State University's Center of Music Research, Taylor[134] introduces computers and computer-based instruction, and demonstrates their potential to music educators. Similarly, Berz and Bowman[135] present a brief history of computer-assisted instruction in music in *Applications of Research in Music Technology*. They discuss how instructional software evolved alongside the development of computer technology and define the differences between application software and instructional software, as well as delineate various computer-assisted programs into categories. In addition, Berz and Bowman discuss the role of music technology in schools and explore how experts integrate it into their own curricula at different learning levels.

With the understanding of how experts in the past incorporated the use of technology in their curricula, scholars continue to investigate newest technologies and ways to maximize their potential as teaching tools. In *Computers in the Classroom* from

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[133] G. David Peters, "Convergence: Music Technology and Education," in *Basic Concepts in Music Education, II*, ed. Richard Colwell (Niwot, Colorado: University Press of Colorado, 1991), 237-242.

[134] Jack A. Taylor, *CMR Report X-4: Introduction to Computers and Computer Based Instruction Music*, revised edition (Tallahassee, FL: CMR Press, 1981).

[135] William L. Berz and Judith Bowman, *Applications of Research in Music Technology.* Reston, VA: Music Educators National Conference, 1994.

1970, Margolin and Misch[136] show teachers how to use technology in their classrooms and illustrate the importance and advantages of computer-assisted instruction. In Enghagen's book *Technology and Higher Education*, Aitken[137] contributes an article on ways different technology tools such as MIDI keyboards, sequencers, and various instructional software programs enhance student learning.

Useful teaching strategies for using technology in K-12 classrooms and private studios are available in books by Reese, McCord, and Walls,[138] Isaak, Erickson, and Vonk,[139] and Holland.[140] Reese et al. in *Strategies for Teaching: Technology* provide a diverse range of strategies illustrating how music educators put the National Standards on Arts Education in action in conjunction with the use of technology. Such strategies including specific objectives, required materials, and step-by-step procedures assist teachers in curriculum development, lesson planning, and assessment of music learning. In the same line as Reese et al., Isaak et al. provide lesson plans consisting of teaching ideas for private teachers as well as suggested classroom activities. Their book also includes a software directory comprising an extensive list of software available only in the 1980s. Independent piano teachers can also take advantage of Holland's useful tips in

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[136] Joseph B. Margolin and Marion R. Misch, eds. *Computers in the Classroom: An Interdisciplinary View of Trends and Alternatives* (New York: Spartan Books, 1970).

[137] Gene Aitken, "Music Technology for the 21st Century," in *Technology and Higher Education,* edited by Linda K. Enghagen, J.D., 57-74. (Washington, D.C.: An NEA Professional Library Publication, 1997).

[138] Sam Reese, Kimberly McCord, and Kimberly Walls, (compiled and) eds. *Strategies for Teaching: Technology* (Reston, VA: MENC – The National Association for Music Education, 2001).

[139] Troy J. Isaak, Fritz J. Erickson, and John A. Vonk, *Micros and Music: Lessons Plans, a Directory of Software for Achieving Educational Objectives and Procedures for Evaluating Software* (Holmes Beach, FL: Learning Publications, Inc., 1986).

[140] Sam Holland, *Teaching Toward Tomorrow: A Music Teacher's Primer for Using Electronic Keyboards, Computers, and MIDI in the Studio* (Loveland, OH: Debut Music Systems, 1993).

applying new technology in their studios. In his practical guide, *Teaching Toward Tomorrow*, Holland includes a series of hands-on projects allowing teachers and students to explore new tools such as MIDI, electronic keyboards, and the latest computers.

Scholars with many years of experience in using technology in their teaching have begun to compile and publish textbooks for class use or supplemental reference. In his 1996 edition *Computer and the Music Educator,*[141] Mash provides teachers with valuable, although outdated, information on using computer and keyboard technologies, the Internet, and a variety of software applications to improve education. Rudolph[142] discusses the latest development in hardware, software, and pedagogy tools and provides nearly 200 teaching strategies for music educators. In his most recent revision (2004), Rudolph includes suggested activities, student assignments and projects, an extensive list of links to websites of free software, and demonstration programs on a CD-ROM.

As higher educational institutions realize the importance of training teachers of the future generation in using technology in their curricula, professors who have long pioneered this field offer textbooks designed for class use. In a most recent publication, Williams and Webster[143] provide a comprehensive study on hardware, software, the Internet, and other advancements. Valuable insights include an overview of music technology via a chronicle of historic highlights of computer technology in music, definitions of computer-assisted instruction software designs and their applications, and technical descriptions of modern technology tools. In her books, Roblyer helps prepare

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[141] David S. Mash, *Computer and the Music Educator*, 4th ed. (Melville, NY: SoundTree, 1996).

[142] Thomas E. Rudolph, *Teaching Music with Technology,* 2d ed. (Chicago, IL: GIA Publications, Inc., 2004).

[143] David Brian Williams and Peter Richard Webster, *Experiencing Music Technology,* 3d ed. (Belmont, CA: Thomson Higher Education, 2006).

classroom teachers to instruct with technology. She discusses ways teachers can apply technology in different educational fields and strategies conforming to diverse learning theories. [144] Roblyer also develops problem-solving exercises that simulate real-world situations in teaching via step-by-step hands-on CD-tutorials.[145]

The knowledge of applying technology is also important to independent piano teachers. Valuable information on the use of technology in independent curricula appears in many piano pedagogy textbooks. Topics on computer-assisted software, methods of technology implementation, and resources on the Internet are included in selected chapters from major pedagogy texts such as *Creative Piano Teaching*,[146] *The Well-Tempered Keyboard Teacher*,[147] and *Practical Piano Pedagogy*.[148]

Application of the Internet in Teaching Music

Since the early 1990s, music educators have been taking advantage of the Internet in their instruction. In *Starting Out on the Internet: A Learning Journey for Teachers*,[149] Roblyer provides fun activities for integrating the Internet into teaching and individual or

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[144] M. D. Roblyer, *Integrating Educational Technology into Teaching,* 3d ed. (Upper Saddle River, NJ: Pearson Education, Inc., 2003).

[145] Ibid., Educational Technology in Action: Problem-Based Exercises for Technology Education (Upper Saddle River, NJ: Pearson Education, Inc., 2004).

[146] Yvonne Enoch, Geoffrey Haydon, and James Lyke, *Creative Piano Teaching,* 3d ed. (Champaign, IL: Stipes Publishing L.L.C., 1996), 438-460.

[147] Marienne Uszler, Stewart Gordon, and Scott McBride Smith, *The Well-Tempered Keyboard Teacher*, 2d ed. (New York: Schirmer Books, 2000), 197-222.

[148] Martha Baker-Jordan, *Practical Piano Pedagogy: The Definitive Text for Piano Teachers and Pedagogy Students* (Miami, FL: Warner Bros. Publications, 2003), 207-240.

[149] M.D. Roblyer, *Starting Out on the Internet: A Learning Journey for Teachers*, 2d ed. (Upper Saddle River, NJ: Pearson Education, Inc., 2003).

cooperative Internet projects. While some exercises explain the concept of the Internet, others provide links to resources useful for musicians and music educators. Hustwit[150] presents a thorough outline of the most popular features of the Internet. In addition to brief discussions on e-mails, mailing lists, and creating webpages, among other topics, Hustwit includes URLs and an annotated bibliography of selected websites. Similarly, Mash's[151] book provides brief but useful information for novices who want to begin using the Internet. Useful links to thousands of websites geared for various musicians – classical, pop, jazz, country, folk and others – also appear in Wills and Wardle's Internet music guide.[152]

Reference Guides for Music Educators

The continual evolution of more versatile computer technology and pedagogical strategies has influenced the development of educational software. Many experts have written guidebooks and manuals providing software and hardware reviews as well as resources useful for music educators. Bartle,[153] Hermanson,[154] and Higgins[155] discuss and

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[150] Gary Hustwit, *The Musician's Guide to the Internet* (San Diego, CA: Rockpress Publishing, 1997).

[151] David S. Mash, *Musicians and the Internet* (Miami, FL: Warner Bros. Publications, 1998).

[152] Dominic Wills and Ben Wardle, *The Virgin Internet Music Guide Version 1.0* (London: Virgin Publishing Ltd., 2000).

[153] Barton K. Bartle, *Computer Software in Music and Music Education: A Guide* (Metuchen, NJ: Scarecrow Press, 1987).

[154] Christine D. Hermanson, ed., *The MTNA Guide to Music Instruction Software,* 2d ed. (Cincinnati, OH: MTNA, 1993).

[155] William R. Higgins, Resource Guide to Computer Applications in Music Education for the Macintosh, MS-DOS/Windows & APPLE II Series Microcomputers, 10th ed. (Grantham, Pennsylvania: Messiah College, 1994).

evaluate various types of instructional and application software (e.g., notation and sequencing). In a now dated work, Bartle discusses evaluation criteria and reviews software available in the 1980s. Hermanson and other music educators have compiled software reviews for piano teachers' reference. Similarly, Higgins provides a comprehensive list of software for each platform of computers, books, and periodicals. He also discusses uses of computers for the following purposes: instruction, classroom management, administration, notation, performance, and communication. Similar literature includes Hofstetter[156] and Axford.[157]

In addition to guides for software evaluations, piano teachers can benefit from introductory information on technology topics such as computers and teaching strategies. Mash, in addition to his book on the Internet, has written two other resource guides. In one, Mash provides basic information about computer and its peripherals and explains the configuration of a computer workstation;[158] in the other, he presents multimedia and its components.[159] Leong and Robinson[160] in *Using the Computer in Music Education*, present basic information on computers, and MIDI, as well as suggest hands-on projects using selected software programs.

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[156] Fred T. Hofstetter, *Computer Literacy for Musicians* (New Jersey: Prentice Hall, 1988).

[157] Elizabeth C Axford, *Song Sheets to Software: A Guide to Print Music, Software, and Web Sites for Musicians* (Lanham, MD: Scarecrow Press, Inc., 2001).

[158] David S. Mash, *Musicians and Computers* (Miami, FL: Warner Bros. Publications, 1998).

[159] Ibid., *Musicians and Multimedia* (Miami, FL: Warner Bros. Publications, 1998).

[160] Samuel Leong and Glenn Robinson, *Using the Computer in Music Education – An Introduction for the Complete Novice* (Nedlands, W. Australia: Callaway International Resource Centre for Music Education, School of Music, The University of Western Australia, 1995).

Although intended for classroom use, Brandom and Engler's[161] book offers tips that can be adaptable for private teaching. They evaluate and correlate 32 prominent software programs with textbooks used in grades four to seven. Peters and Eddins[162] develop procedures for selecting hardware and software for instructional computer stations and laboratories. Additionally, independent piano teachers who are new to technology can learn how to set up a technology-equipped studio and use different software for instruction in a concise manual by Bowen.[163] In her most recent revision (2004), Bowen introduces brief practical guidelines for novice teachers in using technology in private piano studios.

Journals and Proceedings on Music Technology and Its Application

Professional journals for music educators also offer current information on the latest trends of computer and keyboard technology, software evaluation, teaching strategies, and Internet use. Through this medium, experts in music technology and music educators who use technology in their curricula have shared their knowledge with others. Classroom teachers of K-12 and college as well as private teachers can learn from such journal articles featured in *Teaching Music*, *Music Educators Journal*, *The Music & Computer Educator*, *Educational Technology*, and *Journal of Research in Music Education*, among many others.

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[161] Marilyn Brandom and Penny Pursell-Engler, *A Guide for Using Software in the Music Classroom* (Flagstaff, AZ: PM Music Company, 1992).

[162] G. David Peters and John M. Eddins, *A Planning Guide to Successful Computer Instruction* (Champaign, IL: Electronic Courseware Systems, Incorporated, 1981. Reprint, 1996).

[163] Sandra Bowen, *Electrify Your Studio!* (Fort Lauderdale, FL: The FJH Music Company Inc., 2004).

Selected Articles on Music Technology and Its Application Useful to Piano Teachers

Many journals have featured articles by scholars discussing issues such as the history of computer and instructional software, the implementation of technology in music curricula, the use of Internet and its resources, and teaching ideas using specific technology tools. Robinson[164] and Eddins[165] trace research and experimentation in computer-based music instruction from the 1960s to the 1980s. Similarly, Peters[166] outlines the history of music software and hardware, and examines the new tools and their benefits for use in the classroom. Along with Peters, Deihl and Radocy[167] discuss the teaching and testing potentials of computer-assisted instruction.

While some scholars focus on the historical background of the emerging technology, others concentrate on its integration into different music curricula. Syal[168] surveys public school music teachers about their use of computers and develops a model for the gradual and systematic implementation of computers in K-8 music education classrooms. Williams[169] discusses the strengths and weaknesses of music software and the specific teaching features of selected programs. Study of the computer for

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[164] Russell L. Robinson, "Uses of Computers in Music Education: Past, Present, and Future," *Application of Research in Music Technology* 5, no.2 (1987): 12-5.

[165] J. M. Eddins, "A Brief History of Computer-Assisted Instruction in Music," *Journal of the College Music Symposium* 21, no.2 (1981): 7-14.

[166] G. David Peters, "Music Software and Emerging Technology," *Music Educators Journal* 79, no.3 (November 1992): 22-5, 63.

[167] Ned C. Deihl and Rudolf E. Radocy, "Teaching Musicianship via Computer-Assisted Instruction," *Educational Technology* (August 1971): 23-4.

[168] Dianne M. Syal, "Computer Implementation in Music Instruction: Grades K through 8," *Pennsylvania Music Educators Association: Bulletin of Research in Music Education* 18 (1992): 65-76.

[169] Fred Williams, "New Solutions to Curricular Problems," *Music Educators Journal* 79, no.3 (November 1992): 33-5, 68.

instructional use is also the focus of articles by Cremaschi[170] and McArthur.[171] While Cremaschi demonstrates methods by which teachers incorporate computers into a class piano curriculum, McArthur assesses the effectiveness of and attitudes toward its use in the private music studio.

Articles on strategies for using specific technology tools also exist. Dal Porto[172] discusses advantages of various sequencers and presents ways by which teachers can incorporate them into a curriculum. Similarly, Riddle[173] demonstrates the possibility of using notation and sequencing software to teach keyboard ensemble literature in a music curriculum at William Jewell College. For the applied piano studio, Sharp[174] illustrates teaching techniques allowing students to interact with their own performances through the combination use of MIDI sequencing and Yamaha Disklavier in the applied piano studio. Similarly, Beauchamp and Fast[175] discuss the potential of Disklavier as an

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[170] Alejandro Cremaschi, "Incorporating Computers into a Class Piano Curriculum," in *Proceedings of the Seventh International Technological Directions in Music Learning Conference. TDML* 2000. [journal on-line]; available from http://music.utsa.edu:16080/tdml/conf-VII/VII-Cremaschi.html; Internet; accessed 8 July 2005.

[171] Victoria H. McArthur, "Are Computers Doing Their Job? The Effectiveness and Attitudes Surrounding Micro-Computer Instructional Use in the Private Music Studio," *The Quarterly Journal of Music Teaching and Learning* 3, no.2 (1992): 24-30.

[172] Mark Dal Porto, "How Music Technology Inspires Creative Thinking," in *Proceedings of the First International Technological Directions in Music Learning Conference. TDML*, 1994. [journal on-line]; available from http://music.utsa.edu/tdml/conf-I/I-DalPorto.html; Internet; accessed 8 July 2005.

[173] Pauline Riddle, "Using Current Technology to Teach Keyboard Ensemble Literature," in *Proceedings of the Second International Technological Directions in Music Learning Conference. TDML*, 1995. [journal-online]; available from http://music.utsa.edu:16080/tdml/conf-II/II-Riddle.html; Internet; accessed 8 July 2005.

[174] Michael D. Sharp, "Facing the Music: Using the Yamaha Disklavier and MIDI Sequencing in the Applied Piano Studio," in *Proceedings of the Fourth International Technological Directions in Music Learning Conference. TDML*, 1997. [journal-online]; available from http://music.utsa.edu:16080/tdml/conf-IV/IV-Sharp/IV-Sharp.html; Internet; accessed 8 July 2005.

[175] Laura Beauchamp and Barbara Fast, "Teach and Practice on a Reproducing Piano," *Piano and Keyboard*, no.193 (July/August 1998): 38-40.

instructional and learning tool. Teaching improvisation through auto-rhythm or accompaniment technology is also possible, as exemplified in Stampfli's article.[176]

Internet resources valuable to music educators and private piano teachers are also listed in journal articles. Bauer[177] describes ways by which music educators use the Internet for professional development. He discusses the benefits of the Internet as a tool for communication, research, and teaching in addition to including useful URLs. Although not comprehensive, Adkins'[178] annotated list provides websites covering specific areas such as music theory and history, piano, musician wellness, and piano pedagogy that are most valuable for piano teachers.

Journals for Piano Teachers: Technology Columns

Discussions on music technology that are more closely related to independent piano studio teaching also appear in periodicals for piano teachers. In 1988, the Music Teachers National Association (MTNA) launched its first symposium on computer-assisted music instruction at its national convention in Salt Lake City. An informal survey on the use of computers in selected private music studios immediately followed, which demonstrated the use of technology by piano teachers. In the following decade, journals for piano teachers began devoting columns to the discussion of technology use in private teaching studios.

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[176] Tom Stampfli, "Mastering Improvisation Through Auto-Rhythm/Accompaniment Technology," in *Proceedings of the First International Technological Directions in Music Learning Conference.TDML*, 1994. [journal on-line]; available from http://music.utsa.edu/tdml/conf-I/I-Stampfli.html; Internet; accessed 8 July 2005.

[177] William I. Bauer, "Using the Internet for Professional Development," *Music Educators Journal* 83, no.6 (May 1997): 22-7.

[178] Mary Rose Adkins, "Internet Resources in Piano and Piano Pedagogy," *Music Reference Services Quarterly* 8, no.4 (2004): 77-89.

In 1990, two years after MTNA launched its first technology symposium, the *American Music Teacher* began a column "Computer Connection" in which various piano teachers and other musicians contributed articles on technology topics. Four years later, this column changed its title to "Random Access," but still presently features submissions on a variety of topics pertinent to implementing music technology. Other piano journals have followed the *American Music Teacher*'s lead. Such columns are "Tomorrow Today: Technology" in *Keyboard Companion* (started in 1990), "Tech Talk" which was later called "Multimedia," and "Market Tips" in *Piano & Keyboard* (started in 1995 but ceased publication in 2001). Furthermore, some local music teachers' associations demonstrate their interests in technology by including technology columns in their journals as well as appointing technology chairs. In these columns, private piano teachers can acquire valuable information such as software and hardware reviews, curriculum integration, and tips on using the Internet.

The Internet: Resources on Music Technology and Its Application

In recent decades, music educators have become more aware of the Internet's possibilities and have begun to explore its use in teaching. The advantages of using the Internet are manifold: most of the information is current, easily accessible, and available to the public at no cost. Current trends in piano pedagogy such as strategies for applied or group instruction, performance issues such as musician wellness, as well as recent computer and keyboard technologies are available via e-journals, articles, and conference proceedings on the Internet.

Professional associations for music technology provide online services to their members and sometimes nonmembers as well. The Technology Institute for Music Educators (TI:ME),[179] formed in 1995, has published online newsletters since 2001 featuring articles and reports from its bi-annual convention on music technology geared for classroom teachers. Similarly, Association for Technology in Music Instruction (ATMI),[180] which formed in 1975 but only started holding annual conferences in 1994, posts its newsletters online. In addition, ATMI provides its members an extensive database of freeware, shareware, and commercial music instructional software. Both TI:ME and ATMI provide discussion groups and listservs (electronic mailing lists) for their members as well as nonmembers (ATMI). While some require annual subscription, others are free. Technological Directions in Music Learning (TDML),[181] a forum for new concepts in the application of technology to all aspects of music learning, disseminates online articles. This e-journal, although it ceased activities in 2003, still provides free access to its past issues of research reports and articles from TDML's 1994-2003 conferences. Although such web articles are generally targeted toward K-12 and college music educators, many ideas and concepts of the integration of technology can be adapted to independent piano studios.

Instrument manufacturers, online music stores, and music publishers also generally offer newsletter articles featuring technology topics on the Internet. Roland®, a leading manufacturer and distributor of electronic musical instruments, publishes two

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[179] Available from http://www.ti-me.org/ (See Appendix I for annotated bibliography.)

[180] Available from http://atmionline.org/ (See Appendix I for annotated bibliography.)

[181] *Technological Directions in Music Learning* [journal on-line]; a*vailable* from http://music.utsa.edu/tdml/; Internet; accessed 30 July 2005. (See Appendix I for annotated bibliography.)

newsletters online: *Instruments of Change (IOC)*[182] and *Keyboard Educator Newsletter.*[183] These newsletters feature articles and other resource materials to help classroom music educators and private piano teachers integrate technology into their curricula. Piano Lane,[184] an online music store, offers articles authored mostly by independent piano teachers on topics related to studio management, use of technology, and musician wellness. Most of these articles were previously published in other journals such as Alfred's *Piano Rendezvous*, *American Music Teacher*, and Roland's *Keyboard Educator.* Lentine's Music, [185] another online music store, offers articles on educational technology submitted by technology experts as well as classroom teachers. Discussions on technology topics are also available in the "Talking Tech" column in *The Piano Adventures® Teacher*[186] newsletter created by The FJH Music Company, Inc. in 2003. This website is designed for both pedagogy students and teachers already "in business." Also, piano teachers can communicate their ideas with others in the Piano Club discussion forum.

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[182] Dennis Mauricio ed. *Instruments of Change (IOC)* [newsletter on-line]; available from http://www.rolandus.com/community/educator.asp; Internet; accessed 30 July 2005.

[183] Brenda Dillon and Lynda Garcia, eds. *Keyboard Educator Newsletter* [newsletter on-line]; available from http://www.rolandus.com/community/educator.asp; Internet; accessed 30 July 2005.

[184] Available from http://www.pianolane.com; Internet; accessed 30 July 2005.

[185] Available from http://www.lentine.com (See Appendix I for annotated bibliography.)

[186] Marienne Uszler, ed., *The Piano Adventures® Teacher* [newsletter on-line]; available from http://www.pianoteaching.com/newsletter/index.html; Internet; accessed 31 July 2005. (See Appendix I for annotated bibliography.)

Websites supporting the professional development of piano teachers also exist. *Piano Pedagogy Forum*,[187] supported by the University of South Carolina School of Music, publishes web-based articles on piano pedagogy. Piano teachers can find articles on topics offering valuable tips in using technology. MTNA[188] and some state music teachers' associations provide resources for independent piano teachers, including information on piano pedagogy, business practices in the private studio, and other relevant topics. *College Music Society* (CMS),[189] serving the interests of a wider community of music professionals such as college teachers and music students, publishes newsletter articles and its symposium proceedings.

In recent years, the Internet has become an avenue to fun, interactive learning and discovery for music students of all ages. On their websites, some major symphony orchestras such as the Dallas Symphony Orchestra,[190] New York Philharmonic,[191] and San Francisco Symphony[192] dedicate segments to young children as part of their outreach programs. These fun-learning sites or "Kid's Zones" include interactive games and learning activities. Children learn about composers, conductors, performance artists, musical terms, and musical instruments. Colorful pictures, animated graphics, and musical sounds create a lively and dynamic learning atmosphere.

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[187] *Piano Pedagogy Forum* [journal on-line]; available from http://www.music.sc.edu/ea/keyboard/ppf; Internet; accessed 31 July 2005. (See Appendix I for annotated bibliography.)

[188] Available from http://www.mtna.org (See Appendix I for annotated bibliography.)

[189] Available from http://www.music.org (See Appendix I for annotated bibliography.)

[190] Available from http://dsokids.com (See Appendix I for annotated bibliography.)

[191] Available from http://nyphilkids.org (See Appendix I for annotated bibliography.)

[192] Available from http://sfskids.org (See Appendix I for annotated bibliography.)

Also, an increasing number of websites offering interactive piano lessons are available on the Internet. These independently maintained websites provide students an alternative to self-instructional software programs. Areas of learning include improvising skills, basic music theory, chord progressions, and repertoire (jazz, blues, ragtime, church, etc.) Such virtual piano lessons, most of the time supported by video and audio files, are appealing environments for interactive learning. Some lessons are strictly web-based, while others offer the option for downloads. Although fees are required for most online lessons, some offer free instructions. Methods of fee charging differ: by lesson units, by month, or by annual membership. Free lessons often serve as promotional tools to sell self-instructional video CD- or DVD-ROMs. With the variety of websites available, adults who have always wanted to learn to play the keyboard, but never could find the time to attend regular piano lessons, can now enjoy a self-pacing piano instruction.

Teachers' Uses of the Internet

In a private teaching setting, teachers can now use the Internet as a communication tool. In the past decade, listservs evolved with the increased use of e-mails and desire to communicate with peers as a group. Networking with other music educators helps teachers stay current with new ideas and curriculum designs. This outlet allows teachers to correspond with others who share the same interests. For example, in 1997, Steve Clark founded Pno-Ped-L, a subscription mailing list, which provides an accessible platform for independent piano teachers to exchange their experiences and ideas. In addition to listservs, discussion forums have emerged on the Internet. Many

such chat rooms exist for a general audience of musicians, although a few are intended for classical music enthusiasts or for piano teachers. The *Piano World*,[193] an online forum established in 1997, serves the community of piano teachers, piano technicians, and amateur pianists by featuring issues associated with practice, performance, piano maintenance, and information on digital keyboards and synthesizers.

In addition to communicating directly with others in their field, independent piano teachers are able to create and publish their own homepages using web authoring tools available online or in the form of software. These websites allow teachers to communicate with their students and parents; they serve as bulletin boards posting the studio policy, schedules, announcements, and other matters. Such webpages are also effective for promotion and recruitment purposes. Audio files of performances by the teachers and their students, video clips of student recitals, music scores, and audio presentations of student compositions are accessible to the public. Also, teachers can include useful links for parents and students for their own exploration.

The Internet may be used as a valuable research tool. Teachers can obtain reviews on current software and latest technologies, new music releases, and articles on specific topics. Parents can research summer music camps, seek college information, and locate piano teachers for their children. Music students who are aficionados of technology can take advantage of free downloads of sound files such as MIDI and MP3, as well as sheet music. These sound files can arouse students' interest in and appreciation for classical music. Students can now download sheet music to their favorite songs online. While most resources are available at no cost, some require a minimal fee or subscription.

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[193] Available from http://www.pianoworld.com (See Appendix I for annotated bibliography.)

The wealth of resources on the Internet can also serve as teaching and learning tools for piano teachers and music students. Many free educational sites on music theory, history, and ear training are available on the Internet. They provide supplementary tutorials and drills for student learning beyond the private lesson. Teachers can also create and customize student assignments using free notation programs or design puzzles and quizzes utilizing templates, all downloadable from the Internet, to reinforce certain concepts. Students can learn about composers' lives and works via directed reading and listening projects. Learning music history is thus no longer viewed as a tedious task; in fact, students become more motivated and excited to learn in the interactive environment.

