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THE ROLE OF PIANO TECHNIQUE IN TYPING COMPETENCY AND IT PRODUCTIVITY

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Abstract:

Typing competency is often a neglected skill in boosting Information Technology productivity. Now that technology has become a utility, typing is an essential skill for every technology user. Increased typing speed and typing accuracy improve productivity, not only for software firms where coding is a dominant activity but also for other firms with digitally interactive stakeholders. This research discusses the weaknesses in traditional typing pedagogy and the advantages of integrating piano technique into typing training. It further explores the similarities and differences in computer mechanical keyboard typing and piano playing and applies piano keyboard techniques to facilitate training in computer keyboard typing competency. Classic principles of piano technique have ramifications for improved speed, accuracy, and efficiency in typing. The pianist's attention to bodily orientation promotes optimal health and wellness, avoiding injury in workplace settings. Mindfulness building strategies, such as verbal labeling of imperfections, have applications in typing-training as a reflection mechanism which may serve as a catalyst for growth.

Keywords — Typing, Typing Competency, Piano, IT Productivity

1. INTRODUCTION

With the prevalence of electronic records and computer networks, professionals across industries have adopted digital documentations and communications. They spend substantial time in data entry of electronic records and in digital communications of various forms, such as email, texting, and digital document sharing. One of the main factors leading to the resistance in adopting electronic records and digital communications is the complaint that data entry and digital communications may have taken precious time away from face-to-face interaction with customers and co-workers.

For instance, medical doctors may resist the adoption of electronic medical records because of their experiences and perceptions that data entry into electronic medical records have taken precious time away from interaction with patients. It is even worse in emergency medical settings. Studies show that medical physicians in Emergency Departments (ED) spend about 65% of their time on documentation during an ED patient visit (Neri, et al. 2015). Time is especially precious when treating ED patients. For heart-attack patients, “every minute counts” and time saved in data entry may be well used for saving heart muscles or even saving lives (Abdul-al & Wang, 2019).

To improve the data entry speed and accuracy, this research investigates the seemingly simple but yet important task of typing, as a means to save time and boost productivity. Typing is an essential work and life skill that every user of computing technology should possess. Typing speed and accuracy saves time. In this era of ubiquitous computer and Internet use, requiring typing on daily or hourly basis, time saved in typing constitutes an untapped resource in our agile, fast-paced, big data society.

The majority of the IT productivity toolsets focus on high-level improvement such as process optimization and systems integration. However, IT productivity boosting should come from both the top-down and bottom-up approaches. Individual level IT productivity improvement is a bottom-up approach. It is not the long hours of the individual’s work (which easily leads to burn out, an issue actively being addressed even in agile development techniques such as Scrum) but the efficiency of each individual’s work that counts. Improving typing, an essential but often neglected task of teleworkers, is part of the bottom-up approach to boosting IT productivity through individual efficiency.

Now the question is how to improve typing competency. There are traditional typing training programs, such as free, interactive, game-like websites that contain typing tasks and immediate feedback on typing speed and accuracy. What are the limitations of these traditional typing training modalities? Are there other technical and non-technical approaches to enhance typing competency?

This interdisciplinary research aims to show the limitations of traditional typing pedagogy and offers alternative approaches. It draws especially on disciplines within music performance, where manual dexterity is of paramount relevance.

This research sprouted from anecdotal observations by technologists that digital communications from well-trained pianists occur at a faster pace than those non-musicians. In rapid, synchronous typed conversations, musicians, and pianists in particular, demonstrated unusually high speed and accuracy. Pianists report subjective perceptions of comfort with the technical demands of typing large volumes of texts, as compared to non-musicians. Pianists are intrepid when faced with extensive and rapid texting demands. Such timely responsiveness was not observable in email communications to as great an extent, perhaps due to the asynchronous nature of email, as compared to texting.