Purchasing sheet music, software, teaching aids, CDs, and DVDs, as well as musical instruments has become more convenient and time-saving for piano teachers. Online music stores have multiplied in recent years, offering teachers discounts and special promotions. In addition to reduced price, competition often leads such retailers as Piano Lane, J.W. Pepper,[194] Lentine's Music,[195] and Hutchins and Rea/Symmes Music[196] to offer cash incentives or free shipping. Teachers no longer have to travel to the music store and shipments can be delivered to their doorsteps. Comparison of costs of merchandise, previously not possible in a single music store, is now feasible via research on the Internet.

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[194] Available from http://www.peppermusic.com or http://www.jwpepper.com (See Appendix I for annotated bibliography.)

[195] Available from http://www.lentine.com (See Appendix I for annotated bibliography.)

[196] Available from http://www.hutchinsandrea.com (See Appendix I for annotated bibliography.)

Summary

The development of technology is progressing rapidly. Music educators, especially independent piano teachers, are making great efforts to keep abreast with the latest advancements and incorporate them into curricula. Experts in technology and music education fields are now sharing their knowledge with novice and experienced teachers through workshops, seminars, and publications such as journal articles, books, and newsletters on the Internet.

A review of the literature reveals numerous interests among music educators in technology use in their research. Effectiveness and feasibility studies also confirm the copious advantages of computer-assisted instruction in music. Many schools at different levels are now including technology as an integral part of their music curricula. Resources on the Internet are growing daily and are readily available to piano teachers. Although surveys on the use of technology in the private piano studios exist, they are outdated and do not include investigations on the use of the Internet. Therefore, a more current and comprehensive study is necessary to acquire information on how selected independent piano teachers use various technologies – computer, keyboard, accompaniment disks, and the Internet – with their students. Hopefully, the findings presented in this document will help private piano teachers take advantage of the available extensive technology.

CHAPTER III

PRESENTATION OF DATA

A 51-item questionnaire (see Appendix A) was mailed to the first 400 piano teachers on MTNA's alphabetically ordered membership list. Of the 400 survey subjects, 225 returned the questionnaire, resulting in an overall return rate of 56.25%. Eighteen of these respondents indicated that they did not teach piano in an independent studio. Eight questionnaires were returned completely unanswered, due to the addressee's retirement or death or no specified reason. Thus, 199 independent piano teachers responded and returned the questionnaire. Sixty-two of these 199 (31.16%) did not have 12 or more students (see Table 1). As Table 2 shows, 76 teachers of the remaining 137 respondents (68.84%) incorporated technology in their teaching curricula; therefore, these 76 returns were valid responses eligible for the study. The results of these 76 surveys are presented in the following sections. While the remaining 61 of these 137 generally did not qualify for inclusion in the subject pool, their comments on why they did not include technology are instructive and appear in a section following the primary data report. In addition, although they fell outside the parameters for participation, 14 teachers with fewer than 12 students who used technology provided some relevant responses; their results are presented in a section at the end of this chapter.

Table 1

Independent Piano Teachers Who Completed and Returned the Questionnaire

Size of studio	Respondents (n=199)	Percentage
12 or more students	137	68.84
Less than 12 students	62	31.16

Table 2

Independent Piano Teachers with 12 or More Students

Use	Respondents (n=137)	Percentage
Used technology	76	55.47
Did not use technology	61	44.53

Computers

Part I of the questionnaire elicited information about the use of computer in piano teaching. Forty-seven teachers used the computer with their students. This represents 61.84% of the 76 respondents who employed technology in their teaching. As Table 3 shows, 37 of these 47 teachers (78.72%) used one computer. Ten (21.28%) used two computers. According to responses to Question 6, of the majority of the 47 teachers who used computers in their curricula, 31 (65.96%) had PC computers in their studios while 12 (25.53%) owned Mac computers. Only four teachers (8.51%) employed both platforms in their studios (see Table 4).

Table 3

Independent Piano Teachers Who Used Computer Technology for Teaching Purposes

Number of computers	Respondents (n=47)	Percentage
One	37	78.72
Two	10	21.28

Table 4

Computer Users

Computer platform	Respondents (n=47)	Percentage
PC	31	65.96
Mac	12	25.53
Both	4	8.51

For Question 7, participants revealed the location(s) of the computer(s) in their studios. While 27 teachers (57.45%) put their computers in their teaching spaces and 18 others (38.30%) placed them in a separate room, two respondents (4.26%) who owned two computers put one in the teaching space and another in a separate room (see Table 5). Question 8 determined the locations at which computer work occurred. Most of the students used the computer for learning only at their teachers' studios. Thirty-five respondents (74.47%) required student computer work in studios while 12 (25.53%) assigned computer work for both studio and home (see Table 6). No teachers assigned computer work for the home only.

Table 5

Locations of the Computer in the Studio

Location	Respondents (n=47)	Percentage
Teaching space	27	57.45
Separate room	18	38.30
Both	2	4.26

Table 6

Locations of Computer Work

Location	Respondents (n=47)	Percentage
Teacher's studio	35	74.47
Student's home	0	0
Both	12	25.53

Responses to Question 8 also indicated that the average time spent at the computer was limited. As shown in Table 7, only three teachers (6.38%) assigned more than half an hour work at the computer in studios. Ten respondents (21.28%) had their students spend between 15 to 30 minutes and an overwhelming 34 teachers (72.34%) assigned less than 15 minutes of computer work. Of the 12 teachers who assigned computer work at the students' homes, only two of them (16.67%) required more than 30 minutes at the computer. While seven (58.33%) required students to spend between 15 to 30 minutes at their home computers, three (25.0%) assigned less than 15 minutes (see Table 8).

Table 7

Average Time Spent at the Computer (Studio)

Time	Respondents (n=47)	Percentage
15 min or less	34	72.34
15-30 min	10	21.28
over 30 min	3	6.38

Table 8

Average Time Spent at the Computer (Home)

Time	Respondents (n=12)	Percentage
15 min or less	3	25.00
15-30 min	7	58.33
over 30 min	2	16.67

Question 9 asked the respondents when their students used the computer. As mentioned in Chapter One, this and other questions had the possibility of multiple answers. Thirty-one teachers (65.96%) had their students work on the computer before or after the lesson. Twenty-one (44.68%) assigned computer work during the lesson. Only

two respondents (4.26%) had their students come at a separate time to work on the computer (see Table 9).

Table 9

Student Use of the Computer

Time	Respondents (n=47)	Percentage
Before or after the lesson	31	65.96
During the lesson	21	44.68
Separate time	2	4.26

Note: Some respondents gave multiple answers.

In addition to responding to scheduling issues, respondents indicated whether their computers were connected to a MIDI keyboard. Eleven teachers (23.40%) had all their computers interfaced with a MIDI and five others (10.64%) connected some of their computers to a MIDI keyboard.

Music Software

Computer-Assisted Instruction

Questions 10 through 12 in Part II of the questionnaire were designed to obtain information about the use of music software. Forty-three of the 47 teachers (91.49%) who used the computer reported using music software in their studios. As Table 10 shows, 10 of these 43 teachers (23.26%) had used computer-assisted software for less than a year. Fourteen (32.56%) had used the program(s) for one to three years and 19 (44.19%) had reported using software for four or more years. Five of these 19 teachers (26.32%) had used computer programs for 10 or more years.

Table 10

Length of CAI Use

Length (Year)	Respondents (n=43)	Percentage
Less than 1	10	23.26
1-3	14	32.56
4 or more	19	44.19

The 43 users of computer-assisted instruction (CAI) software also provided information in Question 13 on supervision of use. Twenty-nine teachers (67.44%) monitored student use of the computer themselves. Eight teachers (18.60%) created their own instructional manuals for students. Eleven respondents (25.58%) reported other ways to monitor use of the computer. Some teachers assigned students existing program manuals, created record-keeping sheets, posted computer assignments on the studio website, and/or drafted the help of parents. Three participants of the 43 CAI users did not indicate how they monitored students (see Table 11).

Table 11

Monitoring Use of Computer

Supervision	Respondents (n=43)	Percentage
Teacher	29	67.44
Manual	8	18.60
Other	11	25.58
No response	3	6.98

Note: Some respondents gave multiple answers.

Teachers who used computer-assisted software also responded to Question 14 about how they assigned computer work. Twenty-three of the 43 teachers (53.49%) assigned work only when necessary and 20 (46.51%) allowed the students to pick preferred programs. Eleven (25.58%) assigned regular computer work that closely

correlated with piano lessons. Two respondents (4.65%) did not have their own structures in assigning computer work; they indicated that students followed the default lesson plans as designed in the software. Two of the 43 participants did not respond to the question (see Table 12).

Table 12

Assigning of CAI

Assignment	Respondents (n=43)	Percentage
When necessary	23	53.49
Student's choice	20	46.51
Regular	11	25.58
Other	2	4.65
No response	2	4.65

Note: Some respondents gave multiple answers.

For Question 15, participants identified all categories of educational software used in their studios. As shown in Table 13, the most frequently cited categories were theory and ear training. An equal number of respondents used software to aid teaching music theory (35 of 43, 81.40%) and ear training (35 of 43, 81.40%). Rhythm and history were also categories in which teachers often used computer-assisted software. Twenty-four (55.81%) and 10 (23.26%) used instructional software to reinforce rhythm and music history respectively. Nine of the 43 CAI users (20.93%) reported using composition software and one (2.33%) used performance software.

Table 13

Categories of CAI

Category	Respondents (n=43)	Percentage
Theory	35	81.40
Ear training	35	81.40
Rhythm	24	55.81
History	10	23.26
Composition	9	20.93
Performance	1	2.33

Note: Some respondents gave multiple answers.

Respondents were asked in Question 16 to name one or two of their favorite programs for each category and provide reason(s) for use in their studios. Responses varied extensively. Some participants gave names but no clear indication of usage reasons. Some did not provide the full name of the programs; a few only supplied the name of the software publisher. Several of the same titles recurred in different categories for different educational purposes.

A total of 31 software titles, compiled from both full and discernable partial answers, appeared in the collected survey. The most frequently cited titles were *Music Ace*,[197] Alfred's *Essentials of Music Theory*, *Alfred's Interactive Musician*,[198] and Alfred's *Theory Games*.[199] *Music Ace* was the foremost program in four of the six CAI categories: theory, rhythm, ear training, and composition. Numerous respondents indicated *Music Ace* as their favorite program due to its appealing audio and visual effects, clear and logical presentation of concepts, as well as its record-keeping and user-

[197] *Music Ace* and *Music Ace 2, Music Ace Maestro* [CD-ROM] (Chicago, IL: Harmonic Vision Inc., 1996, 1999, and 2005).

[198] *Alfred's Interactive Musician* [CD-ROM] (Van Nuys, CA: Alfred Publishing Co., Inc., 2004).

[199] *Theory Games Software* [CD-ROM] (Van Nuys, CA: Alfred Publishing Co., Inc., 1995).

friendly capabilities. Many teachers also preferred the program because it included gentle corrections for mistakes and was fun to use. Besides *Music Ace*, Alfred's *Essentials of Music Theory*, yielding multiple responses, was among the top favorites. Alfred's *Theory Games* software and *Alfred's Interactive Musician* followed the lead in their use for reinforcing theory, rhythm, and ear training. Other programs named in multiple CAI categories included *Pianomouse*,[200] *Musition*,[201] and *MacGAMUT*.[202]

According to responses to Question 17, 40 of the 43 respondents who used computer-assisted instruction software indicated multiple purposes for their use (the other three did not list any reason). Thirty-eight teachers (88.37%) used the programs to reinforce concepts taught in the piano lesson. Thirty-two (74.42%) motivated students with the use of computer software. Finally, eight teachers (18.60%) introduced new concepts using computer software. Only one teacher (2.33%) indicated other reasons for use; this respondent elaborated that the use of software provided students with a good contrast to sitting at the piano throughout the lesson (see Table 14).

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[200] Kathleen Thyberg, *Pianomouse Music Theory FUNdamentals: Preparatory Level* [CD-ROM] (Granite Bay, CA: Pianomouse.com, 2000).

[201] *Musition 2.0* [CD-ROM] (Victoria, Australia: Rising Software Australia Pty Ltd., 2005).

[202] Ann Blombach, *MacGAMUT 2003* [CD-ROM] (Columbus, OH: MacGAMUT Music Software, Inc., 2003).

Table 14

Purposes of CAI Use

Reason/Purpose	Respondents (n=43)	Percentage
Reinforce concepts	38	88.37
Motivate students	32	74.42
Introduce new concepts	8	18.60
Other	1	2.33
No response	3	6.98

Note: Some respondents gave multiple answers.

Application Software

In this portion of Part II of the questionnaire, respondents provided information on their use of application software. Twenty-four of the 47 teachers (51.06%) who used computers in their curricula reported using these programs. Twenty-two of these 24 teachers (91.67%) used notation software,[203] four (16.67%) used sequencing programs,[204] and one (4.17%) used accompaniment programs[205] (see Table 15).

Table 15

Types of Application Software

Software	Respondents (n=24)	Percentage
Notation	22	91.67
Sequencing	4	16.67
Accompaniment	1	4.17

Note: Some respondents gave multiple answers.

[203] Notation software refers to computer programs that allow students to compose, edit, and print their own compositions.

[204] Sequencing software refers to computer programs that provide sound mixing and editing as well as recording and playback features.

[205] Accompaniment software refers to computer programs that allow students to practice along with customized or newly written accompaniments in a multi-track and multi-timbral environment.

Question 19 asked the respondents to name one or two of their favorite programs for each category and indicate reason(s) for using each program. *Finale*® and *Sibelius* were the two most frequently used notation programs. Other notation software cited included *PrintMusic*®,[206] *Noteworthy Composer*,[207] *Encore*,[208] *Studio Composer*,[209] and *Finale*® *NotePad*®. The majority of uses of such notation programs were student composition projects. Besides notation software, respondents also used sequencing software. *Digital Performer*®[210] received wide use (50%) compared to other titles such as *GarageBand*™, *Quartz Audio Master*,[211] *Logic*® *Pro*,[212] and *Cakewalk*®. Although frequently used in composing student work, sequencing software was mainly used to create accompaniments. In the accompaniment category, only one respondent reported using *GarageBand*™ to reinforce a steady pulse.

Nine teachers responded to Question 20 with information about particularly successful student projects using application software. Most of these projects involved student composition. Six respondents had students write their own compositions using notation software. Two teachers proudly reported that their students won composition contests at the state level. One student used the *Sibelius* program to compose for the Carroll Symphony Composition Contest and had his winning composition premiered by

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[206] *PrintMusic*® [CD-ROM] (Eden Prairie, MN: MakeMusic! Inc., 2006).

[207] *NoteWorthy Composer* [CD-ROM] (Fuquay-Varina, NC: NoteWorthy Software™, Inc., 2006).

[208] *Encore 4.5.6* [CD-ROM] (East Brunswick, NJ: GVOX, 2006).

[209] *Quickstart Studio Composer* [CD-ROM] (San Pedro, CA: Midisoft Music Software, 2006).

[210] *Digital Performer*® [CD-ROM] (Cambridge, MA: Mark of the Unicorn, 2006).

[211] *Quartz Audio Master* [CD-ROM and Freeware] (Les Mureaux, France: Digital Sound Planet S. A., 2001). Available from http://www.digitalsoundplanet.com

[212] *Logic*® *Pro 7* [CD-ROM] (Cupertino, CA: Apple Computer, Inc., 2006).

the orchestra. One teacher had his/her students compose a piece to be played at the spring recital. Another teacher compiled his/her students' compositions and printed them as professional sheet music with the covers designed by the students. Two other respondents used sequencing software in different ways: one teacher had his/her students use *Digital Performer*® to sequence ensemble keyboard music; another teacher created Christmas CDs of the students' performances by adding special effects such as drums on "Little Drummer Boy" using *Digital Performer*®.

While some teachers had successes using application software with their students, 14 of the 24 found limitations with the programs. Time factor and mechanical setup of the hardware were two main concerns of the respondents. Five teachers expressed a lack of time to learn complicated computer programs such as *Finale*® and *Band-in-a-Box*. Two complained about the tedious efforts required to make a perfect notation score. Four respondents indicated difficulties with the maintenance and interface of hardware. One criticized the lack of human element and inflexibility of the computers and another did not use many software programs due to his/her lack of knowledge.

Keyboard Technology

In Part III of the study, respondents provided information about the use of keyboard technology in their studios: the length of use, types of keyboard(s) and their desired features, purposes of use, and possible uses in group activity. Forty-seven of the 76 independent piano teachers (61.84%) who used technology in their curricula taught with keyboard technology. Twenty-five of these 47 teachers (53.19%) had used keyboard technology for four or more years with eight of them (17.02%) using for 10 or more

years. Thirteen (27.66%) had used it for one to three years. Only seven (14.89%) had used keyboard technology in their teaching for less than one year. Two respondents did not indicate the length of keyboard technology use (see Table 16).

Table 16

Length of Keyboard Technology Use

Length (Year)	Respondents (n=47)	Percentage
Less than 1	7	14.89
1-3	13	27.66
4 or more	25	53.19
No response	2	4.26

Of the 47 teachers who used keyboard technology, 31 (65.96%) reported using a full-size digital piano in their studios. Twenty-seven (57.45%) had the synthesizer or portable electronic keyboard in their studios. Only three teachers (6.38%) taught on Yamaha Disklavier (see Table 17).

Table 17

Types of Keyboard Technology

Keyboard	Respondents (n=47)	Percentage
Digital piano	31	65.96
Synthesizer/Portable keyboard	27	57.45
Yamaha Disklavier	3	6.38

Note: Some respondents gave multiple answers.

For Question 24, keyboard users indicated desired features of the type(s) of keyboard(s) they used. The foremost reason for the popularity of synthesizer in teaching studios was its portability. Most teachers liked the synthesizer because it was inexpensive and was MIDI-compatible. Other desired features of the synthesizer included

its touch, timbre, and recording feature. Respondents who used digital pianos also reported attractive features. The ability to record performances and the multiple tracks available on the digital piano made it a valuable teaching tool. Other desired qualities of the instrument included its touch and timbre, MIDI compatibility, and sequencing feature. Users of Yamaha Disklavier reported many significant characteristics including its touch, timbre, sequencing and recording capabilities, as well as "player piano"[213] feature.

Question 25 asked participants whether they used keyboard technology interfaced with the computer. Despite most of the respondents indicating the MIDI-compatibility as a useful feature of all keyboard instruments for Question 24, only 14 of the 47 keyboard technology users (29.79%) interfaced their instruments with the computer.

Question 26 elicited information about the purposes of using keyboard technology in teaching curricula, as shown in Table 18. The majority of 47 keyboard users, 29 respondents (61.70%), had their students practice with the built-in metronome or built-in accompaniments on the keyboard. Twenty-one (44.68%) helped develop their students' ear training skills and allowed students to experiment with different sounds using the multitude of timbre available on the keyboard. Eighteen (38.30%) created teacher accompaniments for solo repertoire using the onboard sequencer. Seventeen (36.17%) had their students practice with multi-track sound files. Nine (19.15%) taught improvisation using the sequencing features available on the built-in sequencer.[214] Seven teachers (14.89%) listed other purposes: two had students practice at the digital keyboard

[213] Player piano is a feature on digital reproducing pianos that displays the key and pedal movements during the playback of standard MIDI files.

[214] A sequencer is a device that can record, edit, store, and playback digital performance or MIDI data.

while waiting for the lesson; five assigned student composition projects. Two participants did not respond to this item.

Table 18

Purposes of Keyboard Technology Use

Purpose	Respondents (n=47)	Percentage
Built-in metronome	29	61.70
Listening skills	21	44.68
Teacher accompaniment	18	38.30
Multi-track	17	36.17
Improvising	9	19.15
Other	7	14.89
No response	2	4.26

Note: Some respondents gave multiple answers.

Questions 27 and 28 of the survey sought information regarding the use of keyboard technology in the group lesson. Twenty-two of the 47 teachers (46.81%) used keyboard technology in group activities. Twenty-one of these 22 (95.45%) employed the technology for ensemble playing such as duets, trios, quartets, and multiple keyboards. Twelve (54.55%) indicated using the technology for group improvisation. Four teachers (18.18%) listed other reasons: one used keyboard technology for ear training drills and games in group lessons, one taught music appreciation and introduced orchestral timbre, and one created music for acting and singing. One indicated teaching only group lessons using keyboard technology. Other activities cited in response to Questions 27 and 28 were group technical exercises, arranging, composing, accompanying, solo playing in unison, ear training, and music analysis (see Table 19).

Table 19

Purposes of Keyboard Technology Use in Group Lessons

Purpose	Respondents (n=22)	Percentage
Ensemble	21	95.45
Improvising	12	54.55
Other	4	18.18

Note: Some respondents gave multiple answers.

Question 29 asked teachers who used keyboard technology to indicate their primary teaching instrument(s) in their studios. Twenty-six of the 47 keyboard users (55.32%) reported using the acoustic piano as their main teaching tool. Six (12.77%) used mainly the digital keyboard for lessons. Eleven (23.40%) indicated both the acoustic and digital pianos as their primary teaching tools in their studios. Four did not respond to the question (see Table 20).

Table 20

Primary Teaching Tools

Teaching tool	Respondents (n=47)	Percentage
Acoustic	26	55.32
Digital	6	12.77
Both	11	23.40
No response	4	8.51

Note: Some respondents gave multiple answers.

Accompaniment Disks

Part IV of the questionnaire elicited information about the use of accompaniment disks, regardless of the type (e.g., MIDI disk or audio CD). Of the 76 teachers who used technology, only 44 (57.89%) used accompaniment disks with their students. Thirty-one

of these 44 teachers (70.45%) were keyboard users while 13 (29.55%) did not own a digital keyboard. Most teachers used a combination of the commercial[215] and the piano method disks. Forty-two respondents (95.45%) used commercially available accompaniment disks in their teaching and 37 of these 44 teachers who used accompaniment disks (84.09%) employed disks that came with a piano method series (see Table 21).

Table 21

Types of Accompaniment Disk

Type	Respondents (n=44)	Percentage
Commercial	42	95.45
Method series	37	84.09

Note: Some respondents gave multiple answers.

For Question 33, 38 of the 44 teachers who used accompaniment disks (86.36%) provided names of their favorite method series as well as reason(s) for use. Most of the participants provided only the publisher of the series though some provided the name of the book. Some briefly commented on the reason(s) for use while a few did not indicate why they liked the methods. Fifteen teachers listed *Piano Adventures*®[216] as their favorite method series because of the quality of musical arrangements. The accompaniments were musical, encompassing wide dynamic contrast and a variety of orchestration. Ten considered the Alfred series[217] as the second best method with accompaniment disks. *Hal*

[215] Commercial or commercially available disks, in this study, refer to accompaniment MIDI or CD disks that are not associated with any piano method book.

[216] Nancy and Randall Faber, *Piano Adventures®,* Primer-5, with CD/MIDI (Fort Lauderdale, FL: The FJH Music Company, Inc., 1993-97).

[217] Gayle Kowalchyk and E. L. Lancaster, *Alfred's Basic Piano Library*, Levels 1A-4, with CD/MIDI (Van Nuys, CA: Alfred Publishing Co., Inc., 1990-95); Gayle Kowalchyk and E. L. Lancaster, *Prep Course*, Levels A-F, with CD/MIDI (Van Nuys, CA: Alfred Publishing Co., Inc., 1989-92); Gayle

Leonard[218] was also recognized by seven teachers for its musical arrangements and two different tempos for effective practice and performance. Three reported that *Hanon*,[219] incorporating a variety of accompaniment styles, made technical exercises more fun to play. Other methods or books that included accompaniment disks were *Fingerpower*,[220] *The Music Tree*,[221] *Celebrate Piano!*®,[222] *Performance Plus*,[223] *Harmony Road Music Course*,[224] *Jazz, Rags & Blues*,[225] and finally, *Alfred's Group Piano for Adults*.[226]

Question 34 of the study asked respondents what type of equipment they used to playback the sound files of the accompaniment disks, as shown in Table 22. Some used more than one device. Twenty-nine teachers of the 44 using accompaniment disks (65.91%) played the disks on a CD player while 20 (45.45%) played them on the built-in

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Kowalchyk, E. L. Lancaster, and Christine H. Barden, *Music for Little Mozarts*, Books 1-4, with CD/MIDI (Van Nuys, CA: Alfred Publishing Co., Inc., 1999-2000); E. L. Lancaster, Victoria McArthur, Martha Mier, Dennis Alexander, and Gayle Kowalchyk, *Premier Piano Course*, Levels 1A-2A, with CD/MIDI (Van Nuys, CA: Alfred Publishing Co., Inc., 2005-06).

[218] Fred Kern, Carol Klose, and Mona Rejino, eds. *Hal Leonard Student Piano Library*, Books 1-5, with CD/MIDI (Milwaukee, WI: Hal Leonard Corporation, 1996-98).

[219] Margaret Otwell, ed. *Hanon for the Developing Pianist*, with CD/MIDI (New York, NY: G. Schirmer, Inc., 2001).

[220] John W. and Jeff Schaum, *Fingerpower,* Primer-4, with CD/MIDI (Mequon, WI: Schaum Publications, 2000-06).

[221] Frances Clark, Louise Goss, and Sam Holland, *The Music Tree*, Time to Begin–4, with CD/MIDI (Miami, FL: Summy-Birchard Music, 2000-02).

[222] Cathy Albergo, J. Mitzi Kolar, and Mark Mrozinski, *Celebrate Piano!*®, Levels 1-4, with CD/MIDI (Ontario, Canada: The Frederick Harris Music Co., Limited, 2002-04).

[223] Gail Lew, ed. *Performance Plus* Series, with CD (Van Nuys, CA: Alfred Publishing Co., Inc., 1996).

[224] David Polito, *Harmony Road Music Course* (Clackamas, OR., 1988).

[225] Martha Mier, *Jazz, Rags & Blues*, Books 1-4, with CD (Van Nuys, CA: Alfred Publishing Co., Inc., 1993-98).

[226] E.L. Lancaster and Kenon Renfrow, *Alfred's Group Piano for Adults*, Book 1, 2nd ed., with CD/MIDI (Van Nuys, CA: Alfred Publishing Co., Inc., 2004); E.L. Lancaster and Kenon Renfrow, *Alfred's Group Piano for Adults*, Book 2, with CD/MIDI (Van Nuys, CA: Alfred Publishing Co., Inc., 1996).

sequencer of a digital keyboard. Others employed the CD or DVD drive on the computer (13.64%), a portable sequencer (6.82%), and/or an iPod® (2.27%). In addition to using accompaniment disks during lessons, 26 teachers (56.52%) reported assigning their students to practice with accompaniment disks at home. As Table 23 shows, 21 teachers (47.73%) reported their students using a CD player to playback sound files at home. Four teachers (9.10%) claimed their students took advantage of the onboard sequencer on digital keyboards while a few others employed devices such as the computer (4.55%), iPod® (2.27%), and/or portable sequencer (2.27%).

Table 22

Equipment Used to Play Accompaniment Disks (Studio)

Device	Respondents (n=44)	Percentage
CD player	29	65.91
Onboard sequencer	20	45.45
Computer	6	13.64
Portable sequencer	3	6.82
iPod	1	2.27

Note: Some respondents gave multiple answers.

Table 23

Equipment Used to Play Accompaniment Disks (Home)

Device	Respondents (n=44)	Percentage
CD player	21	47.73
Onboard sequencer	4	9.10
Computer	2	4.55
iPod	1	2.27
Portable sequencer	1	2.27
No response	18	40.91

Note: Some respondents gave multiple answers.

All 44 teachers who used accompaniment disks also listed purposes for their use in teaching curricula (Question 35). As Table 24 shows, an overwhelming majority of the 44 teachers who used accompaniment disks, 41 (93.18%), used them for the purpose of maintaining a steady pulse. Twenty-six respondents (59.09%) took advantage of the variety of accompaniment styles and timbre of the disks to help cultivate mood and character in student playing. Slightly over half of the disk users, 24 teachers (54.55%), assigned their students practice with different tempos available on the disks. Sixteen teachers (36.36%) used the accompaniment disks to reinforce voicing and balance in student playing; 16 (36.36%) also reported using disks to aid in slow practice. Twelve (27.27%) listed other reasons, including: motivation, fun, reward for good preparation, hands-alone practice, teaching familiar styles more easily, ear training, rhythm practice, and learning to listen and focus on materials.

Table 24

Purposes of Accompaniment Disk Use

Purpose	Respondents (n=44)	Percentage
Maintain a steady pulse	41	93.18
Cultivate styles and moods	26	59.09
Practice at different tempos	24	54.55
Voicing and balance	16	36.36
Slow practice	16	36.36
Other	12	27.27

Note: Some respondents gave multiple answers.

The final two questions of Part IV of the survey, Questions 36 and 37, asked respondents who used keyboard technology and/or accompaniment disks to describe some success stories as well as limitations of their use. Fifteen respondents commented

that the use of accompaniment disks had helped students improve their sense of rhythm. Students were also motivated by the various rock styles available on the disk that came with *Fast Track*.[227] Student interaction became possible with the use of multiple digital keyboards in ensembles. Teachers were able to teach improvisation and composition using onboard sequencers.

In addition to positive feedback on the use of keyboard technology and/or accompaniment disks, respondents also expressed frustrations over their use. Some of the more common listings were the limited flexibility of tempo available on the accompaniment disks, the frequent malfunction of the instrument or disks, and the high cost of maintaining the instrument and replacing the disks. Two teachers commented on the action of the digital keyboard: students preferred to play on digital keyboards with accompaniment disks thus hindering the development of good piano playing technique. Although playing with disks helped students learn how to follow in an ensemble more easily, one teacher thought that playing with the accompaniments may not prepare students to perform a work with rubato or other liberties in tempo. One complained about the inconsistency of count-in measures in the disks. Other complaints included not having enough time to experiment with technology in a short lesson or to teach students how to operate a keyboard instrument or locate a song on the disk.

Internet

Part V of the questionnaire was designed to obtain information about the use of the Internet in teaching studios. Respondents provided information about the length of

[227] Gary Meisner, *Fast Track Keyboard* Methods and Songbooks, with CD (Milwaukee, WI: Hal Leonard Corporation, 1997).

use, purpose of use, and useful Internet links. Only responses related to teaching purposes were used in this study. Forty-four of the 76 respondents (57.89%) who used technology in their curricula had Internet access in their studios. However, only 16 of these 44 (36.36%) used the Internet for teaching purposes. Six of these 16 teachers (37.50%) had used the technology for four or more years with one using for 10 years. Five (31.25%) had used it for one to three years. Four respondents (25%) reported using the Internet in teaching for less than one year and one did not indicate the length of use (see Table 25).

Table 25

Length of Internet Use for Teaching Purposes

Length (Year)	Respondents (n=16)	Percentage
Less than 1	4	25.0
1-3	5	31.25
4 or more	6	37.50
No response	1	6.25

For Question 41, teachers who used the Internet also listed purposes for its use in their teaching curricula. While some teachers used the Internet for a specific reason, some used it for multiple purposes. As Table 26 shows, six respondents (37.50%) supplemented student assignments using theory, ear training, and music history websites available on the Internet. Six (37.50%) created online student projects. Three teachers (18.75%) designed a studio webpage to post student performances, student projects, and assignments. Eight of the 16 Internet users indicated other purposes such as printing information online, researching, and listening to music available on iTunes®. Although electronic-mail communication was not typically considered as a teaching purpose, three

respondents reported using e-mail to convey information such as recitals, competitions, and other important events.

Table 26

Purposes of Internet Use

Purpose	Respondents (n=16)	Percentage
Supplementary assignment	6	37.50
Student projects	6	37.50
Studio webpage	3	18.75
Other	8	50.0

Note: Some respondents gave multiple answers.

Respondents were asked in Question 42 to list some of the useful Internet links that they would recommend for student learning. Only seven of the 16 teachers who used the Internet for teaching (43.75%) responded to this question. Some of the useful links were websites devoted to children's musical exploration: www.classicsforkids.com, www.sfkids.com, www.dsokids.com, www.bsokids.com, www.kids.gov/k_music.htm. Some respondents provided websites helpful for teachers or parents: http://pianoeducation.org, http://en.wikipedia.org/wiki/Portal:Music, www.practicespot.com. Websites for music theory, history, and sheet music were also included: www.musicthoery.net, www.noteablesoftware.us, www.8notes.com.

Teacher's Attitude Toward Use of Technology

The final part of the questionnaire gathered information on respondents' thoughts about using technology. Only 59 of the 76 independent piano teachers (77.63%) who used technology in their studios noted how they obtained information about using

technology. Most of them acquired information about its incorporation in teaching through various ways. Just over half of the overall 76 respondents, 39 (51.32%), reported attending workshops/seminars focusing on music technology. Sharing information among peers such as colleagues and other piano teachers helped 38 respondents (50%) learn about using technology in their teaching. Twenty-three teachers (30.26%) gained knowledge of computer and keyboard technologies through reading books and journals such as *Clavier* and the *American Music Teacher* while 18 (23.68%) attained information about music technology from the Internet. Seven (9.21%) found other ways to obtain information about music technology: four reported gaining information at music retail stores and through music catalogues, two had taken music technology courses at college, and one was taught by his/her son (see Table 27).

Table 27

Resources for Incorporating Technology into Teaching

Resource	Respondents (n=76)	Percentage
Workshops/Seminars	39	51.32
Colleague	38	50.0
Books/Journals	23	30.26
Internet	18	23.68
Other	7	9.21
No response	17	22.37

Note: Some respondents gave multiple answers.

Question 44 asked respondents for the single most useful and effective resource informing them of music technology. Fifty-seven of the 76 technology users (75%) responded to this question. Thirty-five respondents (46.05%) indicated gaining more knowledge from workshops/seminars about incorporating technology into teaching than

from any other single source. Next to workshops, 15 (19.74%) reported learning about music technology from their professional peers as most useful. Nine respondents (11.84%) found books and journals provided the best information about teaching music with technology. Seven (9.21%) reported acquiring knowledge about music technology mainly through the Internet. Only one (1.32%) indicated the retail store as his/her most useful resource. The remaining 19 of the 76 technology users did not respond to Question 44 (see Table 28).

Table 28

Most Useful Resources

Resource	Respondents (n=76)	Percentage
Workshops/Seminars	35	46.05
Colleague	15	19.74
Books/Journals	9	11.84
Internet	7	9.21
Other	1	1.32
No response	19	25.0

Note: Some respondents gave multiple answers.

Fifty-nine of the 76 technology users (77.63%) provided information about the benefits that students received with the use of technology, as Table 29 shows. Forty-one (53.95%) agreed that student attitudes toward piano learning had improved with the use of technology. In addition to general learning attitude, students also improved in other skills such as listening, performance, and musicianship. Forty teachers (52.63%) thought that technology helped their students develop better aural skills. Thirty-two (42.11%) believed that their students gained better musicianship knowledge. Students of 28 respondents (36.84%) apparently demonstrated better performance skills. Ten teachers

(13.16%) cited other positive effects the technology had on their students, including: reinforcement of rhythm and history knowledge, concept mastery, ensemble proficiency, and enhancement of student learning. While some respondents commented that music technology was fun and it motivated their students, one found no positive effects of its use. Still, this respondent indicated he/she had not used technology sufficiently to assess its effects on his/her students.

Table 29

Benefits of Technology Use (Students)

Benefit	Respondents (n=76)	Percentage
Improved learning attitude	41	53.95
Improved listening skills	40	52.63
Improved musicianship skills	32	42.11
Improved performance skills	28	36.84
Other	10	13.16
No response	17	22.37

Note: Some respondents gave multiple answers.

Sixty of the 76 teachers (78.95%) who used music technology also commented in Question 46 on how its use had helped with their teaching. As Table 30 shows, 55 of the 76 respondents (72.37%) agreed that it was motivational for their students. Forty-seven (61.84%) indicated that the use of technology in some ways reinforced concepts introduced to students. Twenty-four (31.58%) reported that they were able to cover a wider range of topics in music with the aid of technology. Twelve teachers (15.79%) strongly agreed that the use of technology had allowed them time to teach more complex concepts and skills. Two teachers (2.63%) noted other technology uses: they created

handouts and worksheets to help students learn concepts not covered in the method books.

Table 30

Benefits of Technology Use (Teachers)

Benefit	Respondents (n=76)	Percentage
Motivate students	55	72.37
Reinforce concepts	47	61.84
Cover wider topic range	24	31.58
Time-saving	12	15.79
Other	2	2.63
No response	16	21.05

Note: Some respondents gave multiple answers.

For Question 47, 23 of the 76 technology users briefly described significant negative experiences they had with the use of technology. Most of these teachers complained about equipment malfunctions, financial limitations, and lack of time to incorporate technology use in the limited-length lesson as well as to train students/parents how to maneuver within programs. One respondent indicated that students sometimes started to play by ear thus affecting the progress of sight-reading skills. Another teacher expressed dislike of digital keyboard technology due to its limited touch sensitivity.

Question 48 dealt with factors hindering the incorporation of technology into curricula. Of the 76 technology users, 50 (65.79%) responded to this question. As Table 31 shows, 44 participants (57.89%) specified cost as a major barrier. Twenty-five of the 76 technology users (32.89%) admitted having a difficult time keeping up with evolving technology. Some, 15 (19.74%), were overwhelmed with too much information in regards to newly developed technology. Fifteen also reported that lack of training had

hindered their use of technology. Eleven (14.47%) commented on the difficulty of learning the technology. Fourteen technology users (18.42%) also cited other reasons that hampered them from incorporating its use: too time-consuming, lack of space and technical support, impersonal, and/or unnecessary. As Table 32 shows, 33 of the 44 who cited cost (75%) thought that computer software was expensive, 21 of these 44 (47.73%) could hardly afford to purchase computers, 20 (45.45%) agreed that digital keyboards were too costly to purchase, and eight (18.18%) considered an Internet subscription as a financial burden.

Table 31

Factors Hindering Technology Use

Factor	Respondents (n=76)	Percentage
High cost	44	57.89
Difficult to keep up	25	32.89
Overwhelmed	15	19.74
Lack of training	15	19.74
Difficult to learn	11	14.47
Other	14	18.42
No response	26	34.21

Note: Some respondents gave multiple answers.

Table 32

Financial Burdens Hindering Technology Use

Factor	Respondents (n=44)	Percentage
Software	33	75.0
Computer	21	47.73
Digital piano	20	45.45
Internet subscription	8	18.18

Note: Some respondents gave multiple answers.

Of the 76 independent piano teachers who used technology in their curricula, 63 (82.89%) responded to Question 49 on how they funded the added costs of technology in their studios. Fifty-one of the 76 teachers (67.11%) absorbed the cost in personal budget while 15 (19.74%) charged their students additional technology fees. Nine teachers (11.84%) also cited other ways of covering the cost of technology: six adjusted student tuition while one had the luxury of having his/her keyboards supplied by a music store (see Table 33).

Table 33

Funding of Technology

Funding source	Respondents (n=76)	Percentage
Personal budget	51	67.11
Student fees	15	19.74
Other	9	11.84
No response	13	17.11

Note: Some respondents gave multiple answers.

Question 50 solicited other technology uses on which respondents wished to comment. Twelve responded to this question. Three commented on taking advantage of the Internet: one used Grout online to educate students and one taught music appreciation using sources on the Internet, while the third wished to have the time to explore online sites to devise a program of study for his/her students. Another of the 12 respondents used a small MIDI keyboard interfaced with the computer to create worksheets, handouts, lead sheets, and arrangements to reinforce concepts or teach new skills. Two respondents commented on the importance of recording students' lessons so that the students would be able to listen to their own performances. Another employed technology to teach ensemble in which students played different parts and learned how to create additional

parts to accompany a solo, using different instrument sounds. Still another teacher used his/her computer's music library to teach music appreciation.

The final question of the survey, Question 51, asked respondents about other uses of technology that they were interested in investigating. Fourteen listed their interests: most claimed they would like to learn more about useful links or information on the Internet, to acquire and learn more software programs, and to learn how to install and use MIDI. Two of the 14 expressed the desire to add a CD burner to their studios. A few addressed the problem of time management and budgeting for the incorporation of technology into teaching curricula. One expressed the wish to incorporate multi-media presentations into future student recitals.

Secondary Data

Non-Technology Users

Question 48 of the survey allowed non-technology users to comment on why they did not use technology. Forty-two of the 109 non-technology users (38.53%)[228] responded to this question. Twenty-seven of these 42 (64.29%) indicated that the high cost of computers, software, keyboards, and the Internet prevented their adoption of technology. Fifteen (35.71%) had a difficult time keeping updated with evolving technology. Thirteen (30.95%) were overcome with the abundance of information about music technology. Equally, 13 admitted not having the knowledge or training for using technology. Nine (21.43%) commented on the difficulty of learning the technology. Twenty-four remaining respondents (57.14%) provided other reasons that hindered their

[228] The 14 technology users with fewer than 12 students are not included in this number.

use of technology. Most of these reasons were similar to those cited by technology users; however, three did not use technology simply because of a lack of interest (see Table 34).

Table 34

Factors Hindering Technology Use
(Non-Technology Users)

Factor	Respondents (n=42)	Percentage
High cost	27	64.29
Difficult to keep up	15	35.71
Overwhelmed	13	30.95
Lack of training	13	30.95
Difficult to learn	9	21.43
Other	24	57.14

Note: Some respondents gave multiple answers.

Technology Users: Independent Piano Teachers with Fewer than Twelve Students

Of the 62 independent piano teachers who taught fewer than 12 students, 14 respondents (22.58%) claimed using some form of technology in their curricula. Five of these 14 teachers (35.71%) responded to Question 48. Four of these 14 (28.57%) indicated cost as a major factor hindering technology use. Two (14.29%) had difficulty keeping up with evolving technology. Another two (14.29%) admitted that lack of training hampered their use of technology. Lastly, one (7.14%) indicated other factors, specifying time constraint (see Table 35).

Table 35

Factors Hindering Technology Use
(Technology Users, Studio < 12 Students)

Factor	Respondents (n=14)	Percentage
High cost	4	28.57
Difficult to keep up	2	14.29
Lack of training	2	14.29
Difficult to learn	0	0
Overwhelmed	0	0
Other	1	7.14
No response	9	64.29

Note: Some respondents gave multiple answers.

CHAPTER IV

INTERPRETATION OF DATA

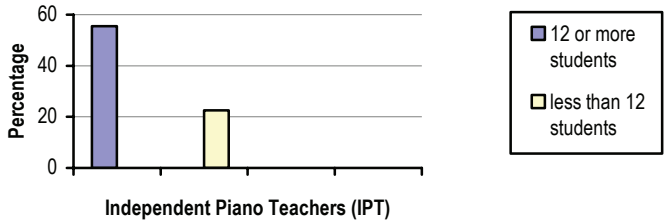
The following chapter interprets the data presented in Chapter Three. It compares technology uses between independent piano teachers of various studio sizes; investigates hindrance factors among technology and non-technology users; notes how technology users incorporated technology into curricula; and finally, examines the benefits of technology use.

Music Technology Use

Independent Piano Teachers with Twelve or More Students Compared to Independent Piano Teachers with Fewer than Twelve Students

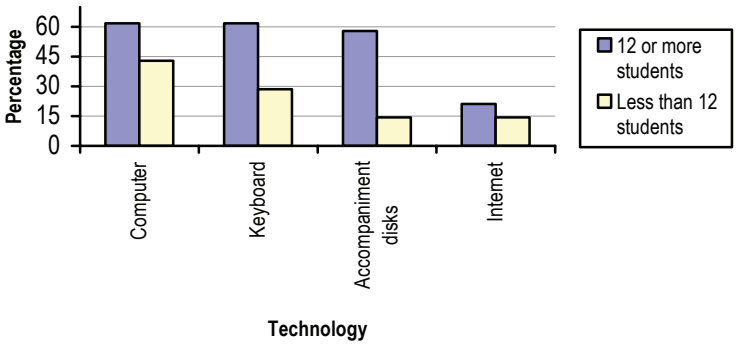
Of the 199 independent piano teachers who completed and returned the survey, 137 maintained a studio of 12 or more students while 62 taught fewer than 12. The results indicate that independent piano teachers, including those with smaller studios, are beginning to realize the potential importance of technology use in teaching. As Figure 1 shows, 76 (55.47%) of those who had 12 or more students and 14 (22.58%) of respondents with smaller studios used some form of technology in their studios.

Figure 1: Technology Users



In contrast to a similar survey completed in 1990,[229] independent piano teachers of various studio sizes today are using a greater variety of technology: computer, keyboard, accompaniment disks, and the Internet. As Figure 2 shows, an equal number of respondents who had 12 or more students (47 of 76, 61.84%) taught with computer and/or keyboard technology. Most of the 14 teachers with smaller studios also used computer (42.86%) and/or keyboard technology (28.57%) in their studios. Additionally, these teachers and those with larger studios have begun to employ newer technologies such as accompaniment disks and the Internet in their teaching. For example, more than half of the 76 respondents with 12 or more students (57.89%) and 2 of the 14 with smaller studios (14.29%) employed accompaniment disks with their students. Fewer respondents used the Internet in their curricula. Data show 21.05% of 76 respondents with larger studios and 14.29% of the 14 participants who maintained smaller studios used the Internet to teach. Apparently, teachers still need more guidance in adopting the fast-evolving Internet. In addition to Internet subscription cost as a possible hindrance, some teachers perhaps felt overwhelmed by frequently changing websites and URLs.

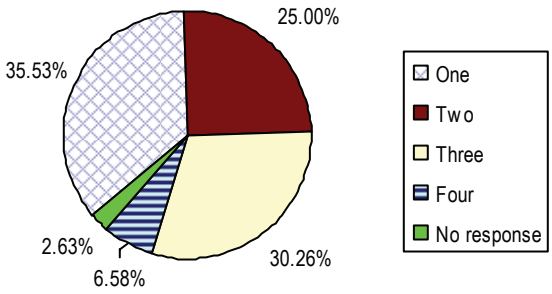
Figure 2: Users of Computer, Keyboard, Accompaniment Disks, and Internet



[229] Barbara G. Young, "The Use of Computer and Keyboard Technology in Selected Independent Piano Studios" (D.M.A. document, The University of Oklahoma, 1990). According to this 1990 study, the surveyed teachers reported using only computer and keyboard technologies.

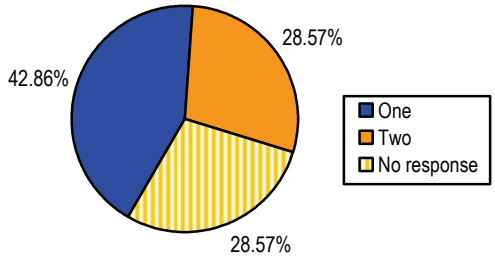
Not only have respondents slightly increased their use of technology in teaching,[230] a greater number of teachers are beginning to use a combination of two or more technologies in their studios. As shown in Figure 3, the use of two or three different types of technology is becoming more common, as reported in 55.26% of the 76 studios with 12 or more students. About one third of respondents (35.53%) used one type of technology, while a handful (6.58%) employed all four technologies. Teachers with smaller studios, on the other hand, used mainly one type of technology; probably this is a result of the lack of funding and/or technological knowledge of which many teachers complained in Part VI of the questionnaire (see Fig. 4). This trend of using more than one type of technology in piano studios reflects the increased awareness among teachers of the quality and effectiveness of technology. Additionally, the results imply that teachers and students may be improving in technological aptitude and therefore becoming more enthusiastic in learning a wider variety of technology.

Figure 3: Combination Use of Different Technologies



[230] In Young's 1990 study, 60% participants reported computer usage and 52% reported keyboard usage, 43 and 64. In this 2005 study, data show 62% for both computer and keyboard uses.

Figure 4: Combination Use of Different Technologies (Studio < 12 Students)



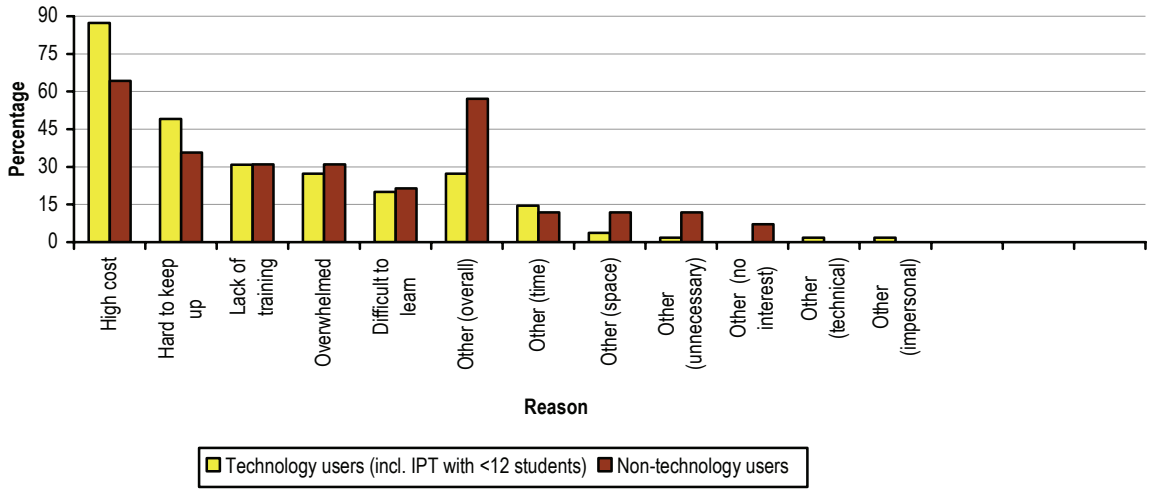
Technology Users and Non-Technology Users

Fifty-five of 90 (61.11%) technology users (including the 14 with fewer than 12 students) as well as 42 of 109 (38.53%) non-technology users reported hindrance factors to technology use in their studios. As Figure 5 shows, both technology and non-technology users shared similar concerns about adopting technology. Surprisingly, an exceptionally high percentage of technology users (48 of 55, 87.27%) listed cost as their main impediment; slightly over half of these 48 technology users (54.17%) were paying for two or more types of technology. The remaining 45.83% of respondents who used only one type of technology simply may not have been able to afford additional technology. Keeping up with fast-evolving technology is yet another issue that affected more technology users than non-technology users. Almost half of the 55 who reported difficulties with technology (49.09%) felt burdened by the need to keep up with the latest available technology such as new computer or keyboard models, new software or accompaniment disks, and software and hardware upgrades.

By contrast, a higher percentage of 42 non-technology users (24, 57.14%) reported other issues besides cost that inhibited technology use. Of these 24, 11.90% had difficulty finding the time to master technology use for teaching. One of them preferred

to use the time to focus on the learning of the instrument and a variety of classical music and theory. Equally, 11.90% indicated that their teaching space was not very conducive for technology. Additionally, 11.90% of non-technology respondents believed that the use of technology was unnecessary. One of them indicated he/she was doing fine without technology and was not convinced that technology would affect student achievement; another believed that technology was not helpful for serious classical teaching. As a whole, cost and fast-evolving technology have more impact on those who use technology because they are constantly trying to maximize the benefits of technology in their curricula. Non-technology users, on the other hand, have a greater spectrum of concerns: space constraints, skepticism of need, and lack of interest.

Figure 5: Factors for Not Incorporating Technology

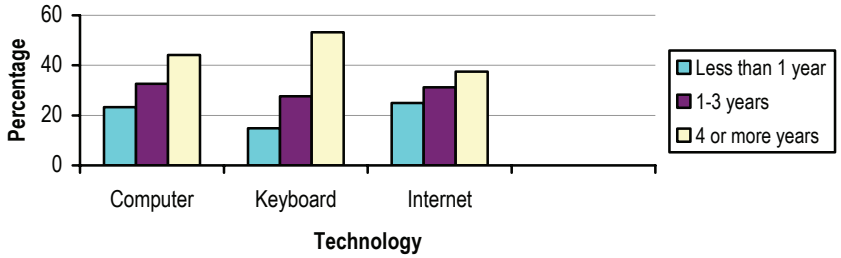


Technology Users: Computer, Keyboard, Accompaniment Disks, and Internet

An equal number of technology-using independent piano teachers with 12 or more students (47 of 76) employed computer and keyboard technologies in their studios. Of the 47 computer users and 47 keyboard users, 30 used both technologies. As Figure 6 shows, the highest percentage of keyboard users reported using the technology for four or more years; eight respondents had taught with keyboard technology for 10 or more years while only five respondents had used the computer, specifically computer-assisted instruction, in their curricula for 10 or more years. Far fewer respondents reported using the Internet to teach (21.05%). Nevertheless, of those who used the Internet, most had employed it for more than one year with one reporting Internet usage for 10 years.

Keyboard technology has been used longer than computers probably due to its ease of use and greater potential in reinforcing student playing skill. Computers, though versatile as an educational tool, present more of a long-term expenditure of keeping hardware and software updated. Finally, data reveal that most teachers using the Internet began to incorporate it in their teaching within the past three years; the Internet, though relatively new, offers unlimited information that is useful to teachers and students.

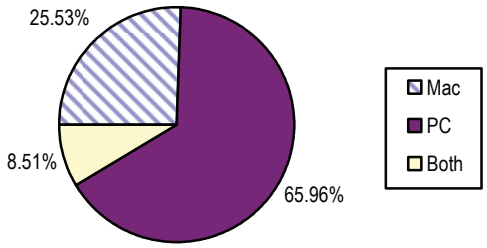
Figure 6: Length of Technology Use



Computer Users

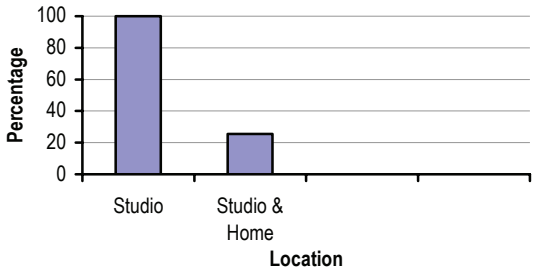
Independent piano teachers today use two predominant computer platforms in their studios – PC and/or Macintosh. Although computer-assisted instructional software was initially designed primarily for the Apple computers, programs are now increasingly available for the PC. Many, including application software, are now hybrid – Macintosh and Windows compatible – in recognition of PCs' greater affordability and widespread popularity. As Figure 7 shows, 65.96% of the 47 computer users preferred using a PC while only 25.53% used an Apple Macintosh. A small percentage (8.51%) owned both platforms in their studios.