Such observations in texting by musicians has instigated research into pianists’ typing performance on mechanical computer keyboards. Interestingly, a better performance was observed and later confirmed with an astounding 120 words per minute typing speed and high typing accuracy, in comparison to a seasoned technologist who had been, for years, content with a 50 words per minute typing speed and comparatively lower accuracy. Hence, the following questions are being asked:

Do people with training in playing musical instruments have better typing techniques than those without such training? Do musicians have better typing speed and accuracy than technologists, all else being

equal? Given the similar use experiences and frequencies of keyboard use – say a pianist to a piano keyboard vs. a seasoned programmer to a computer mechanical keyboard and both have similar years' exposures to using their respective keyboards – does the pianist have better typing competency than a seasoned programmer using computer keyboards? In other words, does the pianist's skill at the piano keyboard transfer to his or her ability to type on a computer keyboard? Does the pianist's highly developed manual dexterity, precision, and speed of digital movement (in the sense of fingers, not numbers) proffer an advantage that could be harnessed and applied with minimal training to typing, resulting in excellent typing skills? Pianists may be in possession of advantages in the context of human computer interactions by virtue for their musical training, possibly even over seasoned technologists. Should that prove the case, recruiters hiring staff for positions requiring extensive typing could exercise a preference for candidates with musical training versus candidates without such training, given all candidates are comparable in other required skills.

Asking a candidate to report on any musical skills when applying for a technical position could be excessive. Nevertheless, it bears investigating whether pianists and other instrumentalists make for superior typists compared to others, and if so, why. Can technologists learn how to improve their typing speed and accuracy from pianists, and subsequently improve their IT productivity? Given the widespread proliferation of digital documentation practice in this Internet age, all Internet and computer are effectively technologists. Hence, any improvement in typing speed and accuracy will benefit every user of technology, rather than just professional technologists.

2. TYPING WILL NOT DIE OUT, NOT YET

Typing ability has been an indispensable skill in the workforce for many decades. From the type-writer era to the computer era, typing is a trained technique essential for data entry clerks such as secretaries, data entry workers, and programmers. However, typing has never been recognized as one of the essential skills for nearly the entire workforce in recent decades due to the ever-increasing use of computers and the Internet, which has eclipsed the value of typing itself. Nowadays, organizations should require workers to build typing skill, considering how often they perform typing tasks multiple hours daily in work-related emails, correspondences, and in interacting with various information systems. Most workforces today are more of teleworkers – they are working behind computers, and some of them perform their jobs virtually over the internet. In addition, tele-conferences have, to some extent, replaced the traditional face-to-face meetings with computer-mediated telecommunications. Even the management, control and auditing of the teleworkers are by the teleworker managers and through tele-conferences, with the supportive data analytics tools to help monitor the job performance and productivities.

Futurists and optimists in technology may argue that typing is a skill that will lose its needs and appeals down the road as other input technology could replace typing. However, typing should remain as a main input method for computation and it can be used in coordination with other input techniques, such as speech recognition. Even with speech recognition with the support of artificial intelligence being on the horizon, there is still a need for human users of computation to type data and information into the computation systems. First of all, speech recognition software is still not mature enough to have high accuracy that does not require corrections. Secondly, not all computation scenarios are fit with inputs through speech recognition. For instance, software coding has strong syntax requirements; a comma would have mean differently than a semicolon in a program. It may be easier and faster to do speech recognition for certain words and sentences used in daily lives. It is not easier or faster to do speech recognition for software coding when the syntax often involves special characters that are not used in daily lives. Hence, inputs through typing have better precisions, situational awareness, and flexibilities than other seemingly more modern techniques.

For instance, the present auto-correction software is mostly non-textual, which means that the auto-correction is often made that actually changes the meaning of the original intent. Then the user has to proof-read and re-correct the auto-correction. Typing is then needed to delete the wrong auto-correction and to input the re-correction. Auto-correction is helpful to improve the accuracy to some extent, but only at the data level, not at the information, i.e., the context level.

In comparison, auto-fill with suggested words and sentence structure is more context aware and definitely helps reduce the need of typing and improve the typing speed and accuracy. However, auto-fill is still an

evolving technology, not all the typing needs can be addressed such as in the above mentioned programming scenario where special characters may be needed in the syntax or mathematical symbols in Greek or Latin forms are needed to be input. Auto-fill has some context awareness but not for all scenarios. Typing, on the other hand, has the human intelligence behind it, and is much more versatile and flexible.In another example, even with the advanced techniques in authentication in cybersecurity, such as biometrics authentication with finger prints/iris reading or private-key authentication with a string of non-readable characters or as a small file, passwords remain as the most used form of authentication where typing is needed for inputting the passwords. Even the enhanced version of password authentication with two factors requires the manual typing of an authentication code sent dynamically in real-time.