Figure 7: Types of Computer



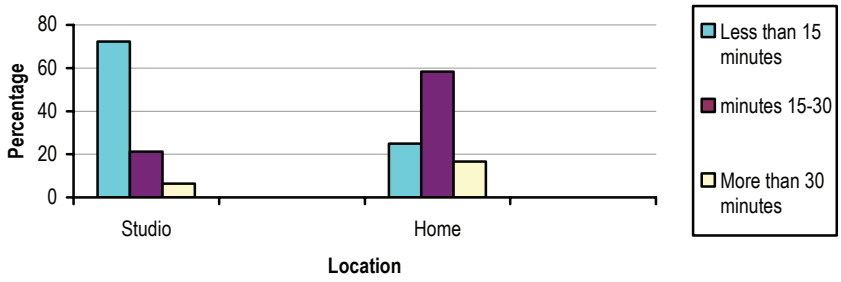
Computers have become more ubiquitous in society; not surprisingly, data reveal a trend of increasing computer use in a small percentage of students' homework. Twelve of the 47 computer users (25.53%) assigned computer work at both their studios and students' homes. Students who had computers at home were probably technologically adept and able to maneuver the programs without teacher supervision. Concepts learned at the lessons were reinforced during computer sessions at students' homes. Still, not all students own a computer at home or are independent at the computer; indeed, no respondent assigned computer work only as homework, although all computer users assigned it at their studios (see Fig. 8).

Figure 8: Locations of Computer Work



Nevertheless, most respondents limited the time for computer use in their studios. In 72.34% of the 47 studios, students spent less than 15 minutes at the computer. On the other hand, home assignments were longer: 58.33% of the 12 teachers assigning computer homework reported their students worked at home for 15 to 30 minutes and 16.67% reported computer work that lasted more than 30 minutes (see Fig. 9). With generally tight teaching schedules, teachers possibly had limited time to supervise computer use. Additionally, they might own only one computer workstation. At home, students were able to work at the computer without the pressure of relinquishing it for the next student; they worked at their own pace and had more time to learn and explore.

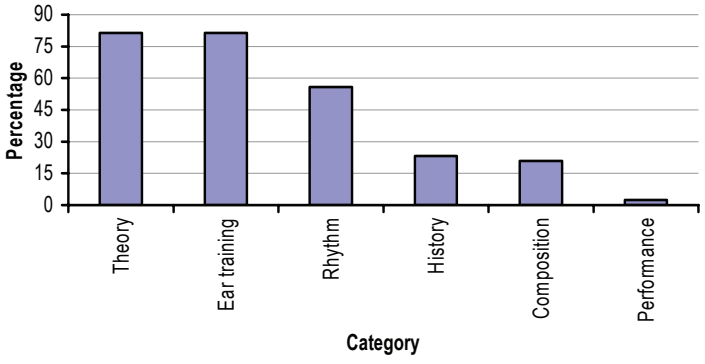
Figure 9: Length of Computer Assignment



Computer-Assisted Instruction

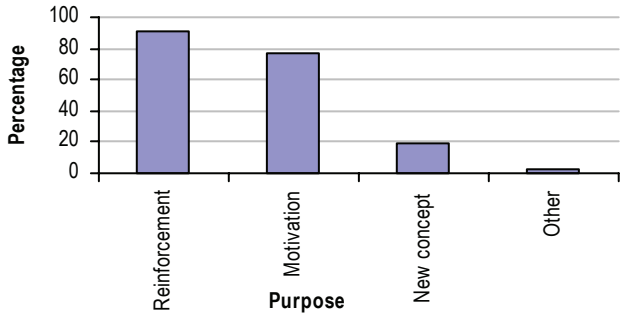
The collected data revealed a wide variety of computer-assisted instruction (CAI) programs within the six categories: theory/note reading, rhythm, ear training, composition, history/music appreciation, and performance. Many of the programs were mainstream titles and most targeted elementary-age children. Independent piano teachers used CAI programs to teach a wider topic range, specifically music theory and ear training. Still, very few relied on using CAI to reinforce performance skill; many preferred the traditional method of teaching/reinforcing playing skills at the piano. As shown in Figure 10, in independent piano studios, theory (81.4%) and ear training (81.4%) software were the two most frequently used programs. Of the 43 respondents with CAI, 58.14% reported using rhythm software in their studios while 23.26% taught history/music appreciation using computer-assisted instruction. CAI programs catering to composition and performance subjects were limited. Only a handful of respondents (20.93%) used computer instruction to teach composition and one reported using *Digital Performer*® to help reinforce performance skills.

Figure 10: Types of CAI



Most computer-assisted software programs, while highly interactive, are still predominantly drill-and-practice in design though perhaps with more colorful and animated characters. A majority of the CAI programs provide infinite randomized exercises to drill and reinforce a specific concept. Accordingly, 90.7% of the 43 CAI respondents used the programs for reinforcing concepts taught in lessons. Most CAI programs also offer students immediate and consistent feedback as well as creative ways to learn a concept; 76.74% of the CAI users agreed that these programs were a strong motivational tool. Very few CAI programs offer pedagogically sound tutorials; only 18.6% of respondents introduced new concepts with the aid of computer instruction. One teacher indicated that computer-assisted instruction provided a good contrast to traditional lessons (see Fig. 11).

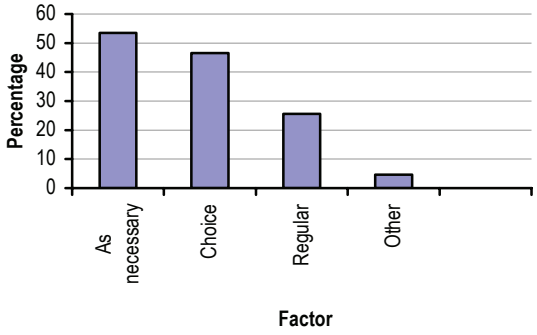
Figure 11: Purposes of CAI Use



Forty-one of the 43 respondents who used computer-assisted instruction software reported how they assigned CAI work. Over half of these 41 CAI users (53.49%) recognized the potential of CAI programs as a strong reinforcing tool and assigned their use whenever necessary. Additionally, 46.51% of the teachers motivated students by allowing them the freedom to choose their favorite programs. Only a quarter (25.58%) of the CAI users incorporated the use of computer programs as regular assignments;

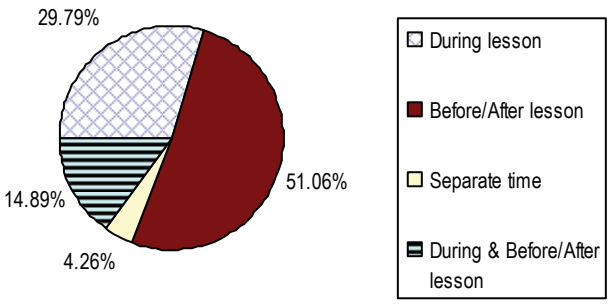
teachers may not have the time to fully learn the program(s) themselves to correlate computer work with lesson plans. One teacher had no specific goal for his/her computer assignments; the software dictated lesson structures by default (see Fig. 12). Effective implementation of CAI software that is closely correlated to individual lesson plans requires substantial time and effort from the teacher.

Figure 12: Assigning of CAI



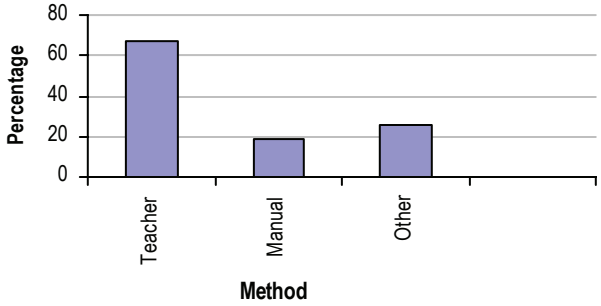
As shown in Figure 13, respondents indicated when students did their computer work in studio. Half of them reported having their students work at the computer only before or after the lesson; probably, teachers were devoting lesson time to repertoire and technique. Additionally, students could benefit from doing computer work before the lesson by reviewing concepts and discussing revisions at the lesson. Working after the lesson, they could reinforce newly learned concepts. Some respondents (29.79%) assigned computer work only during the lesson, perhaps in order to supervise younger students or to introduce and demonstrate new software. Some (14.89%) had their students working at the computer before/after as well as during the lesson. Only a small percentage of teachers (4.26%) scheduled students to come at a completely separate time for computer work, probably because students' numerous extra-curricular activities made scheduling of and transportation to additional appointments difficult.

Figure 13: Timing of CAI Assignment



Surprisingly, many participants (67.44%) still personally monitor student use of the computer; evidently, they felt the need to supervise directly and teach students how to maneuver within programs. Some teachers (18.60%), on the other hand, created or simplified instruction manuals for students to follow during CAI use. Eleven of the 43 teachers using CAI programs (25.58%) chose other options to monitor student use of the computer: some created their own record-keeping sheets or used the tracking feature available on the program for students to use for guidance; some drafted the help of parents; some provided initial demonstrations/tutorials for the students; and finally, some took advantage of the Internet and posted instructions on the studio webpage (see Fig. 14).

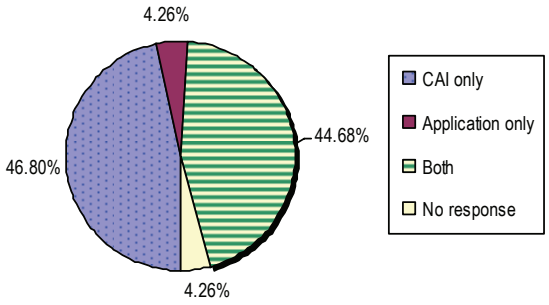
Figure 14: Monitoring of CAI Use



Application Software

In addition to computer-assisted instruction software, independent piano teachers utilized application programs such as *PrintMusic*® and *Digital Performer*® to create a variety of activities. Application software is much more expensive than most CAI programs, requiring more effort from both students and teachers to use to its fullest potential. Figure 15 illustrates the majority of the 47 computer users (46.80%) employed mainly CAI programs (e.g., *Music Ace* to reinforce skills) while only two (4.26%) used application software (e.g., *Finale*® for student composition projects). Two did not indicate the specific type of programs used. Although application software was costly, teachers who used both types of programs (44.68%) apparently realized the potential of application software to complement computer-assisted instruction.

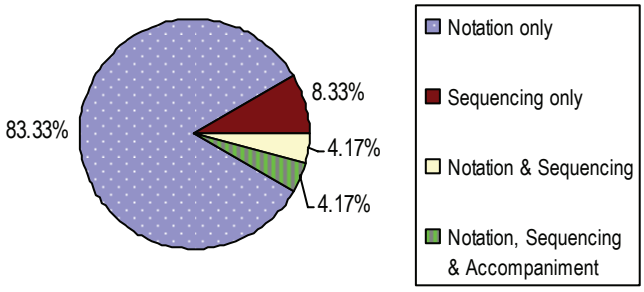
Figure 15: CAI vs. Application Software Users



Multiple programs were listed within the three categories of application software: notation, sequencing, and accompaniment. As Figure 16 shows, 83.33% of 24 application software users employed mainly notation software, especially in student composition projects. Most commonly used titles included *Finale*®, *Sibelius*, and *PrintMusic*®. Sequencing software, on the other hand, had few primary users (8.33%). Multiple titles were revealed in the collected data, prominent among them *Digital Performer*® and

GarageBand™. The final category of application software, accompaniment, received the least attention from computer users; only one teacher (4.17%) indicated using *GarageBand*™ in this category in addition to notation and sequencing programs. Although multiple titles appeared in the collected data, the variation was limited; most teachers (14 of 22, 63.64%) listed mainstream titles (e.g., *Finale*® and *Sibelius*), costly programs designed for professional composers. Only a handful (6 of 22, 27.27%) employed less expensive alternatives (e.g., *PrintMusic*® and *NotePad*®) that worked equally well with any student composition project. Only one respondent indicated using the latest sequencing program, *GarageBand*™, offered by Apple. This respondent also used the same program to create accompaniments for students. Many independent piano teachers appeared unaware of accompaniment programs (e.g., *Band-in-a-Box* and *Home Concert Xtreme*) that can provide excellent tools for improvisation and practicing.

Figure 16: Types of Application Software

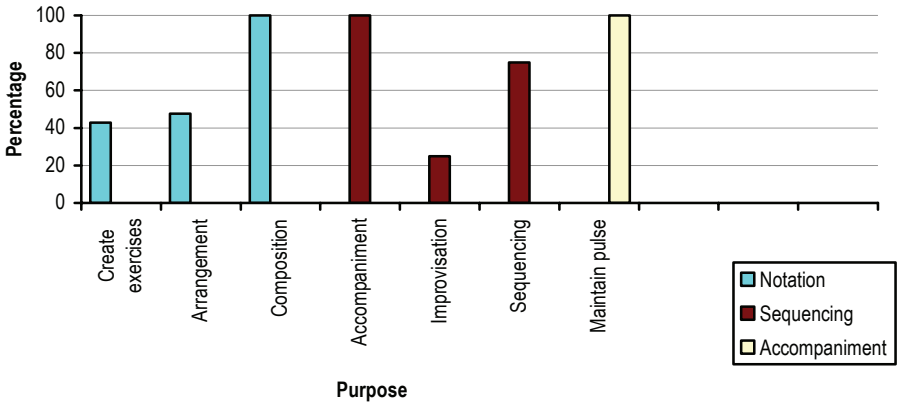


In addition to listing program titles, respondents were asked to indicate reasons for using each category of software. All respondents who used application software agreed on the greatest strength of each category: the notation software was best suited for writing student composition projects, the sequencing program for creating accompaniments, and the accompaniment software for maintaining a steady pulse.

Nonetheless, these were all obvious uses of the programs; some respondents employed the programs in a more creative way. For example, 75% of the respondents who used sequencing software taught students how to create arrangements for solo repertoire using the program (see Fig.17).

Surprisingly, no respondents utilized the accompaniment program to teach improvisation or styles and moods. Independent piano teachers who used application software seemed unaware of the cross features of some application programs. For instance, *Band-in-a-Box*, an intelligent accompaniment software, integrates ear training games and a simple notation feature that allows users to write a composition. Understanding the cross features of selected application software might help teachers save on software investment by allowing them to maximize their existing programs.

Figure 17: Uses of Application Software

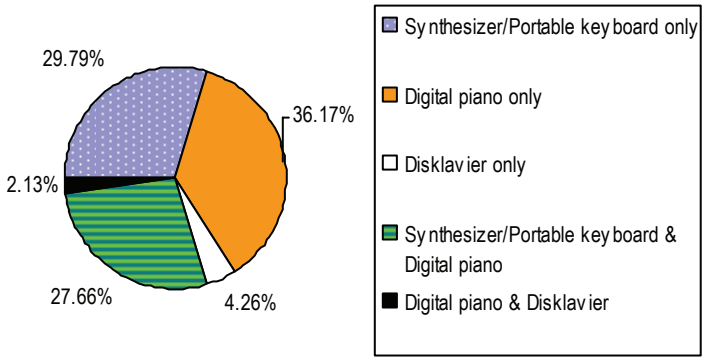


Keyboard Users

The collected data revealed several types of keyboard technology used in selected independent piano studios. Keyboard technology has improved and is becoming more cost effective; digital pianos and synthesizers/portable keyboards are receiving

widespread use. As shown in Figure 18, 65.96%[231] of the 47 keyboard users employed full-size digital pianos; one of these users commented that digital pianos were less expensive than acoustic pianos and two others liked the MIDI disk playback capability on digital pianos. Less expensive alternatives such as synthesizers and portable keyboards followed this lead with appearances in 57.45% of respondents' studios. Only a small percentage of respondents (6.38%) taught with Yamaha Disklavier. Despite its advanced technology and manifold desirable features, this instrument was apparently still unaffordable to many; a Yamaha Disklavier can range from $19,995 (upright) to $87,995 (7'6" grand).[232] Meanwhile, some teachers owned more than one type of keyboard technology in their studios: 27.66% claimed to have both synthesizer and digital piano while 2.13% had both digital piano and Disklavier. One respondent of the latter group reported having his/her instruments supplied by a local music store. Although not feasible with every merchant, teachers can evidently attempt to negotiate with local music stores for an alternative way to maintain one or more keyboard technologies in their studios.

Figure 18: Types of Keyboard Technology

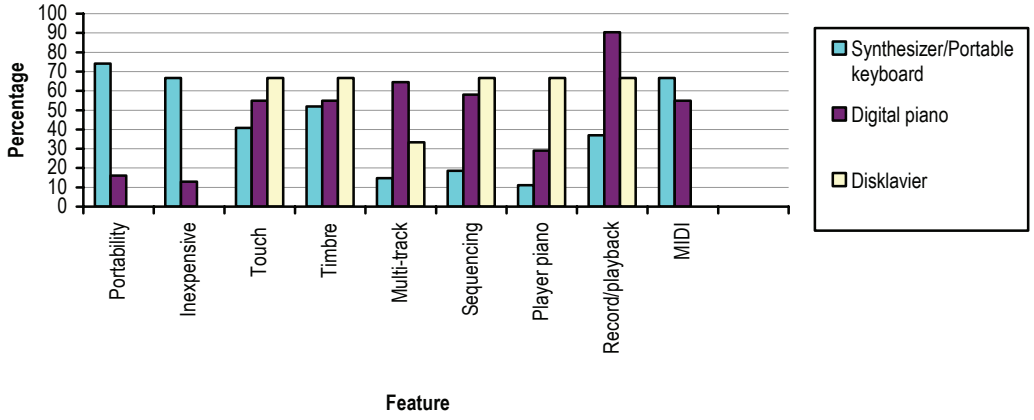


[231] According to Young, only 46% of the independent piano teachers surveyed in 1990 taught with digital pianos, 67.

[232] Retail price quoted by Jerry Hughes, Brook Mays Music Company, Norman, OK., on June 6, 2006.

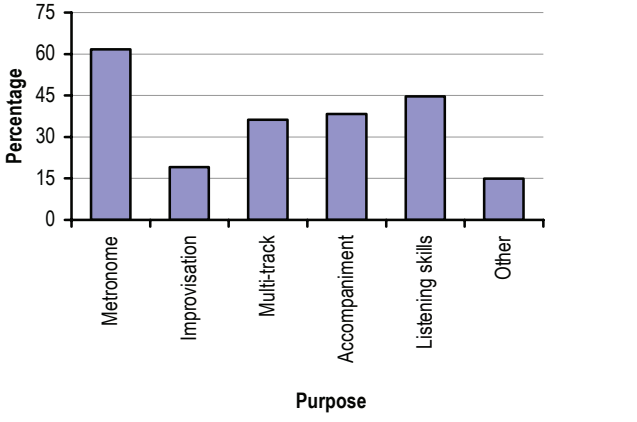
Respondents also indicated the desired keyboard technology features that attracted their use. Synthesizers and portable keyboards received wide use because of their portability (74.08%), affordable price (66.67%), and MIDI capability (66.67%). These features make the instruments most suitable for computer workstations as well as more affordable for their use in curricula. Digital pianos were popular among some independent piano studios because of their recording features: record/play (90.32%), multi-track (64.52%), and sequencing (58.06%). These desirable features could easily make any high-end digital piano a strong alternative to acoustic pianos. Although not many respondents used Disklavier, teachers who did liked the instrument for its five features: touch, timbre, "player piano," record/play, and sequencing capability (see Fig. 19). Again, these valuable qualities of Yamaha Disklavier make it a viable substitute for regular acoustic pianos as a primary teaching tool. Apparently, many teachers recognized the unique features of keyboard technology that led to its widespread use. However, not all respondents seemed to understand fully the meaning of various features. For example, several reported features such as "player piano" that were not available on synthesizers and digital pianos.

Figure 19: Desired Features of Keyboard Technology



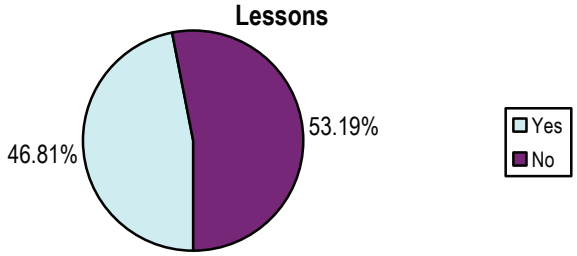
Many keyboard users revealed multiple reasons for using keyboard technology. According to 68.09% of the 47 keyboard users, the foremost reason for use was to maintain a steady pulse in student playing using the built-in metronome/accompaniments. Meanwhile, 38.3% created background accompaniments to enhance solo repertoire. Also, more teachers (46.81%) focused on reinforcing listening skills using different timbre than on cultivating an effective practice habit with the multi-track sound files (used by 36.17% teachers). In addition to using the onboard sequencer to create multi-track files and accompaniments, 19.15% of keyboard users employed the sequencing feature to teach improvisation. Of the 47 keyboard users, 14.89% exploited this technology in various other ways, including: ensemble playing, composing, ear training, experimenting with different sounds, and practicing before the lesson (see Fig. 20). The built-in metronome had the most reported usage despite the availability of a less expensive digital metronome; teachers evidently recognized the benefits of the combined features of keyboard technology: metronome, headset, multiple timbre, and built-in accompaniments.

Figure 20: Purposes of Keyboard Technology Use



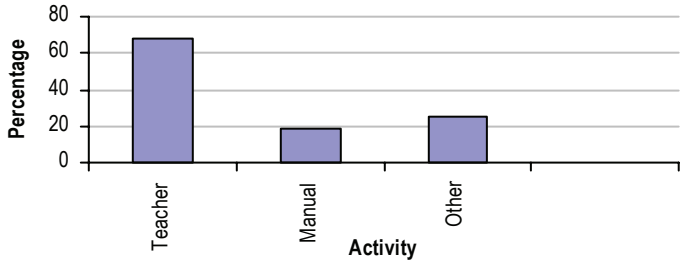
As the trend of teaching in groups grows and the cost of keyboard technology diminishes, especially for digital pianos, more independent piano teachers are beginning to incorporate technology in group lessons. In this study, of the 47 independent piano teachers who used keyboard technology, almost half (46.81%) taught group lessons with this technology (see Fig. 21). These respondents probably chose to implement keyboard technology in group lessons because it allows teaching in such settings to become more conducive: headsets eliminate undesirable sounds; instruments are always in tune with each other; portability makes reconfiguration of teaching space easy.

Figure 21: Keyboard Technology Used in Group Lessons



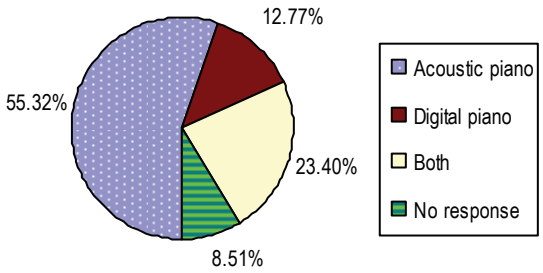
With multiple keyboards, student interaction at the keyboard and among peers can become more effective. The collected data revealed a variety of group piano activities that incorporated keyboard technology. As Figure 22 shows, ensemble playing and improvisation were two widely performed activities, with 95.45% and 54.55% respectively. Other activities included ear training, music appreciation, games, arranging, group technical exercises, and solo playing in unison. These activities were feasible only with valuable features of keyboard technology: headsets, pairing/grouping capability, and timbre splits. Students were able to perform such activities in a challenging yet non-intimidating environment.

Figure 22: Activities Incorporating Keyboard Technology in Group Lessons



Although keyboard technology has many innovative features, over half of the 47 keyboard users (55.32%) indicated the acoustic piano as their primary teaching tool. Several respondents expressed concerns that keyboard technology lacked the ability to cultivate good fingering and playing technique – despite the sophistication of touch sensitivity in some keyboards. In contrast, a total of 36.17% of 47 keyboard users indicated digital pianos as their primary teaching tools: 12.77 % taught mainly with the digital piano – evidently these teachers were convinced that some higher-end digital pianos were equally viable teaching tools; 23.40% reported both digital and acoustic pianos as their main teaching tools – these teachers realized the powerful features of keyboard technology and at the same time preserved the pedagogic value of the acoustic piano (see Fig. 23).

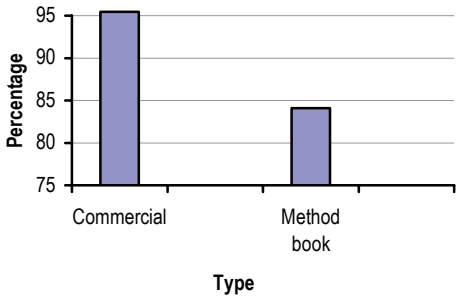
Figure 23: Primary Teaching Tools



Accompaniment Disks (MIDI/CD)

General MIDI disks and CDs have become more common with piano method books; likewise, sheet music and other music anthologies are now published with accompanying disks. The collected data indicated that such commercially available[233] accompaniment disks (e.g., Yamaha *PianoSoft*™, *Performance Plus* series) were more popular than those provided with piano method books (e.g., *Piano Adventures*®, *Hal Leonard Student Piano Library*). Of the 44 teachers who taught with accompaniment disks, an overwhelming 95.45% used commercially available disks while fewer respondents (84.09%) used disks that came with piano method books (see Fig. 24). Commercially available accompaniment disks reached a wider audience, including adult learners, teenagers who liked popular music, and others who wanted to challenge themselves with selections not included in piano method books. Independent piano teachers can choose from a wide range of repertoire to motivate and challenge students with the variety of styles and orchestrations available on the disks.

Figure 24: Types of Accompaniment Disk

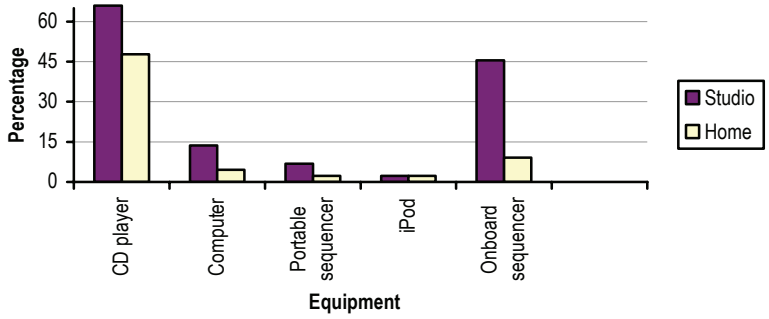


A variety of equipment was employed to playback sound files in both studios and homes. The CD player, with its portability and low cost, was the most frequently

[233] Commercially available disks, in this study, refer to accompaniment MIDI or CD disks that are not associated with the piano method book.

reported, with 65.91% of teachers using it in studio and 47.73% assigning student use at home. The built-in sequencer on the digital piano followed in use with 45.45% and 9.10% for studio and home respectively. Teachers reported even less playback usage on computers in studios (13.64%) and homes (4.55%). Computers may not have been positioned next to or in the same room as the instrument, thus making practicing with sound files impossible. Although appealing to many recreational users, the iPod® was not widely adopted in curricula; many computer users, both PC and Mac, are still unacquainted with and/or inept at downloading sound files from online music libraries and/or audio CDs to the iPod®. The iPod®, by far, is the most powerful tool yet for student practice at home or at any available keyboard due to its extreme portability, earpieces that allow privacy, and enormous memory capacity for sound files (see Fig. 25).

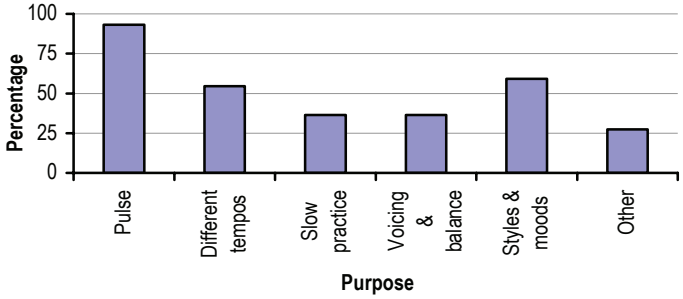
Figure 25: Equipment Used for Accompaniment Disks



Forty-four technology users employed accompaniment disks for multiple purposes. As shown in Figure 26, 93.18% of these 44 respondents helped students maintain a steady pulse using the accompaniments. Disk users (59.09%) experimented with different styles and moods using the wide variety of timbre and instrumental sounds. Just over half of the respondents (54.55%) required students to practice in different

tempos. Slightly more than one third of teachers (36.36%) were able to isolate trouble spots for slow practice due to the flexibility of disk technology. Equally, 36.36% of respondents taught students voicing and balancing with the accompaniment disks. Additional reasons for use were also given by almost one third of the respondents (27.27%): most teachers used the disks because they were motivating and entertaining; some used them as a reward; some taught rhythm and ear training; and one particularly liked using the disks because they added a full texture to a simple piece. Disk users appeared to have taken advantage of many attributes of accompaniment disks; still, some who were using both accompaniment disks and keyboard technology (31 of 44, 70.45%) did not utilize the similar functions on the instruments. Many teachers seemed to rely on readily available accompaniment disks rather than creating their own original accompaniments for specific practicing or learning purposes.

Figure 26: Purposes of Accompaniment Disk Use

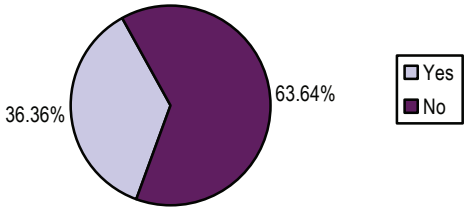


Internet Users

Of the 76 technology users, 44 reported having access to the Internet. However, only 16 of these 44 (36.36%) incorporated it into their curricula; the remaining 63.64% were unaware of resources available online, did not know how to use the Internet for

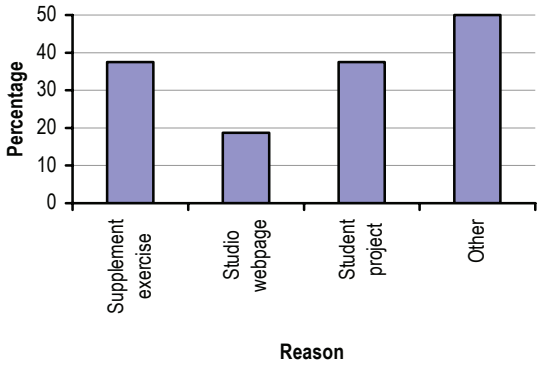
educational purposes, or did not have the time to implement the Internet into teaching (see Fig. 27).

Figure 27: Internet for Teaching Purposes



Of the 16 teachers using the Internet to teach (37.50%), six supplemented theory and/or other assignments with available online resources, as shown in Figure 28. An equal number of respondents reported having students use the Internet for projects. Three (18.75%) created studio webpages to post student performances, projects, and/or assignments. Half of the 16 Internet users indicated using the technology for other, less directly pedagogical, reasons: most of these teachers communicated essential information such as musical events and announcements to their students and/or parents, some printed information online, one conducted research using available resources on the Internet, and one had students listen to music using iTunes®. Few of the Internet users listed websites useful for student learning. More guidance on incorporating the Internet in curricula seems needed. Many websites devoted to music learning are now available at no charge to students, especially elementary-age children; teachers can take advantage of these free online resources to motivate and enhance student learning.

Figure 28: Purposes of Internet Use



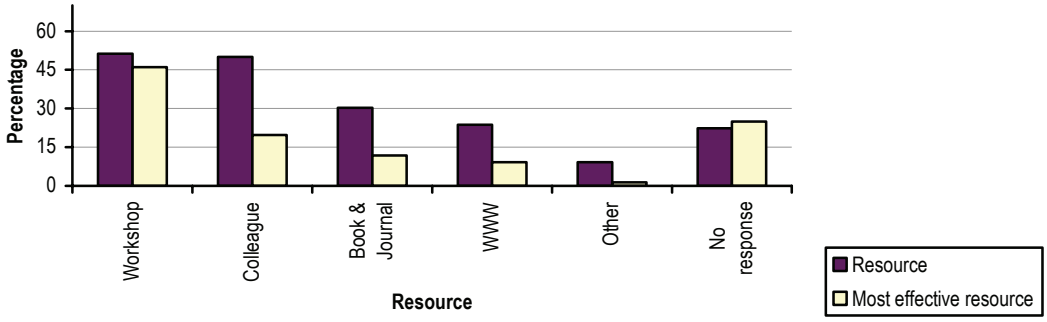
Music Technology: Resources, Benefits, and Funding

Fifty-nine of the 76 technology users (77.63%) reported the resource(s) from which they obtained information about incorporating technology in teaching. Workshops and seminars on music technology were offered frequently in state and national conventions, allowing information on music technology to reach independent piano teachers. As shown in Figure 29, the majority of the respondents acquired their technology knowledge from such workshops/seminars and their colleagues, with 51.32% and 50% respectively; 46.05% listed workshops/seminars as their most effective resource. While all MTNA teachers receive the *American Music Teacher*[234] and this journal frequently offers technology columns, only 30.26% of respondents had acquired information about technology through journals. Still, the number who received information from journals was greater than those who reported that they used the Internet for information (23.68%). A small percentage (9.21%) indicated other ways of obtaining technology information such as retail stores, catalogs, and college graduate courses.

[234] *American Music Teacher* is the official journal for the Music Teachers National Association, published bi-monthly.

Evidently, the hands-on learning experiences of workshops/seminars and the opportunities to learn personally from the experts far outweighed journal articles and websites in terms of technological assistance. Very few teachers reported books/journals and the Internet as useful resources for learning music technology, perhaps because they did not understand the technological jargon.

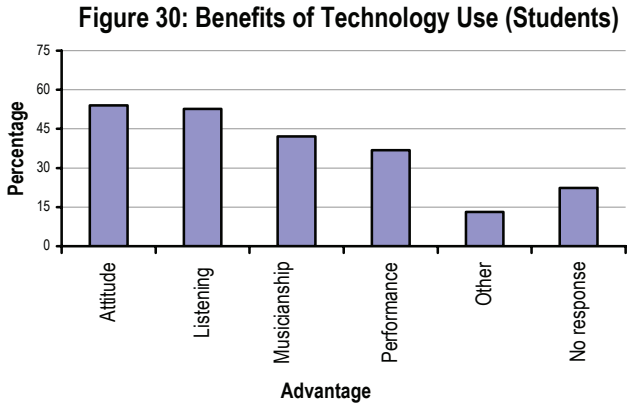
Figure 29: Resources for Learning Music Technology



Although the purpose of this study was to discover trends in technology usage rather than draw definite conclusions on the effectiveness of application, data on the pedagogical merits of technology were still gathered. This information can help the current as well as the upcoming generation of independent piano teachers with the incorporation of technology into their curricula.

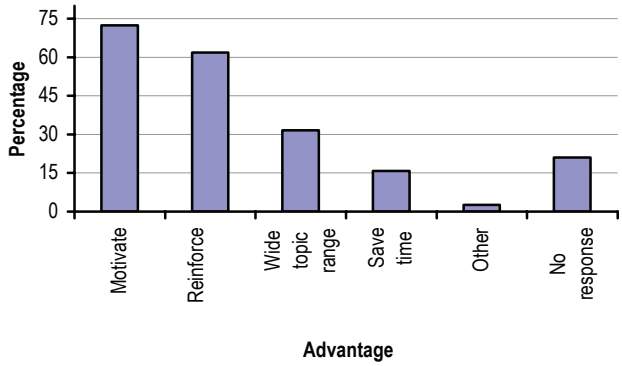
Technology was a strong motivational and learning tool for the students. According to 59 teachers who responded, two apparent benefits were an improvement in students' attitudes toward music learning and listening skills, with 53.95% and 52.63% respectively. Teachers also reported students improving musicianship (42.11%) and performance (36.84%) skills with the use of technology. Other advantages (13.16%) noted in the survey were enhancement of rhythmic and concept mastery, history knowledge, and student learning (see Fig. 30). Improving students' attitudes toward

learning makes teaching easier and helps boost the retention rate of students. Additionally, enhanced listening and musicianship skills help develop a well-rounded pianist.



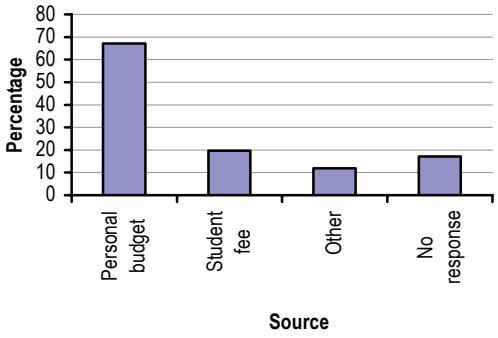
In addition to citing benefits of technology uses for students, 60 of the 76 independent piano teachers who used technology (78.95%) noted ways technology had helped with their teaching. A large percentage of these 60 (72.37%) reported using technology as a motivational tool to make lessons fun. Consequently, teachers were able to enjoy their jobs as instructors as well as to increase or stabilize their income. Technology was also useful in reinforcing concepts taught in lessons, according to 61.84% of the 76 technology users; these respondents took advantage of the manifold pedagogical possibilities of technology to cater to students with different learning styles. Others, 31.58% and 15.79%, respectively, claimed that technology had enabled them to cover a wider topic range and helped save time (see Fig. 31).

Figure 31: Benefits of Technology Use (Teachers)



Finally, the collected data of the survey revealed ways in which independent piano teachers funded their technology uses. Many respondents possibly felt awkward charging students additional technology fees; 67.11% of the 76 technology users absorbed technology expenses into their personal budget. Only 19.74% charged students technology fees. A small percentage (11.84%) adjusted students' tuition fees to include expenses incurred with technology use (see Fig. 32). For the many respondents choosing to fund technology use personally, cost naturally became a major hindrance.

Figure 32: Funding of Technology



CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This study examined the extent to which selected independent piano teachers incorporated technology into their curricula, including the use of computers, software, keyboards, accompaniment disks (MIDI/CD), and the Internet. A 51-item questionnaire with an explanatory cover letter was mailed to the first 400 members on MTNA's alphabetically ordered list. A follow-up postcard was sent three weeks later. Two hundred and twenty-five of the 400 surveys were returned, yielding a return rate of 56.25%; eight questionnaires were returned completely blank and 18 were not from independent piano teachers. Of the remaining 199 independent piano teachers who returned questionnaires, 61 did not use any form of technology in their curricula and 62 taught fewer than 12 students. The study focused on independent piano teachers who used technology and maintained 12 or more students; therefore, the analysis of data was primarily based on the remaining 76 respondents.

The survey questionnaire consisted of six parts: "Computers," "Music Software: Computer-Assisted Instruction and Application Software," "Keyboard Technology," "Accompaniment Disks (MIDI/CD)," "Internet," and "Teacher's Attitude Toward Use of Technology." In Part I, respondents provided information on the number of computers used, the computer platform(s), the location(s) of the computer(s), the average time of computer use at the teacher's studio and/or at the student's home, when students used the computer, and whether the computer was connected to a MIDI. Part II solicited data

about the length of use, supervision of student use, scheduling, skills taught, and purposes of using computer-assisted instruction (CAI) and/or application software. Respondents also provided names of their favorite programs and reasons for their use as well as brief descriptions of successes with and limitations of the programs.

Information about teacher use of keyboard technology was gathered in Part III of the questionnaire: the length of use, type(s) of keyboard(s) and their desired features, and purposes for use. Possible incorporation of technology in group activities was also investigated in this section of the survey. Part IV collected information about the use of accompaniment disks: names of favorite method series with accompaniment disks, reasons for use, purposes of use, the equipment teachers and students employed to playback sound files, and positive/negative experiences with keyboard technology and/or accompaniment disks. Information on the use of the Internet was gathered in Part V. Survey subjects were also encouraged to furnish Internet links that might be useful for student learning. Part VI sought information on how independent piano teachers obtained knowledge about incorporating technology, the most useful resource(s) for informing teachers of music technology, the impacts of technology on teaching and student learning, significant drawbacks with music technology, factors that hindered technology use, and finally ways in which respondents funded the implementation of technology in their curricula.

Conclusions

The following conclusions are based on the data collected from the survey questionnaire:

Music Technology Use

1. Independent piano teachers who used technology in their curricula employed one or more form(s) of the following technologies: computer (61.84%), keyboard (61.84%), accompaniment disks (57.89%), and/or the Internet (21.05%).
2. While 35.53% of the 76 technology users employed only one form of technology, many others employed two or more forms in their curricula: 25% used two, 30.26% used three, and 6.58% used all four types of technology.

Computer Technology

1. Most teachers owned one computer (78.72%); the preferred platform was PC (74.47%).
2. For many teachers using this technology (61.71%), computers were positioned in the same rooms where teaching occurred.
3. Students of all teachers who employed computers in their curricula used this technology in the studios; 25.53% of teachers assigned additional computer work at students' homes.
4. Students generally worked longer (usually 15 to 30 minutes) at their home computers than at those in the studios (usually less than 15 minutes).
5. About half of the teachers (51.06%) assigned computer work before or after the lesson.

Music Software: Computer-Assisted Instruction

1. Computer-assisted instruction programs were more widely used (91.49%) than application software (51.06%). Of the 47 computer users, 46.8% employed CAI programs only and 44.68% taught with both CAI and application software.
2. Theory (81.40%) and ear training (81.40%) were the two subjects most teachers supplemented with CAI programs.
3. Several independent piano teachers (37%) owned two or more categories of computer-assisted instruction programs.
4. *Music Ace* programs were most popular for reinforcing theory, rhythm, ear training, and composition skills.
5. Computer-assisted instruction programs were considered strong tools for reinforcement (88.37%) and motivation (74.42%).
6. Most teachers (53.49%) assigned CAI software when necessary while 25.58% combined CAI use with regular lessons. Some teachers (46.51%) allowed students to choose their favorite programs as an incentive or motivation.
7. Teacher's direct supervision was the most prevalent way of monitoring CAI use (67.44%).

Music Software: Application Software

1. Only 4.26% of the 47 computer users employed application software as their sole type of computer program.

2. Notation programs (91.67%) were predominant among all application software usage, especially in student composition projects. Only 8.34% of users owned more than one type of application software.
3. *Finale*® and *Sibelius* were the two most popular notation programs.
4. All teachers used application software primarily for the following tasks: notation software for composing student projects, sequencing software for creating accompaniments, and accompaniment software for maintaining pulse in student playing.
5. Some respondents described successful student projects using application software. For example:
    - "each year I have each of my student[s] compose a piece to be played at the spring recital"
    - "having students compose their own music and print it out so professionally is motivating to them"
    - "…3 students (elementary age)…wrote a piece and put it on Finale, and they each designed a cover. I went to Kinkos and copied it in full color in a large paper so that when folded, it looked like a very professional piece of sheet music"
    - "one of my students used Sibelius to notate a composition for the Carroll Symphony Composition Contest and he was declared one of the winners. His composition was played by the symphony"

Keyboard Technology

1. Over half of the independent piano teachers who used keyboard technology (55.32%) indicated the acoustic piano as their primary teaching tool although 12.77% taught mainly with digital pianos and 23.40% used both digital and acoustic pianos as their primary teaching tools.
2. Independent piano teachers who used keyboard technology preferred full-size digital pianos (65.96%) over synthesizers/portable keyboards (57.45%) or Yamaha Disklavier (6.38%). Some teachers (29.79%) owned more than one type of keyboard technology.
3. Despite a high level of keyboard technology usage, only 29.79% of respondents interfaced keyboards with the computer.
4. The built-in metronome (68.09%) and multi-timbre (46.81%) functions of keyboard technology were the two most popular features; they were used to reinforce a steady pulse in student playing and cultivate student listening.
5. Less than half of the keyboard users (46.81%) incorporated keyboard technology into group lessons; 95.45% and 54.55% of these teachers implemented its use in ensemble and group improvisation activities, respectively.

Accompaniment Disks (MIDI/CD)

1. Most of the teachers who used accompaniment disks were also using keyboard technology. Although over half of the 76 technology users (57.89%) used accompaniment disks, 29.55% of these disk users did not use keyboard technology.

2. Teachers who used accompaniment disks preferred commercially available[235] disks (95.45%) to those that came with piano method books (84.09%).
3. The most widely used accompaniment disks that came with piano method books were from Faber's *Piano Adventures*® and the Alfred series. Some of the general positive comments on accompaniment disks included:
    - "helps to motivate more practice"
    - "very dynamic and musical"
    - "quality background music"
4. Accompaniment CDs received more widespread use than MIDI disks: 65.91% of teachers and 47.73% of students used CD players to playback sound files while 45.65% of teachers and 9.10% of students employed onboard sequencers on digital pianos to playback MIDI files.
5. Two prevalent uses of accompaniment disks were to maintain a steady pulse and to cultivate different styles and moods in student playing. Some teachers' comments included:
    - "aids in rhythm, more exciting than a metronome"
    - "…beautiful arrangements kids enjoy!"
    - "almost everything we use accompaniment disks far enhances the student's musical experiences"
    - "I have had wonders in improving rhythm with accompaniment disks"
6. Some teachers who used accompaniment disks described successful student projects using keyboard technology and/or accompaniment disks:

[235] Commercially available disks, in this study, refer to accompaniment MIDI or CD disks that are not associated with any piano method book.

- "one student wrote a fanfare and printed parts with the computer. His high school band performed it"
- "students use recording/sequencing to 'orchestrate' solo music"
- "…recorded polyrhythms hands separately for easy learning – after quantizing the student can play either hand with the recorded track to fully understand how they fit together, then play hands together and speed up"

Internet

1. Although 44 of the 47 computer users (93.62%) had Internet access, only 36.36% of these 44 incorporated the Internet in teaching.
2. Half of those who used the Internet in their curricula employed the technology primarily for communicating information such as announcements of musical events and retrieving information online. Still, 37.50% of those teaching with the Internet supplemented exercises and assigned student projects using this technology.
3. Only 43.75% of Internet users listed useful Internet links that they would recommend for student learning. Apparently, many teachers still need more guidance in the investigation of the Internet application in teaching; as one respondent expressed, he/she wished "to know more about new links or information online about theory, history, composition, scores, etc."

Teacher's Attitude Toward Use of Technology

1. Technology users reported that their students had improved in their listening skills (52.63%) and attitudes toward learning (53.95%) with the use of technology.
2. Over half of the teachers who used technology found its use had helped them motivate students (72.37%) and reinforce concepts (61.84%).
3. Workshop/seminar was the most reported (51.32%) and most effective (46.05%) resource from which teachers obtained information about music technology.
4. Half of technology users acquired knowledge about music technology from their colleagues; 19.74% of them considered this the most effective resource.
5. Cost was the primary factor that hindered technology use in many independent piano studios as reported by both technology users (87.27%) and non-technology users (64.29%).
6. Over half of the technology users (67.11%) absorbed technology costs with their personal budgets.
7. Other technology usages respondents noted in the survey included:
    - "I regularly print out information about upcoming performances…use Grout online to educate"
    - "I use [computer and small MIDI keyboard and Finale] A LOT to create worksheets, handouts, lead sheets, and arrangements to reinforce concepts or teach new skills"

Recommendations for Independent Piano Teachers

Based on the collected data and the conclusions, the following are recommendations for independent piano teachers who are currently using technology or are interested in implementing technology in their curricula:

Computer Technology

1. Respondents who employed computer software reported using primarily mainstream titles such as *Music Ace*, Alfred's *Essentials of Music Theory*, *Finale*®, and *Sibelius*. It is recommended that teachers investigate a wider assortment of CAI/application programs; the appropriate use of a variety of software designs and contents can address different pedagogical needs of individual students. Also, teachers could subscribe to a variety of professional journals such as *American Music Teacher*, and *Keyboard Companion*. Technology columns in these journals frequently offer reviews on new software programs as well as articles on how piano teachers can incorporate them into curricula.
2. The complexity of programs was one of the primary concerns regarding the use of computer and/or software programs. According to several respondents:
    - "…very complicated to learn"
    - "…hard to understand…can't get it set up to work properly"
    - "some software programs take too long for one to learn"
    - "the software to write music are very complicated and also require midi-systems attached to the PC"

- "…what printed was musical gibberish which we refined during hours of work! I couldn't help laughing when I saw that the 'Quick Tour' of the Sibelius software was over 70 pages long!"

Teachers who own a computer could investigate resources on the Internet; they can download freeware programs that have similar but less complicated features for trial usage. Additionally, they can peruse free demos online to ensure the level of user-friendliness, the quality of pedagogical content, and the propriety of use in their curricula.

3. Time is yet another issue in incorporating computer software use in curricula as indicated in some survey responses:
   - "time-consuming to teach students how to maneuver in a program and how to become self-sufficient in opening and beginning to work in a software program"
   - The amount of time it takes for the student/parent to learn how to properly use the program [is a hindrance]"

   An orientation covering new computer programs could occur in a group lesson with the students' parents present. Parental supervision of software use at home is important to keep students motivated and potentially to alleviate the teacher's burden. With less direct supervision of computer use during lessons, teachers can focus on more crucial tasks such as teaching repertoire and technique. Finally, teachers need to provide self-made manuals containing simple instructions and clear objectives for use in their curricula.

4. The majority of reported CAI use was to reinforce theory and ear training skills. Subject areas such as music appreciation and history should receive a wider use of CAI programs. Knowledge of orchestral instruments, composers' backgrounds, and different musical eras helps students understand the colors of timbre, compositional styles, and unique characteristics of various genres.
5. Performance skills received the least software usage; such skills could be reinforced at home with the use of CAI and/or application programs. For example, the *Teach Me Piano* series[236] motivates students to practice with background accompaniments and interactive instructions on piano playing. This type of tutorial program provides immediate feedback on performances and serves as a viable practice tool at home. Application software such as *Home Concert Xtreme*,[237] an intelligent accompanying program, allows students to practice in three different modes: Learn Mode – the accompaniment follows the user's tempo and proceeds only when the user plays the note(s); Jam Mode – the accompaniment does not follow the user's tempo but allows the user to set the initial tempo, and responds to the performer's dynamics; and Perform Mode – the accompaniment synchronizes with the user's fluctuating tempo and responds to the dynamics and any repetition or skip in the performance. This flexible practicing environment helps students learn a new piece carefully and reinforce a learned repertoire with an increased awareness in dynamic and tempo executions.

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[236] *Teach Me Piano*™ and *Teach Me Piano Deluxe*™ [CD-ROM] (Yonkers, NY: Voyetra Turtle Beach, Inc., 1997 and 2001).

[237] *Home Concert Xtreme* [CD-ROM] (Rehoboth, MA: Time Warp Technologies, Ltd., 2006).

6. Many respondents employed application programs for their obvious uses and evidently were not aware of other creative applications. Teachers could explore a wide variety of innovative ways to maximize the potential of an application software program. In his *Teaching Music with Technology*,[238] Rudolph offers over 100 teaching strategies for integrating technology including application programs into music curricula.
7. Computers should not only be used as a tool for CAI and application programs. Teachers could take advantage of the existing applications such as iTunes® or Media Player on Mac and PC respectively to create a music library for student listening or transfer music from the computer to students' iPods®. Such usage was noted by one respondent, "I often use my computer's music library to play excerpts for students…apply things we hear to things we've discussed like music history."

Keyboard Technology

1. Since keyboard technology has proven its wide usage (65.96%) and established its stature as a primary teaching tool (36.17%) in studios, teachers could consider using high-end full-size digital pianos as practice tools for students in studios or at homes. Headsets allow privacy, the onboard sequencer allows playback of MIDI accompaniment files, and the MIDI compatibility extends the possibility of composing, improvising, and practicing using application software with the

[238] Rudolph, *Teaching Music*.

computer. One respondent commented, "young students prefer digital keyboard with accompaniment tapes than acoustical piano."

2. Although expensive and not widely used in studios, those who employed Yamaha Disklavier recognized its five desirable features: touch (acoustic), timbre, "player piano," record/play, and sequencing capability. Teachers could explore using digital reproducing pianos as primary teaching tools in their studios. Moreover, the Disklavier can be more powerful and versatile when interfaced with the computer.
3. Ensemble playing and improvisation skills, along with other creative group activities, should be taught in multiple digital keyboard settings. Using digital keyboards, students can express a variety of moods and characters with different sounds. Pairing or specific group configuration allows students to work as a team on orchestration or composition projects. Some respondents commented on the use of keyboard technology in group settings:
    - "jam sessions on digitals with small groups of late elementary and junior high students."
    - "using technology to teach groups not only makes good sense, it makes it more enjoyable as well. Students love to learn ensembles with different parts…especially when they can play using a different instrument sound."

Accompaniment Disks (MIDI/CD)

1. Although 54.55% of accompaniment disk users took advantage of the flexibility in playback tempo of disk technology (general MIDI) to cultivate good practice

habits, 29.55% of non-keyboard users had to use less flexible accompaniment CDs. Two respondents commented on the limitations of accompaniment CDs:

- "with CDs you can't adjust the tempo; most students feel they are too fast"
- "the tempos are a little quick so the student might have to practice awhile before being able to play with the CD"

Teachers who prefer to use accompaniment CDs or who do not have a playback sequencer could consider using the PSD CD players or recorders by Superscope.[239] Students can practice at different tempos with accompaniment CDs on PSD CD players. Teachers can create custom practice CDs, burn CDs, record student performances directly to CDs, record with CD accompaniments, and adjust the tempo of any CD without altering the pitch. Those who have Internet access could consider using *Amazing Slow Downer*,[240] a shareware program that allows users to adjust the tempo of an audio CD without changing the pitch. With this tempo adjustment feature, teachers can duplicate/burn the same repertoire in various tempos for practice purposes.

2. Some frustrations with the use of accompaniment disks were noted in the survey:
   - "students have complained about not being able to hear the piano in some of the…disks"

[239] Available from http://www.superscopetechnologies.com. Superscope Technologies, Inc., a privately held company in Geneva, IL, offers two types of music practice tools: CD players and CD recorders. PSD220 and PSD230 are portable CD players that allow the changing of tempo without altering the pitch and vice versa; price ranges from $299-$349 in 2006. PSD300 and PSD340 are portable dual drive CD recorders that cost between $699-$999 in 2006.