Therefore, typing is not going to die out. Even if it may eventually die out when computation becomes so humanistically natural and hands free, it will still take a long time for technologists to develop such a computational system and for users to adopt the use of such a system. In the meanwhile, improving the efficacy in typing competency would still be beneficial in increasing technology productivity. And both the technologists and the users of the invented technologies may learn a technique or two from keyboard masters like the pianists, for the purpose of improving typing speed and accuracy.

This research aims to discuss the advantages of the traditional training in playing on a piano keyboard and how these advantages can help improve typing speed and accuracy, hence productivity.

3. TYPING COMPETENCE AND TRAINING

3.1. Generation gaps in typing competence

Touch typing is a style of typing that muscle memory is trained for the users to type the alphabets without seeing the keyboard itself. However, this is limited to the new generations (e.g., Millennials – born between early 1980s and late 1990s) especially in the last two decades and that is due to school systems implementation of keyboarding lessons curriculum. Most of them now are between the ages of 10s and 30s; which are trained well in keyboard typing. Despite this good training, speed and accuracy of typing still differ significantly among the new generations. For other generations, typing competence varies even more. For groups over the age of 35, there are three groups of users: the first group of users are familiar with the typing techniques such as touch typing, but without systematic training in typing at school; the second group of users are somehow familiar with the keyboard with limited knowledge of the features and short cuts supported by the keyboard but have less typing competence than the first group; and the third group of uses are less familiar with the keyboard and have major difficulty typing fast or manipulating the keyboard keys to make an entry. They do not know how to touch type and they do data entry through looking at the keyboard, finding the keys and then pressing the keys with two fingers typically the index fingers. The last two groups are less tech savvy; they constantly shy away from the use of keyboards in computers and smart devices. Due to their age and work experiences, they are actually more senior and important workforces, however, their non tech-savviness is actually problematic and results in less IT productivity in a techno era like today. But they are not obligated to training in typing as typing proficiency is often required job skill for entry workers but not for senior and experienced ones.

3.2. Limitations in the software-based training of typing

Different keyboard requires different training techniques. The traditional techniques are mostly for the mechanical keyboards, as those used for desktop computers and for the traditional laptops.
Typing competency in touch typing is typically trained through software that provides the feedback on the performance. For instance, keybr.com is a popular online website that offers free training services to improve typing competency. The trainees can focus on a particular set of keys to become familiar with, letters, words, and/or sentences are then generated by the software. The trainees type the exercise. The software indicates what letter, word, or sentence is typed correctly and what is not. In real-time, the word per minute and accuracy measures are provided on the screen. Hence, the trainees can self-reflect on the present typing competency and use these measures as feedback mechanism to help improve the typing competency over time through repeatedly being trained in this manner.

Although the website and other similar typing training software are useful, the improvement in typing competency is accomplished through “practice makes perfect.” It is expected that repetition helps build muscle memory and such re-familiarity over and over again helps the trainees to self-correct the mistakes.

However, there are several fallbacks in this approach. A major issue related to typing training through “direct practicing” without the teachings on “mindfulness in typing” is that trainees may adopt the wrong posture or form when typing with the eagerness of practicing, and such wrong posture or form would easily become muscle memories that later on would be difficult to correct. Studies have shown that typing with the wrong posture or form are associated with musculoskeletal disorders (MSDs) in the upper extremities (Chang, Johnson, Katz, Eisen, & Dennerlein, 2009; Gerr, Monteilh, & Marcus, 2006). Although it is not conclusive whether or not extensive computer use is a cause in carpal tunnel syndrome, hand specialists in occupational therapy have recommend the adoption of right posture and form when typing the keyboard and/or using computer mouse. Incorrect posture such as rolling shoulders forward would shorten neck and shoulder muscles and compress nerves in the neck, which can affect computer users’ wrists, fingers and hands. Repeated and extensive computer use with the incorrect posture may lead to more MSDs in the upper extremities, which subsequently reduce the IT productivity due to non-optimal computer use, sick leaves, and medical costs.