[240] *Amazing Slow Downer v.2.8.5* [Shareware]; available from http://www.hitsquad.com/smm/programs/AmazingSlowDowner (for PC) or http://www.hitsquad.com/smm/mac/AmazingSlowDowner (for Mac); Internet; accessed 26 June 2006.

- "…inconsistency of count-in measures…publisher does not include track numbers in method book"

Teachers could preview accompaniment disks (MIDI/CD) before use, noting the quality of recording, the consistency of count-in measures, and the appropriate use of timbre/orchestration for different styles.

3. Surprisingly, only one respondent reported using iPod® to playback sound files at the studio and home. For practice purposes, teachers could create and download a multi-track recording of the student's repertoire into the iPod®; students can choose either track to listen to while singing or playing the other part. In addition, teachers could create sound files in a variety of tempo and instrumentation settings to enhance a more solid performance and to motivate students to practice.

Internet

1. Only 36.36% of the 44 respondents who had Internet access taught with online resources and only seven provided Internet links useful for student learning. More teachers who use computer technology could subscribe to the Internet and consequently research creative pedagogical ideas, new teaching materials (sheet music, recordings, accompaniment disks, and software), and free learning websites (freeware and online sites for music theory, history, ear training, and games). Moreover, as students become rapidly technologically adept with Internet use, teachers could assign students guided homework on the Internet: writing summaries on composers' biographies, listening to classical music on Internet

radios, and completing theory or ear training exercises/games on the available free websites.

2. Only 18.75% of the 16 Internet users created studio webpages. One respondent commented, "it takes a great deal of prep time to work on webpages for students…but it is worth it because it enhances the student experience." Independent piano teachers could create their own studio webpages. Advantages are manifold: a) teachers can promote their studios; b) teachers can effectively convey important information to students and parents – musical events (studio and/or community), practice suggestions, lesson plans, instructions for software use, motivational articles, annotated bibliographies of recommended student/parent readings, music (MP3, WAV, or MIDI sound files), student performances, video clips of student recitals, and links to useful websites.
3. Fewer than half of the respondents who used the Internet to teach provided links to useful online resources. Several respondents also commented on other uses of technology that they were interested in investigating:
   - "…internet based activities students can do at home"
   - "student webpages"

   Apparently, teachers were interested in using the Internet to teach but did not have the time to incorporate this technology. As one noted, "I would love to get Internet but don't have the time to invest in exploring the sites available to devise a program of study for my students." Teachers could obtain information about the Internet and online resources from professional journals, workshops, and/or colleagues. In addition, efforts should be made to preview all available materials

on the Internet before assigning them to students and precautions should be taken with websites that have poor pedagogical values or do not provide accurate information.

Resources on Music Technology

1. Workshop/seminar is apparently the best resource for learning music technology. According to some respondents' comments on technology use:
   - "just started using this fall since I joined NAMTA, IMTA & NMTA and learned at workshops about this tool"
   - "I saw a workshop/presentation at a piano conference this summer…that combined multi-media presentation with music performance. I hope to incorporate this at my next annual student recital"

   Independent piano teachers could join professional memberships such as MTNA and local/state music teachers' associations. Through these organizations, teachers can learn about music technology from the experts in hands-on workshops and seminars.
2. Teachers could establish a network of current technology users or technology enthusiasts via technology workshops to share ideas or knowledge on using technology. As two of the respondents commented:
   - "I would be interested in information about what other teachers have found helpful"
   - "lack of knowledge on my part…[due to] lack of interaction with other savvy teachers"

3. The Internet deserves more exploration as well as wider utilization from independent piano teachers. The multitude of helpful information online can enhance teaching and enrich knowledge. Some of the positive comments provided by respondents are:
    - "I love the amount of information about music on the Internet"
    - "I appreciate the many sources for public domain compositions, especially Baroque literature, Mozart string quartets"

Funding of Technology Use

1. Evidently, cost was the foremost hindrance factor in adopting technology. Yet many respondents chose to absorb technology expenses with their personal budget. To avoid this burden, teachers could either charge a separate technology fee or incorporate technology expenses into student tuition. This will help motivate students/parents to take advantage of technology both in studios and at homes. Finally, teachers could attempt to finance their technology by negotiating with local music stores for low purchase financing interests, discounted rentals, or special endorsement deals.

Recommendations for Further Study

Based on the findings of this study, it is recommended that future studies investigate the following:

1. The comparative effectiveness of the pedagogical use of digital reproducing pianos (Yamaha Disklavier) and acoustic pianos.

2. The feasibility of accompaniment disks (MIDI/CD) in cultivating musicality in student performance, especially phrasings, performance skills, and aural perception.
3. Student achievement in keyboard playing skills across four different learning environments: a) conventional piano instruction without technology, b) piano instruction with keyboard technology and accompaniment disks, c) piano instruction with computer technology and the Internet, and d) piano instruction with all four technologies (computer, keyboard, accompaniment disks, and the Internet).

In future research that involves surveying independent piano teachers, certain precautions might be taken to eliminate some of the weaknesses present in this study. The low response rate of the survey of this study might be attributed to the use of mailed questionnaires; mail could have been lost in the process of distribution, questionnaires might have been left unnoticed, or teachers might have chosen not to participate in the study. An online survey was not possible as the primary research method for this study because it was against MTNA's policy to release its members' e-mail addresses. In future studies, as a supplement to mailed questionnaires, an invitation to participate in an online survey may be sent to the authorities of different state music teachers' associations; the researcher could request permission to post the invitation including an explanatory cover letter on the associations' websites. Survey results and/or annotated bibliographies of useful resources on music technology could then be mailed or e-mailed to participants upon request.

Future researchers could also conduct a survey targeting only technology workshop attendees at the MTNA conference. This concentrated population of technology users and enthusiasts would yield higher response and return rates of questionnaires due to their existing interest in technology use. At the same time, the opportunity for and timing of conducting such surveys are completely restricted to the annual occurrence of workshops.

In addition to the low return rate of the survey, another weakness might be the limitation of the study to independent piano teachers with 12 or more students. The notion that only independent piano teachers with larger studios could afford technology use in curricula was a fallacy. All independent piano teachers, regardless of studio size, should be included in the survey of technology use.

The incorporation of technology in independent piano curricula has grown considerably in recent decades. The present research serves as an exploratory study of how selected independent piano teachers implemented technology in their studios. With the above recommendations, continued studies are necessary to evaluate evolving technology. Future piano pedagogy research should also examine the effectiveness of technology use with piano students and discover more efficient ways to integrate technology use in independent piano curricula.

Teachers need to define their curricular and pedagogical needs before purchasing any form of technology. They could examine a wide range of current technologies and their teaching applications by consulting technology experts from local music stores, instrument dealers, or other piano teachers who have used the technology in their studios.

An appropriate implementation of technology into a well-defined curriculum can save cost as well as maximize potential use and benefits of technology.

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APPENDIX A

SURVEY QUESTIONNAIRE

THE IMPLEMENTATION OF TECHNOLOGY INTO THE CURRICULA OF SELECTED INDEPENDENT PIANO STUDIOS

SURVEY QUESTIONNAIRE

This survey is designed to investigate how independent piano teachers use technology (computers, keyboard technology, and the Internet) in piano studios (at home or commercial site). Your identity will be kept confidential.

Questions 1-3: Please circle "YES" or "NO".

1. Are you an independent piano teacher?	**YES**	**NO**	If the answer to question 1 is "NO," please return the questionnaire in the accompanying self-addressed envelope.
2. Do you currently have 12 or more students in your piano studio?	**YES**	**NO**	If the answer to question 2 is "NO," please return the questionnaire in the accompanying self-addressed envelope.
3. Do you use any form of technology for teaching purposes in your piano studio?	**YES**	**NO**	If the answer to question 3 is "NO," please skip to **question 48** before returning the questionnaire in the accompanying self-addressed envelope.

PART I: COMPUTERS

4. Do you use the computer for music learning with your students in your teaching studio?
   ___ YES ___ NO
   If the answer to question 4 is "NO," please skip to Part III, question 22.

5. How many computers do you use for teaching purposes in your studio? Please specify: ___

6. Which computer platform(s) do you use in your studio? (Check all that apply)
   ___ Apple Macintosh ___ PC (e.g. Dell, IBM, HP)

7. Where are computers located in your studio? (Check all that apply)
   ___ In the same room where you teach
   ___ Separate room/area

8. Where and what is the average time the computer is used per student per week? (Check all that apply)
   a) ___ Your studio: ___ 15 mins. or less ___ 15-30 mins. ___ over 30 mins.
   b) ___ Student's home: ___ 15 mins. or less ___ 15-30 mins. ___ over 30 mins.

9. In your studio, students use the computer: (Check all that apply)
   ___ During the lesson
   ___ Before or after the lesson
   ___ Separate time (different day/time from regular lesson)

10. Are all computers connected to a MIDI keyboard or a digital piano?
    ___ All ___ Some ___ None

PART II: MUSIC SOFTWARE

A. COMPUTER-ASSISTED INSTRUCTION

11. Do you use educational software (e.g. *Music Ace, MiDisaurus*) in your studio?
    ___ YES ___ NO
    If the answer to question 11 is "NO," please skip to question 18.

12. How long have you used educational software in your curriculum?
    ___ Less than 1 year ___ 1-3 years ___ 4 or more years (please specify): ___

13. How do you monitor student use of the computer? (Check all that apply)
    ___ Teacher's supervision
    ___ Self-made manuals with instructions
    ___ Other (please specify): _____

14. How do you assign computer work using educational software? (Check all that apply)
    ___ Regular assignments closely correlated with lessons
    ___ Assign when necessary
    ___ Student's own preferred choice
    ___ Other (please specify): _____

15. Please check all categories of educational software that you use in your studio:
    ___ a) Theory/Note Reading ___ b) Rhythm ___ c) Ear training
    ___ d) Composition/Improvisation ___ e) Music History/Music Appreciation
    ___ f) Performance/Technique ___ g) Other (please specify): _____

16. Please name one or two of your favorite programs for each category and check reason(s) for each program: (Check boxes that apply)

	Appealing audio & visual effects	Clear, logical presentation of concepts	User-friendly	Record-keeping	Other: (please specify in the appropriate box)
a) Theory/Note Reading					
1)					
2)					
b) Rhythm					
1)					
2)					
c) Ear Training					
1)					
2)					
d) Composition/Improvisation					
1)					
2)					
e) Music History/Appreciation					
1)					
2)					
f) Performance/Technique					
1)					
2)					
g) Other: (please specify)					
1)					
2)					

17. For which of the following purposes do you use educational software? (Check all that apply)
___ Introduce new concepts
___ Reinforce concepts learned in the lesson
___ Motivate students
___ Other (please specify): _____

B. APPLICATION SOFTWARE

18. Do you use notation, sequencing, or accompaniment software (e.g. *Finale, Band-in-a-Box, Home Concert*) in your studio?
___ YES ___ NO
If the answer to question 18 is "NO," please skip to Part III, question 22.

19. For each type of software, please name one or two of your favorite programs and check reasons for each program: (Check boxes that apply)

a) Notation Software	Create theory/sight reading exercises	Orchestrate/ arrange music	Student composition project	Other: (please specify in the appropriate box)
1)				
2)				
b) Sequencing Software	Create accompaniments	Practice improvisation	Student sequencing project	Other: (please specify in the appropriate box)
1)				
2)				
c) Accompaniment Software	Practice with a steady pulse	Practice improvisation	Listen to styles and moods	Other: (please specify in the appropriate box)
1)				
2)				

20. Please briefly describe any particularly successful student project(s) you have had using any of the above application software:
_____
_____

21. Please briefly describe any significant limitations or drawbacks you have found with computers and/or software:
_____
_____

PART III: KEYBOARD TECHNOLOGY

22. Do you use keyboard technology (i.e. digital piano, MIDI keyboard) in your studio?
___ YES ___ NO
If your answer to question 22 is "NO", please skip to Part IV, question 30.

23. How long have you used keyboard technology in your studio?
___ Less than 1 year ___ 1-3 years ___ 4 or more years (please specify): ___

24. Please indicate the kinds of keyboard(s) that you use and check reasons for each instrument that you use: (Check boxes that apply)

	Portability	Inexpensive	Touch sensivity	Multi-timbral	Multi-track Recording	Sequencing capability	"Player piano" feature	Record/playback features	MIDI-compatible	Other: (please specify in the appropriate box)
a) Synthesizer/Portable electronic keyboard										
b) Full-size digital piano										
c) Yamaha Disklavier										
d) Other (please specify):										

25. Do your students use keyboard technology interfaced with the computer?
___ YES ___ NO

26. For which of the following purposes do you use keyboard technology in your studio?
___ Student practice with the metronome or built-in accompaniments
___ Student improvises using sequencing technique
___ Student practices with multi-track sound files
___ Teacher creates background accompaniment for solo repertoire
___ Develop better listening skill i.e. balance, dynamics, touch/articulation
___ Other (please specify): _____

27. Do you use keyboard technology in the group lesson?
___ YES ___ NO
If the answer to question 27 is "NO," please skip to question 29.

28. Which of the following activities take place in a group lesson that uses keyboard technology? (Check all that apply)
___ Ensemble playing (duets, trios, quartets, multiple keyboards)
___ Group improvisation
___ Other (please specify): _____

29. Which of the following instrument do you use as your main teaching tool in your studio?
___ Acoustic piano ___ Digital Piano ___ Both

PART IV: ACCOMPANIMENT DISKS (MIDI/CD)

30. Do you use any accompaniment disks (3.5" floppy or CD) in your studio?
___ YES ___ NO
If the answer to question 30 is "NO," please skip to Part V, question 38.

31. Do you use any commercially available accompaniment disks?
___ YES ___ NO
If the answer to question 31 is "NO," please skip to Part V, question 38.

32. Do you use accompaniment disks with any particular piano method series?
___ YES ___ NO
If the answer to question 32 is "NO," please skip to Part V, question 38.

33. Please give your favorite method series with accompaniment disks and give a reason why it is your favorite:
Method: _____ Reason: _____

34. What equipment do you use to playback sound files from the accompaniment disk? (Check boxes that apply)

	Portable CD player	Computer CD/DVD drive	Portable sequencer	iPod	Onboard sequencer (digital piano)	Other (please specify):
a) Your studio						
b) Student's home						

35. For which of the following purposes do you use accompaniment disks in your studio? (Check all that apply)
___ Maintain a steady pulse provided by the accompaniment
___ Practice at different tempos without altering the pitch
___ Isolate specific sections for slow practice
___ Teach voicing and balance
___ Teach different styles and moods
___ Other (please specify): _____

36. Please briefly describe any particularly successful student project(s) you have had using keyboard technology or accompaniment disks:
_____
_____
_____

37. Please briefly describe any significant limitations or drawbacks you have experienced with keyboard technology or accompaniment disks:
_____
_____
_____

PART V: INTERNET

38. Do you have Internet access in the computer(s) in your studio?
___ YES ___ NO
If the answer to question38 is "NO," please skip to Part VI, question 43.

39. Do you use the Internet for teaching purposes in your studio?
___ YES ___ NO
If the answer to question 39 is "NO," please skip to Part VI, question 43.

40. How long have you used the Internet for teaching purposes?
___ Less than 1 year ___ 1-3 years ___ 4 and more years (please specify): ___

41. How do you use the Internet with your students? (Check all that apply)
___ Supplement exercises (theory, ear training, music history)
___ Create studio webpage to post student performances, student projects, assignments, tutorials
___ Student projects
___ Other (please specify): _____

42. What are the useful World Wide Web links that you would recommend for student learning? List your top five choices. (Please write the links in full e.g. http://www.ou.edu)

a) _____

b) _____

c) _____

d) _____

e) _____

PART VI: TEACHER'S ATTITUDE TOWARD USE OF TECHNOLOGY

43. How do you obtain information about incorporating technology in teaching? (Check all that apply)
___ Workshops/Seminars
___ World Wide Web
___ Books/Journals (please specify): _____
___ Your colleague/ other independent piano teacher
___ Other (please specify): _____

44. What is the most useful resource that informs teachers of music technology? (Check ONE only)
___ Workshops/Seminars
___ World Wide Web
___ Books/Journals (please specify): _____
___ Your colleague/ other independent piano teacher
___ Other (please specify): _____

45. How has the use of technology helped your students? (Check all that apply)
___ Improved listening skills
___ Improved performance skills
___ Improved musicianship skills
___ Improved attitude toward piano learning
___ Other (please specify): _____

46. How has the use of technology helped with your teaching? (Check all that apply)
___ Save time for more complex teaching
___ Motivate students
___ Reinforce concepts
___ Teach a wider range of topics in music (e.g. ear training, history, improvisation, composition)
___ Other (please specify): _____

47. Please briefly describe any significant limitations or drawbacks you have experienced with the use of technology in general:
_____

_____

48. What are the factors that hinder your use of technology in your studio? (Check all that apply)
___ Difficult to learn
___ High cost: ___ computers ___ software ___ keyboards ___ Internet service
___ Lack of training
___ Difficult to keep up with fast evolving technology
___ Overwhelmed with too much information
___ Other (please specify): _____

_____

_____

49. How do you fund the added costs of technology in your studio?
___ Absorb cost in personal budget
___ Student fees for technology
___ Other (please specify): _____

50. Are there other uses of technology that you use and wish to comment on?

_____

_____

_____

_____

_____

_____

51. Are there other uses of technology that you are interested in investigating or areas to extend your use of technology?

_____

_____

_____

_____

_____

_____

When you are finished, please place this survey in the accompanying self-addressed envelope, and place it in the mail.

Please mail it to:

May Tsao-Lim
P.O. Box 1143
Ames, IA 50014-1143

Thank you for your time!

APPENDIX B

LIST OF PILOT STUDY PARTICIPANTS

1. Dr. Karen Beres
   Coordinator of Group Piano
   North Carolina School of the Arts
   1533 South Main Street
   PO Box 12189
   Winston-Salem, NC 27127-2188

2. Dr. Victoria Johnson
   Assistant Professor, Music
   College of Music & Dramatic Arts
   Louisiana State University
   Baton Rouge, LA 70803-2504

3. Dr. Joann Kirchner
   Boyer College of Music and Dance
   2001 N. 13th Street
   Philadelphia, PA 19122

4. Dr. Pamela Pike
   Assistant Professor of Music
   Department of Music
   University of Arkansas at Little Rock
   2801 S. University Avenue
   Little Rock, AR 72204

5. Dr. Thomas Swenson
   Assistant Professor of Music, Director
   Salem College, Community Music School
   Winston-Salem, NC 27108

APPENDIX C

COVER LETTER TO PILOT STUDY PARTICIPANTS

October 11, 2005

Dear Colleagues in Piano Pedagogy,

Thank you for agreeing to assist in the development of my survey questionnaire. Enclosed is a copy of the survey questionnaire that will be mailed to 400 independent piano teachers from the MTNA's membership list. Please attempt to answer all questions to your fullest knowledge. If you have not taught with any form of technology, please answer the questions based on your experience with technology as a music student, or based on the type of teaching curricula in which you would incorporate one or more form of technology in the future.

Please make any suggestions for revision in the questionnaire or on a separate piece of paper. If you have any particular questions or suggestions, please feel free to email me at maylim@iastate.edu. Please return the questionnaire in the self-addressed envelope by October 21, 2005.

Your time and assistance in this study are greatly appreciated!

Sincerely,

May Tsao-Lim

APPENDIX D

COVER LETTER TO INDEPENDENT PIANO TEACHERS

THE IMPLEMENTATION OF TECHNOLOGY INTO THE CURRICULA OF SELECTED INDEPENDENT PIANO STUDIOS

May Tsao-Lim
P.O. Box 1143
Ames, IA 50014-1143

October 24, 2005

Dear Piano Teacher,

I am currently conducting a research study under the auspices of the University of Oklahoma, investigating how independent piano teachers incorporate use of technology in their studio curricula. As an active member of MTNA, your assistance in this project would be invaluable, and I invite you to participate. The results of this study will be the foundation of my doctoral document at the University of Oklahoma, under the direction of Dr. Jane Magrath and Dr. Barbara Fast in the School of Music.

Your participation will involve completing the enclosed survey and returning it in the accompanying self-addressed envelope. It should only take about 30 minutes of your time. Your involvement in this project is voluntary, and you may choose not to participate or may stop at any time. The results of the study may be published, but your anonymity will remain.

The findings of this study will provide information valuable to other independent piano teachers with no cost to you other than the time it takes to complete the questionnaire. No out of the ordinary risks to participants are anticipated.

If you have any questions about this research study, please do not hesitate to call me at (515) 294-3453 or email me at maylim@ou.edu. You may also contact Dr. Jane Magrath at (405) 325-4681 or email jmagrath@ou.edu. Questions about your rights as a research participant or concerns about the project should be directed to the Institutional Review Board at The University of Oklahoma-Norman Campus at (405) 325-8110 or irb@ou.edu.

By returning this questionnaire in the accompanying envelope, you will be agreeing to participate in the study described above. Please mail your completed survey by November 12, 2005.

Thank you for your consideration.

Sincerely,

May Tsao-Lim
D.M.A. Candidate, University of Oklahoma

APPENDIX E

FOLLOW-UP LETTER TO INDEPENDENT PIANO TEACHERS

THE IMPLEMENTATION OF TECHNOLOGY INTO THE CURRICULA OF SELECTED INDEPENDENT PIANO STUDIOS

May Tsao-Lim
P.O. Box 1143
Ames, IA 50014-1143

November 12, 2005

Dear Piano Teacher,

A questionnaire seeking information on how you use technology in your private piano curriculum was mailed to you two weeks ago. If you have already completed and returned the survey, please accept my gratitude. If you have not had the opportunity to answer and return the questionnaire, please take the time to do so now. Your response is very important to this project.

If you did not receive the survey, please email me at maylim@ou.edu or call me at (515) 294-3453, and I will mail you another copy immediately. Your time and participation in this study are greatly appreciated!

If you have any questions about this research study, please do not hesitate to call me at the above number or contact Dr. Jane Magrath at (405) 325-4681 or email jmagrath@ou.edu. Questions about your rights as a research participant or concerns about the project should be directed to the Institutional Review Board at The University of Oklahoma-Norman Campus at (405) 325-8110 or irb@ou.edu.

Sincerely,

May Tsao-Lim
D.M.A. Candidate, University of Oklahoma

APPENDIX F

SELECTED LIST OF COMPUTER SOFTWARE, ACCOMPANIMENT DISKS, INTERNET LINKS FROM TEACHER RESPONSES

Computer Software Programs

Computer-Assisted Instruction (CAI)

Alfred's Essentials of Music Theory
Alfred's Interactive Musician
Alfred's Theory Games Software
Auralia
Juilliard Music Adventure
Jump Start Music™
MacGAMUT
Making Music
Making More Music
Metronimo Tetris
MiDisaurus
Musition
Music Ace and Music Ace 2
Music Goals by Eye & Ear
Music Goals Rhythm
The Musical World of Professor Piccolo
Note Attack!
Note Name Drills
NotePlay
The Nutcracker Music Game
Pianomouse
Play It By Ear
Rhythm Ace

Application Software

Digital Performer®
Encore
Finale®
Finale® NotePad®
GarageBand™
Logic™
Noteworthy Composer
PrintMusic®
Quartz Audio Master
Sibelius
Cakewalk® Sonar

Accompaniment Disks (MIDI/CD)

Alfred's Basic Piano Library
Alfred's Group Piano for Adults
Alfred's Music for Little Mozarts
Alfred's Premier Course
Celebrate Piano!®
Faber's Piano Adventures®
Hal Leonard Student Piano Library
The Music Tree series
Hanon for the Developing Pianist
Harmony Road Curriculum
Mier's Jazz, Rag, & Blues
Performance Plus
Schaum's Fingerpower

Internet Links

www.8notes.com
www.bsokids.com
www.classicsforkids.com
www.dsokids.com
www.geocities.com/thephunnyfarm
www.google.com
www.itunes.com
www.kids.gov/k_music.htm
www.musictheory.nent
www.musicnets.com
www.noteablesoftware.us
www.practicespot.com
www.sfkids.com
www.wikipedia.org
http://familygames.com/free/notecard/html
http://I-webring.com/hub?ring=musichistory
http://pianoeducation.org

APPENDIX G

ANNOTATED LIST OF COMPUTER-ASSISTED INSTRUCTION SOFTWARE

Title	Publisher	Platform				Fundamentals of music						Music appreciation				Skill				Version			Other Features
		MAC	PC	Hybrid	Age	Note reading	Theory	Rhythm	Terms	Ear training	Sight singing	History	Composer	Instrument	Style/Form	Composition	Performance	MIDI	Record keeping	CD-ROM	Download	Demos	
Adventures in Musicland	ECS Media			✔	5-9								✔							✔			Recognition of musical symbols; concentration games of sounds and composers.
Alice in Vivaldi's Four Seasons	Tigor Media, Inc.	✔	✔		4-10								✔							✔	✔		Part of the Interactive Classics™ series; games, puzzles, and music trivia.
An Introduction to Classical Music	Attica Cybernetics		✔		8+							✔	✔							✔			Multimedia presentation of music of 45 composers from Baroque to Modern eras.
Appreciating the Orchestra	Clearvue & SVE			✔	6-14									✔						✔			Introduction to instruments and basic structures of the orchestra via music of Britten, Prokofiev, Copland, & Tchaikovsky.
Art & Music series	Zane Publishing			✔	9-14							✔											Interactive learning with pictures/sounds; Medieval through 20th century including Impressionism and Surrealism.
Auralia	Rising Software		✔		8+													✔		✔		✔	Customized tests and tutorials; support smultiple syllabi; microphone optional.
Bach Chorales (Vols. 1 & 2)	PG Music		✔		H.S.-College															✔			Bach's life and times; interactive learning via outstanding musical performances of Bach chorales.
Beethoven Lives Upstairs	M-Pen Inc.		✔		7+								✔	✔									Listening to Beethoven's major works; arcade-style games; available in DVD-ROM.
Children's Music Journey	Adventus Interactive			✔	4+	✔										✔	✔			✔			Interactive lessons, activities, and games; teaches piano playing with two hands, music reading, composing, & improvising.

		Platform				Fundamentals of music						Music appreciation				Skill				Version			
Title	Publisher	MAC	PC	Hybrid	Age	Note reading	Theory	Rhythm	Terms	Ear training	Sight singing	History	Composer	Instrument	Style/Form	Composition	Performance	MIDI	Record keeping	CD-ROM	Download	Demos	Other Features
Complete Classical Music	Topics Entertainment				8+				✔				✔	✔						✔			5 CD-ROM set; Hutchinson Encyclopedia of music; in-depth study of Mozart, Vivaldi, and Chopin; Classical Orchestra notes; multimedia presentation and trivia games.
Counterpointer	Ars Nova Software, LLC			✔	Colleg											✔				✔	✔		SATB – roman numerals and figured bass; Fux examples; compose for 2-8 voices.
EarMaster Pro™ 5	eMedia		✔		8+			✔		✔	✔									✔	✔	✔	2 tutors –Standard (440 lessons) and Jazz (211 lessons); transcribing melody/rhythm exercises; sight-reading; imitation of rhythms; microphone required.
EarMaster School™ 5	eMedia		✔		8+			✔		✔	✔									✔	✔	✔	Similar to EarMaster Pro 5; additional features of e-learning, student administration, networking possibility; customization of lessons and tests available.
Essentials of Music Theory 2.0	Alfred			✔	8+	✔	✔	✔	✔	✔								✔	✔	✔		✔	Terms illustrated with pronunciation, narration, picture, and sound examples; educator version allows customization of exercises and tests.
Great Composers series	Zane Publishing			✔	9+							✔	✔							✔			Interactive learning of 18 standard composers; 6 CD-ROMs.
Groovy Music	Sibelius			✔	3-11	✔		✔								✔				✔			Introduction to basics of sound, rhythm, pitch and composition using pictures and animation; series of 3 programs: Shapes (ages 5-7), Jungle (7-9), City (9-11); single computer, whiteboard, or network.
Hearing Music	Viva Media			✔	8+					✔										✔			Recognition of musical patterns before reading.

Title	Publisher	Platform				Fundamentals of music						Music appreciation				Skill				Version			Other Features
		MAC	PC	Hybrid	Age	Note reading	Theory	Rhythm	Terms	Ear training	Sight singing	History	Composer	Instrument	Style/Form	Composition	Performance	MIDI	Record keeping	CD-ROM	Download	Demos	
The History of Jazz	Clearvue & SVE			✔	9+							✔											Interactive learning of jazz history.
inform: A Music Analysis System	ECS Media			✔	College		✔			✔					✔					✔			Analyze musical form while listening to and viewing the music; guided analyses of 14 repertoire (Bach, Mozart, Purcell, etc.).
Interactive Musician	Alfred			✔	6+	✔		✔		✔								✔	✔	✔		✔	Pitch, sight reading, and rhythm components; educator version allows customization of drills and tests.
iRead Music with Music Theory	Midisoft	✔	✔		6+		✔													✔			2 CD-ROM set; basic theory knowledge; 10 games; multiple languages.
Juilliard Music Adventure	Theatrix			✔	9+			✔	✔	✔				✔		✔							Learn fundamentals of music concepts before note reading.
Jump Start Music™	Knowledge Adventure			✔	5-8	✔	✔	✔						✔						✔			Join Hopsalot on an adventure through 4 musical lands; basic theory knowledge; not 100% positive/motivating feedback.
Lamb Chop Loves Music	Philip Media, Inc.			✔	3-7									✔	✔					✔			Based on the classic story *The Musicians of Bremen*; starring Shari Lewis; musical styles and instruments; games and songs.
MacGAMUT 2003	MacGAMUT			✔	H.S.-College					✔								✔	✔	✔			Customization available; harmonic and melodic dictations especially helpful.
Making Music	Viva Media			✔	5+			✔						✔		✔			✔	✔			Compose music before note-reading; introduction to instruments, tempo, melody, rhythm, and sound.

Title	Publisher	Platform				Fundamentals of music						Music appreciation				Skill		MIDI	Record keeping	Version			Other Features
		MAC	PC	Hybrid	Age	Note reading	Theory	Rhythm	Terms	Ear training	Sight singing	History	Composer	Instrument	Style/Form	Composition	Performance			CD-ROM	Download	Demos	
Making More Music	Viva Media			✔	8+			✔						✔		✔			✔	✔			Turn drawings into musical scores; fun games for learning basic musical notations.
MiBAC™Music Lessons I	MiBAC Music Software	✔	✔		7+	✔	✔	✔		✔								✔	✔	✔		✔	Fundamentals of music theory and ear-training skills; customization available.
MiBAC™Music Lessons II	MiBAC Music Software			✔	H.S.-College		✔			✔								✔	✔	✔		✔	Learn chords and harmony with roman numerals through naming, writing, and playing.
MiDisaurus (Vols.1-8)	Town4Kids			✔	4–11	✔	✔	✔		✔			✔	✔				✔	✔	✔			Over 500 interactive activities with colorful animation, games, and songs.
MiDisaurus: The Great Composers & Their Music	Town4Kids			✔	4–11								✔		✔					✔			Musical forms and works by great composers.
MiDisaurus Musical Instruments	Town4Kids			✔	4–11									✔						✔			Introduction to instruments of the orchestra and instruments from around the world.
MiDisaurus Notation	Town4Kids			✔	4–11	✔			✔											✔			Explores expression and articulation markings, key signatures, and sight reading.
MiDisaurus Rhythm	Town4Kids			✔	4–11			✔												✔		✔	Explores note and rest values, tempo, and time signatures.
Mozart's Magic Flute	Tigor Media, Inc.		✔		5-10							✔	✔							✔	✔		Part of the Interactive Classics™ series; interactive learning about Mozart.
Mozart's Musical Adventure	SelectSoft® Publishing		✔		5-10								✔	✔						✔			Part of Superstart! Music series; discover sounds and instruments through games, biographies, and music.

Title	Publisher	Platform				Fundamentals of music						Music appreciation				Skill				Version			Other Features
		MAC	PC	Hybrid	Age	Note reading	Theory	Rhythm	Terms	Ear training	Sight singing	History	Composer	Instrument	Style/Form	Composition	Performance	MIDI	Record keeping	CD-ROM	Download	Demos	
Multimedia History of Music	Voyetra Turtle Beach		✔		8+							✔	✔							✔			Lives and works of standard composers (15th-early 20th century).
Multimedia History of Music & Great Composers	Voyetra Turtle Beach		✔		8+							✔	✔							✔			Lives and works of 14 composers (Renaissance – Romantic).
Multimedia Musical Instruments	Voyetra Turtle Beach		✔		8+									✔						✔			Video demonstration of playing techniques of over 50 instruments.
Music Ace 1	Harmonic Vision			✔	7+	✔	✔	✔		✔						✔		✔	✔	✔		✔	24 self-paced lessons reinforcing beginning music theory; Doodle Pad provides a venue for beginning composition.
Music Ace 2	Harmonic Vision			✔	7+	✔	✔	✔		✔						✔		✔	✔	✔		✔	24 self-paced lessons; continuation of Music Ace 1.
Music Ace Deluxe	Harmonic Vision			✔	7+	✔	✔	✔		✔						✔		✔	✔	✔		✔	Combination of Music Ace 1 and 2 with 36 carefully sequenced lessons; Doodle Pad and games.
Music Ace Maestro	Harmonic Vision			✔	7+	✔	✔	✔		✔						✔		✔	✔	✔		✔	Combination of Music Ace 1 and 2 with 48 lessons; student assessment and curriculum management tools; educator version.
Music Games	Alfred			✔	7-9	✔		✔	✔											✔			Fun, interactive games for learning fundamentals of music.
Music Goals by Eye & Ear	Singing Electron		✔		6+	✔	✔			✔				✔				✔	✔	✔			Reinforce sight-reading, play-by-ear, improvising, and memorizing skills.
Music Goals Rhythm	Singing Electron		✔		6+			✔											✔	✔			Customized drills; listening, reading, and dictation exercises.

Title	Publisher	Platform			Fundamentals of music						Music appreciation				Skill			Version			Other Features
		MAC	PC	Hybrid	Age	Note reading	Theory	Rhythm	Terms	Ear training	Sight singing	History	Composer	Instrument	Style/Form	Composition	Performance	MIDI	Record keeping	CD-ROM	Download	Demos	
Music Lab Harmony	Town4Kids		✔		8+	✔	✔			✔	✔						✔	✔		✔			Harmonic dictation and analysis; keyboard sight-reading skills; microphone required.
Music Lab Melody	Town4Kids		✔		8+	✔	✔	✔		✔	✔									✔			Solfege training available; microphone required.
The Musical World of Professor Piccolo	Opcode Systems, Inc.			✔	6+		✔	✔	✔	✔				✔	✔			✔					Self-paced interactive music course with sequential music lessons and arcade games.
Musicianship Basics©	New Horizons	✔	✔		6-9	✔	✔	✔	✔	✔									✔	✔		✔	60 graded activities for learning music fundamentals; JavaScript required.
Musition 2	Rising Software		✔		10+	✔	✔		✔					✔				✔	✔	✔			Customized tests and drills; symbols and instruments; fundamentals of music.
NotePlay	Alfred		✔		6+	✔												✔		✔		✔	Speed reading from single notes to chords and counterpoints.
O-Generator	Sibelius	✔	✔		6-16	✔		✔							✔	✔				✔			Virtual music teacher guides students in learning fundamentals of music and composing traditional and contemporary music (rock, pop, hip-hop) through structured lessons; Quicktime required.
Peter and the Wolf	Midisoft		✔		5+									✔						✔			DVD movie and 15 related game applications; movie runs on DVD players or Mac computers.
Piano Is Fun!	Fernando Enterprises Pty Ltd		✔		6-9	✔	✔			✔									✔		✔		20 progressive lessons with interactive exercises and practice games; customized lessons available; multiple users up to 50 students.

Title	Publisher	Platform				Fundamentals of music						Music appreciation				Skill				Version			Other Features
		MAC	PC	Hybrid	Age	Note reading	Theory	Rhythm	Terms	Ear training	Sight singing	History	Composer	Instrument	Style/Form	Composition	Performance	MIDI	Record keeping	CD-ROM	Download	Demos	
Piano Wizard™	Allegro Multimedia, Inc.		✔		3+	✔											✔	✔		✔		✔	Combines fundamentals of piano playing with colorful video games; pre-reading to simple note-reading; SMF files available for download.
Pianomouse Goes to Preschool	Pianomouse.com			✔	3-5	✔							✔	✔						✔			Easy musical patterns, 4 composers, and instruments; games for young children.
Pianoumouse Meets the Great Composers, Vol.1	Pianomouse.com			✔	8+								✔							✔			Biographies of 8 composers from Baroque, Classical, and Romantic period; fun, interactive games that test knowledge.
Pianomouse Music Theory FUNdamentals	Pianomouse.com			✔	6-12	✔	✔			✔										✔		✔	Preparatory level of music theory; concentration games.
Play It By Ear	Alfred		✔		6+					✔									✔	✔		✔	Recognition of single notes, chords, intervals, melodies, and scales.
Practica Musica®5	Ars Nova Software, LLC			✔	8+		✔			✔								✔	✔	✔			Wide variety of customizable activities; advanced theory; demo movies available.
Quickstart Music Mentor	Midisoft		✔		8+	✔			✔				✔	✔				✔		✔			Interactive learning of composers and musical instruments.
Quickstart Piano	Midisoft		✔		8+												✔	✔		✔	✔		Animated magic hands show fingerings at the keyboard; SMF files and video clips.
Rhythm Ace	Alfred		✔		6+			✔										✔		✔		✔	3 types of exercises: reading, dictation, and customized drills.
Sesame Street® Music Maker	SelectSoft® Publishing		✔		3+						✔			✔		✔				✔			Explore musical concepts (instruments, pitch, tempo, composition, sing-along) with Sesame Street characters.

Titles	Publisher	Platform				Fundamentals of music						Music appreciation				Skill				Version			Other Features
		MAC	PC	Hybrid	Age	Note reading	Theory	Rhythm	Terms	Ear training	Sight singing	History	Composer	Instrument	Style/Form	Composition	Performance	MIDI	Record keeping	CD-ROM	Download	Demos	
Sibelius Compass	Sibelius	✔	✔		12+		✔								✔	✔				✔			Learn to compose with lessons, worksheets, and tests.
Sibelius Instruments	Sibelius	✔	✔		12+									✔						✔		✔	500 listening and general quizzes; lesson plans & student assignments; playing and writing techniques of over 50 instruments.
Sibelius Notes	Sibelius	✔	✔		6+	✔	✔	✔												✔			Over 200 ready-to-use graded exercises and worksheets; requires *Sibelius* notation software.
Sibelius Starclass	Sibelius	✔	✔		6-11	✔		✔			✔			✔	✔					✔			Over 180 ready-to-use lesson plans; hundreds of sound clips and printable pictures; excellent tools for educators.
Superstart! Music Piano for Kids	SelectSoft® Publishing			✔	6+	✔	✔	✔	✔									✔		✔			Professor Rhythm and his 5 cheeky characters help students learn to read and play; printable sheet music of familiar tunes include finger positions and notes for coloring.
Tchaikovsky's Musical Adventure	SelectSoft® Publishing		✔		5-10								✔	✔						✔			Part of the Superstart! Music series; discover instruments, melodies, and composer through games, biography, and music.
Tchaikovsky's Nutcracker	Tigor Media, Inc.		✔		5-10								✔	✔						✔	✔		Part of the Interactive Classics™ series; games, puzzles, and trivia questions.
Theory Games	Alfred			✔	7+	✔		✔	✔									✔	✔	✔		✔	Correlated with Alfred's Basic Piano Library; usable with other piano methods.
Vivaldi's Musical Adventure	SelectSoft® Publishing		✔		5-10								✔	✔						✔			Part of the Superstart! Music series; discover instruments, melodies, and composer through games, biography, and music.

APPENDIX H

ANNOTATED LIST OF APPLICATION SOFTWARE

Title	Publisher	Platform						Version			Other features
		MAC	PC	Hybrid	Notation	Sequencing	Accompaniment	CD-ROM	Download	Demos	
Band-in-a-Box 2006	PG Music Inc.	✔	✔				✔	✔		✔	Automatically generates arrangements of piano, bass, drums, guitar, and strings in wide variety of popular styles.
Cubase SE3	Steinberg Media Technologies			✔		✔		✔			Powerful tool for composing, recording, editing, and mixing; unlimited tracks.
Digital Performer® 5.0	MOTU, Inc.	✔				✔		✔			Integrated MIDI and audio sequencer with unlimited tracks for sound mixing.
Encore	GVOX	✔	✔		✔			✔		✔	Composition software with transcribing and editing capabilities; scores as large as 64 staves per system.
Finale® 2006	MakeMusic, Inc.	✔	✔		✔			✔		✔	Professional notation features with human playback feature; create or save music as SmartMusic Accompaniments® for solo/ensemble practice needs.
Finale® Allegro®	MakeMusic, Inc.		✔								Similar to Finale® but at a lower price; Band-in-a-Box auto harmonizing and human playback features.
Finale® NotePad®	MakeMusic, Inc.							✔			Print or publish score on the Internet; free download from the Internet; requires Finale®.
Finale® PrintMusic®	MakeMusic, Inc.	✔	✔		✔			✔		✔	Write, print or make CDs/MP3s of original compositions; music scanning.
GarageBand™ 3	Apple	✔				✔		✔			Part of iLife '06 bundle; create audio and video Podcasts; full MIDI editing for software instruments.
Home Concert Xtreme	TimeWarp Technologies, Ltd.	✔	✔				✔	✔			Intelligent accompaniment program that follows student performances; an excellent practice tool.
Jammer Pro 6	SoundTrek		✔			✔	✔	✔		✔	Automated music composition software; create wide variety of accompaniments, arrangements, or original music; 2600 Musician and 2900 Groove styles.
Logic® Pro 7	Apple	✔			✔	✔		✔			Advanced notation feature allows real-time performances; sophisticated MIDI sequencing for digital recording, mixing, and editing.

Title	Publisher	Platform						Version			Other features
		MAC	PC	Hybrid	Notation	Sequencing	Accompaniment	CD-ROM	Download	Demos	
Master Tracks Pro	GVOX	✔				✔		✔		✔	Professional MIDI sequencing program: record, edit, and play compositions.
MiBAC™ Jazz	MiBAC Music Software			✔			✔	✔		✔	Similar to Band-in-a-Box but easier to use with less accompaniment styles.
Music MasterWorks	Aspire Software		✔		✔	✔		✔	✔	✔	Voice-to-note music composing software; microphone required; entry-level notation features.
Music Time Deluxe	GVOX	✔	✔		✔			✔		✔	Create and print original music; arrange for bands or small ensembles.
NoteAbility Pro™	Opus 1 Music, Inc.	✔			✔			✔		✔	Professional notation program.
Notion™ 1.5	VirtuosoWorks, Inc.			✔	✔		✔	✔		✔	Notation based live performance option for real-time performance control (*NTempo* feature).
NoteWorthy Composer	NoteWorthy Software, Inc.		✔		✔			✔		✔	Create, playback, record, and print; publish songs on the Internet.
PowerTracks Pro Audio 10	PG Music Inc.		✔								Music recording and editing sequencer with integrated digital recording and notation.
Quickstart Studio Composer	Midisoft		✔								Compose, record, edit, and play music; standard MIDI sequencing features.
Sibelius 4	Sibelius			✔							Internet publishing possible with Scorch®; educator version includes Worksheet Creator with over 1700 ready-made teaching materials.
Sibelius Scorch	Sibelius										Free download on Internet Explorer for PCs; supports any Sibelius files.
Sibelius Student	Sibelius	✔									Share student works and interact with other students by publishing original compositions on SibeliusMusic.com for free.
SONAR Home Studio 4	Twelve Tone Systems, Inc.							✔			Multi-track digital recording: create, record, arrange, and edit; integrated notation tools for creating and printing original music.

APPENDIX I

ANNOTATED BIBLIOGRAPHY OF INTERNET RESOURCES

Theory/Ear Training/History

eMusicTheory.com
This site offers free online interactive drills on basic theory (note names, intervals, scales, chords). The monthly subscription for teachers varies depending on the number of student users. Teachers can manage assignments and keep scores. A discussion forum is available for both students and teachers. Java applet is required for online learning and a MIDI instrument is required. A software version is available for download.
www.emusictheory.com

Teoria
An interesting theory and ear-training site that was created and has been well maintained by José Rodríguez Alvira since 1997. The major components—"Tutorials," "Exercises," and "References" (definition of terms and concepts)—offer clear and brief explanations (English or Spanish) as well as visual and audio illustrations. Interactive exercises can be customized. Limited free theory and ear-training exercises and tutorials are available online. Macromedia Flash player is required. An annual membership is required for downloading the entire site (except links). Appropriate for elementary to early-advanced level students.
www.teoria.com

Ricci Adams' Musictheory.net
This site offers free online theory for elementary to advanced level students. "Lessons" (tutorials), available in 7 languages, offer simple and clear instructions with interactive presentations; lesson pages are printable. "Trainers" (drills) provide unlimited randomized drills with immediate scoring; customization is available. "Utilities" offers teachers tools such as a chord calculator, staff paper, and matrix generators. An offline edition of the site is available for download. Macromedia Flash player is required.
www.musictheory.net

Music Notes
An educational music website created by high school students for elementary and intermediate students. The site includes tutorials on music theory, information on music history and musical instruments, brief backgrounds on various styles from classical to rock, and interactive games such as crossword puzzles and interval drills.
http://library.thinkquest.org/15413

Good Ear
This is a free online ear-training site created by Martin Schoeberl in 2000. Drills are randomized and customizable with options of tempo and sound choices (piano, electric piano, guitar, violin). Particularly useful drills include jazz chords, solfége, and perfect pitch. Appropriate for elementary and late-intermediate students.
www.good-ear.com

Big Ears
This is a free online interval driller created by Michael Ossmann in 1996. Chromatic and diatonic pitches from a two-octave span form randomized intervals. Java applet is required. The presentation is simple yet applicable for training students of all ages.
www.ossmann.com/bigears

The Musical Intervals Tutor
In 1999, inspired by a wealth of teaching experiences in ear-training, Madeline Salocks created this free website that helps students hear intervals (m2 to P8) and scales (major, harmonic minor, chromatic, pentatonic, and church modes). This site incorporates innovative use of popular theme songs (e.g., *Simpsons*, *Pink Panther*, *Jaws*) to introduce intervals. Tests are available to assess skills. A flash plug-in is required. The clear instructions and colorful illustrations are appropriate for elementary to early-advanced students.
www.musicalintervalstutor.info

Web Ear Training
This online ear-training course created by Dr. Michael F. Murray from the department of music at Missouri State University. Four levels of courses with each consisting of 10 progressive lessons that contain melodic, rhythmic, and harmonic dictations as well as error detection exercises. Challenging drills are appropriate for advanced pre-college and university students.
http://courses.missouristate.edu/MikeMurray/webet

Dolmetsch Online
This site was created by the Dolmetsch family, descendents of an early period instrument builder who was well-known in the late 19th and early 20th centuries. Webmaster Dr. Brian Blood has contributed many useful resources including music theory and history (tutorials with explicit explanations and illustrations spanning the 16th to 20th centuries), a music dictionary, composers' biographies, ear tests, and drills. Contributions by others include practical guides to composition and orchestration as well as a jazz improvisation almanac. Appropriate for high-school and college students as well as teachers.
www.dolmetsch.com/index.htm

The Online Listening Lab
W.W. Norton & Company, the publisher of *Enjoyment of Music* and *A History of Western Music*, created a valuable listening resource center online. License(s) for the Online Listening Lab and/or the Naxos Music Library are available for purchase. The Naxos Music Library offers digital anthologies of music (Middle Ages to Contemporary);

the Online Listening Lab offers streaming audios and composer biographies, listening guides, and online quizzes ("Music Identification" and "Style Identification"). Immediate feedback with explanations is available for the listening quizzes. Macromedia Flash Player and Internet Explorer are required. This is an excellent site for college music students including those preparing for graduate comprehensive exams.
www.wwnorton.com/web/listenonline/welcome2.htm

Educational Games/Music Appreciation

Happy Note!
For this website, Pascal Riben has created games for learning music fundamentals. Activities include note reading ("Treble Clef" and "Bass Clef"), sight-singing ("Sing'n and Learn"), ear training ("Play It By Ear"), and arcade games ("Tetris," "Note Cracker," "Notes in Space"). Several online games are free although purchase is available via e-mail. Appropriate for elementary students.
www.happynote.com/music/learn.html

Kaboose
These games for exploring sounds, keyboard and other instruments, basic note reading, and sound mixing are intended mainly for preschool children. Children as young as four can play and record their own performances on the keyboard or the mixer (e.g., "Boomthang"). An ear training drill (intervals) is designed for elementary to early-intermediate level students; chromatic intervals up to an octave are included. *Kaboose* also includes links to other music game sites.
www.kidsdomain.com/games/music.html

Metronome Home
Serving as a music education resource site for parents, students, and teachers, this website includes basic information on composers from the Medieval to contemporary periods. Links to detailed biographies, works, and discographies are also available. Not all links are regularly updated.
www.metronomehome.com/ComposersABCPage.php

A Carnegie Hall Listening Adventure
Created by Carnegie Hall, this site is designed primarily for children ages 6-12. Students can learn about sound, music notation, and instruments through listening adventures with animated characters (Violet and Uncle Olliesuch). It covers repertoire such as Britten's *Young Person's Guide to the Orchestra* and Dvořák's *Symphony No.9*. Free registration is optional for access; however, it is required if students want to save their games.
www.carnegiehall.org/article/explore_and_learn/art_online_resources_listening_adventures.html

Dallas Symphony Orchestra
This is a colorful and educational site created by the Dallas Symphony Orchestra. The "Music Room" includes interactive learning activities and games for students; the "Teacher's Lounge" provides resource tools including activity lesson plans for teachers. Game activities for students include "Beethoven's Baseball," "Music Match," and more. Windows Media Player is preferred to play sound files. Most of the graphics and limited sound files are available on Mac computers. Appropriate for children ages 6-12.
www.dsokids.com/2001/rooms/musicroom.asp or
www.dsokids.com/2001/rooms/teachers/asp

SFS Kids' Site
This site was created by the San Francisco Symphony for children's music exploration. There are two main areas: "The Music Lab" provides an interactive environment for students to learn fundamentals, such as notes, tempo, rhythm, harmony, symbols, instrumentation, and composition; "Instruments of the Orchestra" provides brief descriptions along with audio and visual illustrations of all standard instruments of the orchestra. Appropriate for children ages 6-12.
www.sfskids.org

The New York Philharmonic Kidzone
This website is filled with a variety of learning activities for children: games, instruments, composers, and composition workshops. Students can also learn to make instruments by using ordinary items found at home or get acquainted with famous conductors and soloists as well as selected members of the New York Philharmonic Orchestra. Appropriate for children ages 6-12.
www.nyphilkids.org

Classics for Kids®
Cincinnati Classical Public Radio designed this website for children ages 7 and up. Students can listen to current and past shows, and read about the lives and works of the featured composers. Learning activities such as "Hear the Music," games, instruments of the orchestra, and a musical dictionary are included. The "Parents" section provides information to help parents guide their children's interest in music; a recommended list of music books for adult reading is included. Flash Player 6 is required.
www.classicsforkids.com

Making Tracks
This website maintained by BBC Radio 3 (UK) encourages children to experiment with sounds and composition. Several games serve as compositional tools for children to create with sounds and rhythms without prior note-reading experience; students can submit their compositions to the radio station online and get their works posted on the website. Shockwave is required for some of the composition games. Appropriate for children ages 5-12.
www.bbc.co.uk/radio3/makingtracks

NAC Orchestra Kids Zone
The National Arts Centre (Canada) created this website for both teachers and students. Though it has not been updated since 2000, it offers educational information and games for children including "All about Ludwig van Beethoven" and "Fun & Games." Teachers can download a "Teacher's Kit" and activity sheets. Flash Player is required for some games. Appropriate for children ages 5-10.
www.nac-cna.ca/tour2000/en/kidszone/fungames

Alfred's Fun Zone
This kid's corner site was created by Alfred's Publishing Company for children ages 6-10. Fun online musical games for children include "Copycat," "Musical Darts," *Essentials of Music Theory* online crossword puzzle, and *Music for Little Mozarts* memory game. Macromedia Shockwave is required; some online games are available for download.
www.alfred.com

Sphinx Kids
An extension of the Sphinx Organization's Classical Connections program, Sphinx Kids contains interactive games and videos from the Sphinx Classical Connections CD-ROM as well as from the *New York Philharmonic KidZone* website. Children learn about composers, instruments, and minority composers and performers. Flash or Shockwave Player is required for games. Appropriate for children ages 6-12.
www.sphinxkids.org

Morton Subotnick's Creating Music
This website, created by the author of software programs *Making Music* and *Making More Music*, provides an interactive environment for children to experience sounds in a creative manner. The learning activities include composition ("Sketchpad" and "Rhythm Band"), phrase structure ("Puzzles"), musical contours, and other games. Java enabled browser, Quicktime, and Shockwave are required to perform all activities online. Appropriate for children ages 6-12.
www.creatingmusic.com

Tritone Music Series
This website offers an online self-paced, graded, and keyboard-based music curriculum created by Tritone Online Music Education Systems for teachers and students in public school systems or private music teachers or home-schooled students. Study of the fundamentals of music is possible via guided instructions, game learning lessons and activities, immediate feedback, and tests. Annual subscription is required. Windows or MAC compatible; requires Javatrax, Shockwave, and Quicktime as well as a 61-key MIDI keyboard.
www.tritonemusic.com