There are other website on typing training that does provide some educational material as to how to type. Typing tutorials on youtube.com would provide some explanations, however, they are mostly about which finger is positioned for which key, etc. These explanations are mostly for mechanical how-to in typing, not at the detailed level of how-to-perform-the best in typing. Some online tutorials and training websites provide some how-to-perform-the best tips, but they are quite brief. For instance, how-to-type.com provides brief guidance on how to position and use hands and fingers in touch typing. It provides brief guidance like

“Your hand should be raised above the keyboard with your fingers curving down to point directly on the keys. This will make it easier for you to move your fingers without moving your hands. Take a moment to properly position your right hand before continuing. It is very important to develop good habits early in your typing practice.”

Guidance exemplified above is useful but not refined enough. It is useful for the beginning trainees, from zero words per minute typing speed to a reasonable forty to fifty words per minute (sufficient speed for digital workforce); but it is not refined enough to improve a teleworker to improve forty to fifty words per minute typing speed to close to one hundred or above one hundred words per minute speed.

4. APPLYING PIANO TECHNIQUES IN TYPING

4.1. Similarities and Differences in Computer Keyboard Typing and Piano Playing

Piano keyboard training requires the use of all ten fingers. While learning the piano keyboard, right from the start, the brain slowly through practice adapts to receiving muscle orders from the hands with each of their movements or functions on the keyboard, which also transmit into saved functions in both the short and long-term memory in the brain. However, as an instrument, the piano is one of the rare instruments that require the use of all five fingers on each hand with almost equal usage of all of the fingers. For instance, a player of a string musical instrument may not use much of his or her left thumb of the holding hand because the left thumb is mostly for holding the instrument in position. The other hand’s playing the instrument is often just for the purpose of holding as well. In computer keyboards, typing mainly requires the use of four fingers except the thumbs that perform the space key strikes when typing.

In training how to play the piano keyboard, the more frequent the practices, the faster the brain recognizes key notes strikes in the piano keyboard. For instance, when learning piano at young age, a player (one of the coauthors here) had no access to a real piano to practice; instead, she drew the piano keyboard keys on the surface of a marble table to use for practice. Every time she needed to practice, she would read the music manuscript first, look at the keys drawn on the marble table, and then train her fingers to position on the right key over and over again without hearing the tones. During that time, she became one of the best students in the music institute despite her inability to hear the tones as she practiced. Once she had access to a real piano, she manifested unique abilities to play without errors. This true event is an example of our human brain abilities to be trained on most difficult tasks such as using all five fingers to play the piano.

Even though a computer keyboard, a virtual keyboard, or even a smart devices keyboards require different use of fingers to manipulate the keyboards, the skills needed to be effective in their use are similar to those required for piano keyboards. For instance, keying on the piano keyboard is a result of training the human eyes, the brain, and the muscles to correspond together in order to perform a key strike without looking; just as required in typing on a computer keyboard. However, there are some differences as well. When typing on a computer keyboard, the user mainly uses only all the fingers except for the thumbs which are trained to only press the space key. On the other hand, in a smart phone device, the thumb acts as the primary tool for typing, while the other fingers serve only as holding the device. Another difference is that learning the piano keyboard requires good memory and speed. Playing the piano keys do not follow a mutual speed and require agility. One technique in learning the piano keyboard depends on the variation of speed in the notes; some music sentences are faster, and others are slower within the same song or practice piece. Meaning that the brain gets trained on responding to the eyes' muscle recognition of the speed required, then the brain sends a message to the muscles in the hands to move slower or faster. This technique is not recognized in the computer keyboard training, nor in the any other technical keyboards. This training gives a pianist an ability without prior planning to respond to the brain messages on striking the correct piano key note at the right time. In technology related keyboards, users type usually using the same pace after becoming familiar with a certain way in typing. However, the speed and the recognition of what keyboard key to manipulate at what time is not something everyone is capable of. Additionally, the piano player learns to strike different keys in different positions on the keyboard using multiple fingers at the same time. In computer keyboards, a person types using one figure at a time, leaving speed as the most important factor that identifies a good typist.

When applying the piano keyboard training techniques to typing could result in better neuro recognition of the computer keyboard keys and faster typing. The individual mentioned in the previous section ended up learning typing a lot faster than a normal individual who did not play the piano instrument. On the other hand, this piano player also types about one hundred twenty (120) words per minute. This is because the brain is familiar with striking many piano key notes at the same time and in faster fashion too. Once the brain is familiar with that, the brain's recognizes the computer keyboard keys' positions a lot faster. Since the computer keyboard typing depends on typing only one key at a time, it is easier to do.