Freeware & Shareware Programs

Hitsquad Musician Network
This excellent resource site offers numerous demos, freeware, and shareware programs focusing on a wide variety of musical areas. Teachers or students can easily download programs into any computer platform they choose. Some interesting and useful music sites for both platforms are provided in the following links.
Mac users:
www.hitsquad.com/smm/mac/EAR_TRAINING
www.hitsquad.com/smm/mac/MUSIC_TUITION
www.hitsquad.com/smm/mac/KIDS_MUSIC_SOFTWARE
www.hitsquad.com/smm/mac/MULTITRACK_RECORDING
www.hitsquad.com/smm/mac/NOTATION
PC users:
www.hitsquad.com/smm/win95/EAR_TRAINING
www.hitsquad.com/smm/win95/MUSIC_TUITION
www.hitsquad.com/smm/win95/KIDS_MUSIC_SOFTWARE
www.hitsquad.com/smm/win95/MULTITRACK_RECORDING
www.hitsquad.com/smm/win95/NOTATION

Functional Ear Trainer
The freeware programs ("Basic" and "Advanced") on ear training featured on this website have been designed by Alain Benbassat. These are non-traditional ear-training programs that offer original and effective ways to recognize notes in the context of a key. Donations are accepted. Appropriate for elementary to advanced students.
www.miles.be

Metronimo Music Web Site
This European music website offers game programs (freeware and shareware) in English, French, or Spanish to learn music theory, composers, and orchestral instruments. Among such programs are "Pianonimo," "Rhythmonimo," "Tetronimo," and "Metronimo Quiz." Other online games such as puzzles, quizzes, memory, hangman, and word search are free. Appropriate for elementary and intermediate students.
www.metronimo.com

EarMaster Pro 5.0 and *EarMaster School 5.0*
Highly interactive ear training programs published by EarMaster ApS are available for download with license fees. A CD-ROM version for Windows only is also available. *EarMaster School* is the educator version (Windows only); management of multiple users is available. Appropriate for elementary to advanced students.
www.hitsquad.com/smm/programs/EarMaster
www.hitsquad.com/smm/programs/EarMaster_School

Super Duper Music Looper Xpress v2.0
This freeware program offered by Sony Media Software allows children ages 6-9 to create and record music using hundreds of instruments and sound effects as well as their

own vocals. No note-reading is necessary. Original creations can be shared with friends via e-mail. This is also available on CD-ROM (Windows only).
www.hitsquad.com/smm/programs/SDMLXPress

Amazing Slow Downer v2.8.5
This shareware program was designed by Rolf Nilsson for PC and Mac computers. Teachers and students can slow down the speed of the music (audio CD, MP3, AIFF, and Wave files) between -50% and 400% time-stretching without altering the pitch. A CD player capable of digital reading is required.
www.hitsquad.com/smm/programs/AmazingSlowDowner (Mac)
www.hitsquad.com/smm/mac/AmazingSlowDowner (PC)

General Resources for Teachers

Discovery School's Puzzlemaker
This site was created by Discovery Communications, Inc. Although not intended for music teachers, the site nevertheless provides a free tool for music educators to create printable puzzles (e.g., crosswords, word searches) using a variety of templates available online. A CD-ROM is also available for purchase.
http://puzzlemaker.school.discovery.com

Quia (*Quintessential Instructional Archive*)
This is an excellent resource site intended for students and educators of K-12 schools and colleges. This site contains templates for creating online activities (flashcards, memory, and matching games), word searches, rag-to-riches games, and quizzes in a variety of formats. An annual subscription is required for both students and teachers; the subscription allows users to access class web pages, quizzes, and grade reports as well as online calendars and schedules. The shared online activities and quizzes are free to public users.
www.quia.com

PracticeSpot
This site offers free resources and tools to students and teachers. "Press" offers teachers tools to create and print customized drills for topics including sight-reading, scales, note reading, rhythms, and chords; tips on promoting studio, practicing, and teaching; and templates for worksheets, recital programs, and teaching schedules. "Classic" provides students a dictionary of musical terms, a graphical scale manual, a chord wizard, and more. Teachers can also learn how to build a studio webpage from this site.
www.practicespot.com

MusicTeaching.com
This site is a project created by the team behind *PracticeSpot*. Teachers can use this site to generate customized drills and printed exercises ("Pitchreading Drill" and "Terms and Signs"). Acrobat reader and Javascript are required.
www.musicteaching.com

4Teachers.org
This resource site was created by the Advanced Learning Technologies in Education Consortia at the University of Kansas Center for Research on Learning. Although not designed for music educators, this site nonetheless offers teachers free online tools, such as ready-to-use Web lessons and quizzes for implementing technology into curricula.
www.4teachers.org

PianoWorld.com
This site provides numerous free piano forums intended for classical and non-classical pianists, adult beginners, piano technicians, and piano teachers. Information on locating piano tuners, piano movers, and dealers as well as purchasing sheet music, instruments, books, and CDs can be found. The printable word search, "Piano Trivia Quizzes," "Piano Fun Facts," and "Music Funnies" (a collection of silly puns related to the piano and music in general) are particularly interesting for both teachers and students.
www.pianoworld.com

Pianonet
The official website of the National Piano Foundation offers a comprehensive guide about pianos – history of piano, manufacturing of piano, choosing a piano – as well as articles for group piano teachers on topics such as technology, teaching ideas, and useful bibliographies. An enrollment is required to receive free newsletters.
www.pianonet.com

Pianoteaching.com
A website created by Nancy and Randall Faber, this resource offers teachers and students free newsletters via e-mail, updates on the latest Faber publications, samplings of orchestrated accompaniments, and a discussion forum. The wide variety of topics discussed in the PIANO club forum includes teaching issues/tips, motivation, technique, repertoire, games/activities, early childhood/adult teaching, and technology. Past forum discussions are available in a huge archive. A weekly teaching video clip is provided.
www.pianoteaching.com

K-12 Resources for Music Educators
This resource site is designed for band, choral, orchestra, and classroom teachers as well as other music educators. It offers hundreds of links available online. Particularly useful for piano teachers are the links for classroom music teachers and all music educators. The website also includes over 50 links to MIDI and MP3 archives and music technology resources. Students can learn about history, biographies, and works of great composers using provided links.
www.isd77.k12.mn.us/music/k-12music

Music Technology Resources for Teachers

The Piano Education Page
One of the largest sites devoted to piano education, this resource was established by John Zeigler and Nancy Ostromencki. Much helpful information for teachers is included. The "Teaching Studio" provides a space for teachers to share teaching tips and experiences, and features articles on studio operation, teaching career issues, technique, and technology use in studio; "Message Board" hosts forums on a wide range of topics for teachers, students, and parents; "Reviews" provides teachers with useful reviews on teaching methods, books, videos, and software; and "Links" includes hundreds of links to websites of interest to piano teachers as well as general music educators. Students can also learn about composers and performers in "Just for Kids" and listen to over 600 solo MIDI piano pieces in the "Audition Room."
http://pianoeducation.org

SoundTree
This resource site was created by SoundTree, a leader in music technology systems that provides services for educators. "Teaching Resources" contains a huge collection of lesson plans/projects and classroom (K-20) music technology success stories. It provides useful teaching tips and ideas for music educators including piano teachers.
www.soundtree.com

The Classical Music Navigator
This excellent website allows serious musicians and teachers to find information on over 400 standard composers including major works, influences on their writing, and influences they had on others. A unique presentation of indexes of composers, genre, geography, styles/forms, and terms is featured in this site. This project was created by Dr. Charles Smith, Professor of Library Public Services at Western Kentucky University in 1993.
www.wku.edu/~smithch/music/index2.htm

ClassicalWorks Timeline
This comprehensive timeline offers factual information on the history of music. A glossary of musical terms, a photo gallery of composers, and numerous links to classical MIDI files are also available.
www.classicalworks.com

Classical Net™
An Internet resource useful to all musicians, this site features over 3000 CD/DVD/book reviews, 6000 sound files, and over 4000 links to other classical music websites. Information offered about composers and their works from the Medieval period to the present is useful for students and teachers. A moderated classical music listserv is also available.
www.classical.net

Naxos.com
The official site for Naxos, a major classical music label, offers brief biographies and discographies of hundreds of performer artists and composers that are informative for students and teachers.
www.naxos.com

The Classical Music Archives™
One of the largest classical music online sites, this resource features over 30,000 full length classical music files by over 2000 composers. Biographies of composers and selected artists, major works of composers, discographies of performers, definitions of terms, and recordings (live, MIDI, WMA/MP3, Zip files) of a wide variety of genres/mediums are available for an annual subscription fee. Non-registered users can access biographies and limited MIDI files for no cost.
www.classicalarchives.com or
www.prs.net/midi.html

The Classical MIDI Connection
This site provides thousands of MIDI sound files of classical music for no cost. Instructions, forums, and recommended books on MIDI are also available.
www.classicalmidiconnection.com

Piano Home Page
This informative site was created by an independent piano teacher Martha Beth Lewis for parents, students, and piano teachers. It includes "Questions and Answers" on topics such as pedagogy, business practice, music theory, and performance practice as well as articles on piano pedagogy topics.
www.serve.com/marbeth/piano.html

Music Tech Teacher
This site is an extension of the music technology curricula taught by K. Garrett at Central Park School in Birmingham, AL. Teaching tips, lesson plans, and over 100 quizzes, puzzles, and games about music as well as printable student worksheets are made available to teachers free of charge.
www.musictechteacher.com

FindArticles™
This site offers thousands of articles on a wide variety of topic areas, some for free and some for purchase. Categories of particular interest to music educators and piano teachers are "Arts & Entertainment" and "Computers and Technology." Articles from piano journals, such as *Keyboard Companion* and *American Music Teachers*, as well as reviews on books, concert, and software are included in the database.
www.findarticles.com

Easy Music Theory
Gary Ewer promotes his *Easy Music Theory on CD-ROM* through this website featuring video lessons, written tutorials, worksheets, quizzes, trivia, and free articles. Free sample lessons are available online. This is primarily appropriate for adult learners due to the wordy instructions and lack of attractive illustrations.
www.easymusictheory.com

Sheet Music and Sound Files (MIDI, MP3, WAV)

The Free Sheet Music Guide
This site provides teachers and students annotated bibliographies of and links to numerous websites that offer downloadable sheet music. Users can browse by category or instrument. The genres include pop/rock, classical, Christian, and Christmas.
www.freesheetmusicguide.com

The Sheet Music Archive
Numerous sheet music selections of standard classical composers are available for download (limited to two pdf files per day) or purchase (CD-ROM). An extensive listing of music by Bach, Beethoven, Chopin, and other major keyboard composers is included.
www.sheetmusicarchive.net

Music-Scores.com
This site offers digital classical sheet music and MIDI files of different instruments (piano, violin, flute, duo piano, etc.) to members for an annual subscription and to non-members (three pdf files/day). Over 500 repertoire selections of all levels are included. Brief background information as well as visual and audio examples are available for previews. An online sheet music store is also available.
www.music-scores.com

Virtual Sheet Music
With an annual subscription, this site offers unlimited downloads or printing of classical sheet music. Non-members can purchase sheet music via direct download or e-mail. MIDI files are also available for preview.
www.virtualsheetmusic.com

Easy Sheet Music
An annual subscription is required for unlimited downloads of sheet music while limited free downloads are available for non-subscribers. The easy piano music includes mainly popular classics, boogies and blues, world/folk songs, and simplified arrangements of opera classics.
www.easysheetmusic.com

The Mutopia Project
This site offers over 600 pieces of classical music for download, printing, and distribution at no cost. Users can search an extensive database by composer, instrument, or style.

Each music listing includes detailed information such as catalog number, instrumentation, date of composition, as well as preview images of musical excerpts. The repertoire ranges from the Renaissance to Romantic eras; gospel, traditional hymns, and jazz genres are also included.
www.mutopiaproject.org

Variations
This is a helpful resource site for serious musicians, college music students, and teachers. Developed by the William & Gayle Cook Music Library of Indiana University (Bloomington), *Variations* is an ongoing experimental project on methods of distributing musical scores (from the library holdings and other public domains) and recording liner notes online. Wide-ranging literature includes these genres: opera, song, chamber, orchestral, choral, solo instrumental, and piano. Digital images of the entire book – covers, prefaces, introductions, and scores – are available for viewing and printing.
www.dlib.indiana.edu/variations/scores

Professional Organizations/Forums

Music Teachers National Association (MTNA)
This official website of Music Teachers National Association offers useful resources including databases for *American Music Teachers* articles and intermediate chamber music repertoire; MTNA publications of the proceedings from Pedagogy Saturday workshops; suggested readings for teachers; and music wellness bibliographies. Children can also take advantage of links to games and learning sites on "Websites for Kids."
www.mtna.org

National Group Piano/Piano Pedagogy Forum (GP3)
Founded by Barbara Fast, Michelle Conda, Andrew Hisey, and Laura Beauchamp, this biennial forum is intended for college and university teachers of group piano and piano pedagogy. Discussion issues include collaborative piano, keyboard education, keyboard technology, piano pedagogy, group piano, and piano performance. Articles and conference reports are published on a website maintained by the University of South Carolina School of Music.
www.gp3forum.org (Official site of GP3)
www.music.sc.edu/ea/Keyboard/PPF/index.html (Articles & Conference reports)

The National Association for Music Education
Formerly known as Music Educators National Conference (MENC), this association offers resources to music educators from all levels and areas. A membership subscription is required and available for both teachers and college students. Past and current issues of periodicals such as *Music Educators Journal*, *Teaching Music*, and *Journal of Research in Music Education* are available for members. Limited access to selected articles and links to music education sites is available for non-members.
www.menc.org

TI:ME
The official website of The Technology Institute for Music Educators offers resources on technology use in teaching curricula. A membership subscription is required to receive newsletters and free journals such as *Electronic Musician* and *Music Educator Technology Magazine*. Members can also search databases of lesson plans that help integrating technology into teaching and researching in music education technology. Other benefits of membership include access to articles on using technology in teaching and on fundamental concepts in music technology, tutorials on learning music software, discussion group mailing list, and a message board where members share ideas and experiences in music technology.
www.ti-me.org

ATMI
The Association for Technology in Music Instruction offers an extensive database of freeware, shareware, and commercial software on its Music Technology Directory, accessible to both members and non-members. ATMI Listserv is also available for members to share ideas on technology use.
www.atmionline.org

TDML ejournal
Technological Directions in Music Learning, a forum for new concepts in the application of technology to all facets of music learning, offers proceedings and articles from 1994-2003 TDML conferences on its website. Topics include multimedia, general music education, theory and composition, distance learning, keyboard instruction, and technology curricula. Although dated, these proceedings present valuable information on music technology and are easily downloaded as pdf files.
http://music.utsa.edu/tdml

CMS
The College Music Society offers its subscribed members articles on music theory, ethnomusicology, composition, music education, and performance from its newsletters and the journal *College Music Symposium*. Articles on music technology written by experts such as Peter Webster are also available for members.
www.music.org

Good-Music-Guide Classical Music Forum
This online forum for classical music enthusiasts and amateur musicians is maintained through subscriptions and donations. Topics discussed include classical music for beginners, recordings, and composers.
www.good-music-guide.com/forum

The Classical Music Guide Forums
This site offers an online outlet for classical music enthusiasts to discuss this genre. A membership subscription is optional. Two discussion forums of interest to music teachers are “Classical Music Chatterbox” and “Classical Concert Reviews.”
www.classicalmusicguide.com

Piano Internet Resources List
This resource site offers hyperlinks to websites helpful to musicians including students and piano teachers. Links to music organizations, publishers, companies, mailing lists, and educational sites on composers/performers/repertoire are included.
http://rmmpiano.tripod.com/internet.src.html

Piano Pedagogy Plus
This piano pedagogy site was created by Dr. Jon Ensminger, a faculty member of Northland Baptist Bible College. Three areas of primary interest and usefulness include articles on teaching, theory/composition, and technique; reviews on books, music, and music technology; and forums on music technology (MIDI and computer software, keyboards) and pedagogical issues (elementary and advanced teaching, injury prevention, practice tips, and method books). Registration is free for all users.
www.pedaplus.com

Pianovision.com
This site has three components: a host to the World Piano Pedagogy Conference, an online shop for sheet music and books, and an online magazine for piano teachers and students, *WebZine*. An annual subscription to *WebZine* allows members to receive discounts on the WPPC registration; other benefits include direct interactions with the best teachers/experts in the world and access to articles, forums, music reviews, and discussions on movement and wellness.
www.pianovision.com

Online/Downloadable Piano Lessons

Duane Shinn's Instant Chord Finder
Duane Shinn offers a software program that teaches keyboard chord playing in both clefs using all types of chords and their inversions. Visual displays of staff notation, finger position, and a keyboard chart are available on the screen. A full program can be purchased for download. This is a helpful program for adults and teenagers who want to play popular songs and lead sheets.
www.keyboardchords.com

PlayPiano.com
Duane Shinn, author of *Instant Chord Finder*, offers two years of free online weekly lessons on playing piano music of different styles using piano chords and chord progressions. This website promotes his piano lessons on CD- and DVD-ROMs. Appropriate for adults and teenagers.
www.playpiano.com
www.freepianolesson.com

ChordPiano.com
This software program by Duane Shinn reinforces playing with all types of chords. It may be purchased on CD- and DVD-ROMs.
www.chordpiano.com

Piano Lessons Unlimited
To promote his video DVDs and CD-ROMs, David Sprunger created an online powerpoint presentation of his piano course *Pattern Piano and Keyboard* that emphasizes playing with rhythmic patterns. The program reinforces play by ear and improvisation skills. Sample lessons are available for download although programs are Windows compatible only. The program is appropriate for adults and teenagers.
www.playpianotoday.com

PianoForKids.com™
This piano curriculum was developed by Dan Delaney for children ages 5-13. Lessons can be viewed on the Internet or video CDs. Guided lessons, interactive games and quizzes are included. Each lesson comes with a story and a picture; children are encouraged to submit their own pictures/drawings to be incorporated into the program. "Name That Note" is a note-reading game that encourages speed reading; customization is available. A guided tour and sample lessons are available online. CD-ROMs are available for Windows only. Monthly subscriptions or three-month CD bundles are available for purchase. Windows Media Player is required.
www.pianoforkids.com

PianoInstruction.com
Designed by Dan Delaney for students ages 13-adult, lessons can be viewed on the Internet or video CDs. The self-evaluation and practice planner allow students to trace progress and design daily practice schedules. The program emphasizes scale fingerings and an understanding of chords. A guided tour and sample lessons are available online. CD-ROMs are also available for Windows only. Monthly subscriptions or three-month CD bundles are available for purchase. Windows Media Player is required.
www.pianoinstruction.com

GoPiano.com
Free online keyboard lessons are offered by Gregory Ramsey; a CD-ROM is available for a donation. Primarily audio instructions are offered online but some graphic displays are featured in the CD-ROM. Lessons are presented in text and audio clips; a high level of reading and comprehension is required. In addition to the lessons, quizzes and theory exams are included. Real Player or Windows Media Player is required.
www.gopiano.com

Piano on the Net
This free online piano course offered by PianoNanny.com and The Nanny Group provides a 34-lesson piano course that is appropriate for adult learners. Although lessons are labeled as "Starter," "Intermediate," and "Advanced," the actual contents are

equivalent to the first two years of a standard beginning piano curriculum. Apple QuickTime, JavaScript, and Macromedia Flash are required.
www.pianonanny.com

Learn Piano Online
Developed by Lisa, an independent piano teacher in San Diego, CA, users of this piano curriculum can receive over 100 pages of free keyboard instructions via e-mail. The complete piano course is also available for purchase (CD-ROMs or annual online subscription). The course employs basic chord approaches to teach simple songs for both hands; no note-reading is required for beginner lessons until Lesson 4. It consists of primarily text explanations with minimal graphic illustrations and is appropriate for adult learners.
www.learnpianoonline.com

The Piano Patch Kids!
This preschool piano series is an extension of the *Learn Piano Online* curriculum. The primer series is designed for children ages 3-7. The course is available for purchase (downloads only using Adobe Reader). Students learn to play right hand alone before playing hands together using Middle C reading approach.
www.thepreschoolteacher.com

Online Music Stores

McCormick's
This online store offers products to marching band directors, guard instructors, and music educators. Technology users can purchase a wide range of computer programs (CAI and application software), instrument accessories, and classroom computer equipment. Teachers who are interested in setting up a music technology lab can take advantage of the promotional bundles that include different combinations of software programs and instruments. A free catalog is available upon request.
www.mccormicksnet.com

Friendship House
This online store provides K-12 classroom teachers as well as piano teachers an abundance of teaching aids: multimedia (books, DVDs, CDs, software), reproducible worksheets, classroom decorations, and awards (e.g., student achievement certificates and ribbons). A free catalog is available upon request.
www.friendshiphouse.com

Lentine's Music
This online store offers an abundance of products as well as music software. In "Education Technology," music teachers can access many articles offering tips on topics such as implementing technology ("Music Education Technology") and setting up a technology lab ("Technology Laboratory"). Reviews of software programs are also

available in Instructional Courseware. Articles on using MIDI are included in the "Audio & MIDI Recording" and "MIDI Instruments" sections.
www.lentine.com (Online Store)
www.lentine.com/educationtechnology.htm (Articles on Music Technology)

Piano Lane
Independent piano teachers can easily find teaching materials for piano from this online store. Thousands of types of piano music – standard classical, methods, jazz, pop, broadway, sacred, ensemble – are available. The publications for the National Federation of Music Clubs are also included in the database.
www.pianolane.com

Prima Music
This online store offers a wide variety of instrumental music (piano, guitar, strings, brass, and woodwind) ranging from standard classical to popular, folk, sacred, seasonal, and jazz styles. Ensemble music for keyboards and other instruments are also available. Registration for a free membership is required to receive discounts on selected purchases.
www.primamusic.com

J. W. Pepper®
One of the largest sheet music stores, the Pennsylvania-based company J.W. Pepper and Son, Inc. offers music online for all types of music educators: directors of band, orchestra, church, and choral; classroom teachers; piano teachers; and vocal and instrumental teachers. In addition to music, this store also offers computer software and MIDI accessories. A digital music delivery service – *eprint*^{SM} – is offered for direct downloads to the computer; Scorch Viewer program is required. A free catalog is available upon request.
www.jwpepper.com

Hutchins and Rea
A Georgia-based company, Hutchins and Rea is probably the largest online music store for serious musicians. This store offers a huge collection of titles for a wide range of instruments. It includes hundreds of study scores, over 16,000 of piano titles, and thousands of titles for other instruments and voices. A free catalog is available upon request.
www.hutchinsandrea.com

APPENDIX J

DIRECTORY OF SOFTWARE PUBLISHERS

Adventus Interactive
3667 Strawberry Hill St., Suite 103
Halifax, Nova Scotia
Canada B3K 5A8
1-888-999-MIDI (6434)
www.adventus.com

Alfred Publishing Co., Inc.
P.O.Box 10003
16320 Roscoe Blvd., Suite 100
Van Nuys, CA 91410-0003
1-800-292-6122
www.alfred.com

Allegro Multimedia, Inc. (dba Allegro Rainbow™)
1-877-PIANO-04 (742-6604)
www.allegrorainbow.com

Apple®
1-800-MY-APPLE (692-7753)
www.apple.com

Ars Nova Software, LLC
16770 NE 79th St., Suite 207
Kirkland, WA 98083-0637
1-800-445-4866
www.ars-nova.com

Aspire Software (Online company)
910-792-9100
www.musicmasterworks.com

Clearvue & SVE
6465 North Avondale Avenue
Chicago, IL 60631
1-800-253-2788
www.clearvue.com

ECS Media
1713 S. State St.
Champaign, IL 61820
1-800-832-4965
www.ecsmedia.com

eMedia Music Corporation
664 NE Northlake Way
Seattle, WA 98105
206-329-5657
www.emediamusic.com

GVOX
199 Rt 18
East Brunswick, NJ 08816
732-565-3842
www.gvox.com

Harmonic Vision, Inc.
155 North Wacker Drive, Suite 725
Chicago, IL 60606
1-800-474-0903
www.harmonicvision.com

Knowledge Adventure®
2377 Crenshaw Blvd., Suite 302
Torrance, CA 90501
310-533-3400
www.adventure.com

MacGAMUT Music Software, Inc.
1170 Old Henderson Road, Suite 100
Columbus, OH 43220-3623
1-800-305-8731
www.macgamut.com

MakeMusic®, Inc.
7615 Golden Triangle Drive, Suite M
Eden Prairie, MN 55344-3848
1-800-843-2066 (Finale)
1-888-874-2144 (SmartMusic)
www.makemusic.com or www.finalemusic.com

Mark of the Unicorn (MOTU, Inc.)
1280 Massachusetts Ave.
Cambridge, MA 02138
617-576-2760
www.motu.com

MiBAC Music Software, Inc.
P.O.Box 468
Northfield, MN 55057
1-800-645-3945
www.mibac.com

Midisoft Music Software
729 W. Basin Street
San Pedro, CA 90731
310-602-5000
www.iddincusa.com or www.midisoft.com

Music Games International (Tigor Media Inc)
P.O.Box 1376
Amherst, MA 01002
1-877-877-1369
www.interactiveclassics.com

Opcode Systems, Inc.
3850 Fabian Way, Ste. 100
Palo Alto, CA 94303
415-856-3333
www.opcode.com

Opus 1 Music Inc.
3456 Dunbar St.
Vancouver, B.C.
Canada V6R 2C2
604-221-1121
http://debussy.music.ubc.ca

PG Music Inc.
29 Cadillac Ave.
Victoria, B.C.
Canada V8Z 1T3
1-800-PGMUSIC (268-6272)
www.pgmusic.com

Philips Media, Inc.
10960 Wilshire Blvd.
Los Angeles, CA 90024
1-800-340-7888

Pianomouse.com
4120 Douglas Blvd., #306-224
Granite Bay, CA 95746
1-888-287-3380
www.pianomouse.com

Rising Software Australia Pty Ltd.
3 Darling St.
Fairfield, Victoria
Australia
1-888-667-7839 (USA)
www.risingsoftware.com

Sibelius USA Inc.
1407 Oakland Blvd., Suite 103
Walnut Creek, CA 94596
1-888-SIBELIUS (474-2354)
www.sibelius.com

Singing Electron
13901 Balsam Lane North
Dayton, MN 55327
1-866-624-6257
www.musicgoals.com

Sony Media Software
1617 Sherman Ave.
Madison, WI 53704
1-800-577-6642
www.sonymediasoftware.com

SoundTrek
5453 Royal Jasmine Way
Sugar Hill, GA 30518-7942
770-831-8515
www.soundtrek.com

Steinberg Media Technologies GmbH
Neuer Hoeltigbaum 22-32
22143 Hamburg
Germany
++49 40 210 35-0
www.steinberg.net

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3 Lorimar Lane
Rehoboth, MA 02769-1746
www.timewarptech.com

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Watertown, MA 02472-5003
1-800-342-0236
www.tomsnyder.com

Town4Kids Inc. (USA)
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425-869-6075
www.town4kids.com/us_ecom

Twelve Tone Systems, Inc.
268 Summer St.
Boston, MA 02210
617-423-9004
www.cakewalk.com

VirtuosoWorks, Inc.
201 S. Elm St., Suite 300
Greensboro, NC 27401
336-275-2994
www.notionmusic.com

Viva Media, LLC
580 Broadway Suite 604
New York, NY 10012
212-431-4420
www.viva-media.com

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5 Odell Plaza
Yonkers, NY 10701-1406
1-800-233-9377
www.voyetra.com