The only difficulty (called "difficulty" by a piano player not by a technologist!) that arises is that the thumb is not utilized as an important finger in the typing on the computer keyboard. It takes some time to train the brain and the muscles on not using the thumbs for typing, but only to hit the space key on the keyboard. It is an important function in keyboard typing, although not needed for typing the letters keys. However, muscle pauses in typing on a keyboard happens when hitting the space key. During that time, the muscles wait for further instructions from the brain on the next strikes to make to type a word. In piano, this issue does not exist. The key notes strikes are continuous in an un-sequential fashion, making brain training much more meticulous and detailed accompanied with speed recognition.

4.3. Applying piano keyboard techniques in typing

The following basic piano keyboard techniques may provide techniques for typing. These techniques are related to mindful typing practices with more contextual awareness than the traditional mechanical how-to guidance in traditional training in typing.

4.3.1 Fingers low and close to keyboard

One generally accepted principle of piano technique, with adherents across various national schools of technique, states that efficiency of energy, speed of execution, is inversely proportional to the distance between the fingertip and the piano key. For example, and equation for accuracy in piano playing generally holds, that accuracy = $1/x^2$, x being distance from between fingertip and key. Thus, accuracy decreases in a non-linear function as the distance between fingertip and keyboard increases. Speed of the initial key attack and the subsequent rebound from the key is greater with closer proximity between finger and key due to the shortened journey from the starting point to destination. Inertia is more easily overcome, saving energy, when distances following a change of direction are decreased.

Related to the question of orientation to the piano keyboard, the body, specifically the torso should be also centered at the piano, the navel area in alignment with C4, approximately. Optimal orientation of body to the keyboard results in ideal muscular usage, as opposed to musculature strain following heavy in contorted, asymmetric positions. It may benefit mechanical keyboard typists to exercise awareness with respect to their bodily orientation at the keyboard, following in the example of pianists. In piano, the distance between the body and keyboard is specific. The position of the arms have to be in an “L” shape and loosely dangling in front of the rib cage to circumvent unnecessary strain on the upper trapezius muscles, as well as to allow freedom of movement across the keyboard. Similarly, this technique is also required when using the computer keyboard. The position allows the arms to support the muscles when operating the fingers while moving up and down the keyboard. Hence, similar techniques are utilized for both with the exception of moving further away from the computer away as the case in piano as the keyboard extends both directions beyond the reach from the center of the body position.

4.3.2. Enhance the feedback loop

Piano has a built-in feedback loop that encourages the pressing of the right key with a pleasant sound and discourages the pressing of the wrong key with an off-the-tune sound (in a particular context such as a piece of music). Such a pleasant right sound vs. an off-tune wrong sound creates naturally the reactions in human brains. The reward zone in the brain would be activated when a pleasant right sound is heard and vice versa.

In comparison, the computer keyboard does not really provide such a strong feedback loop with the obvious reward and punishment innate to the human biology. Rather than what the typing training software typically does, which uses different colors indicating right or wrong typing of a character, a software could be redesigned to incorporate more obvious reward and punishment mechanisms innate to the human biology, such as playing a pleasant or off-the-tune sound, like those in a piano music. Even further, multiple sensory mechanisms can be used to stimulate even stronger or more reward and punishment regions of the human brain to provide better reinforcement in training.

4.3.3. Name the mistake and say it out loud

It is a technique to train a beginner pianist to improve the awareness with the keyboard and how his/her mistake can be alerted by naming it out why certain mistake occurs. Is it the pressing of the wrong key? Is it the rushing of tempo that has caused the key mishap? Is it the wrong finger that has been used to press the key even though the key has sounded correctly?

The above piano techniques are just the demonstrations of the basic piano techniques. There are many more basic techniques and plenty of advanced techniques. The key is to the master the basics before moving to the advanced ones.

Typing does not sound to be as fun as playing pianos. But typing could be made as fun as playing pianos. If typing training software comes with teachings of basic typing techniques rather than encouraging trainees to directly “dive” into the practice of typing and to be rewarded with a game-like scores, typing training could be more skillful and mindful. The skills built can also be more long-lasting. It would not be lost when not being practiced because both the intellectual understandings and muscle memories have already been built and practiced on.

5. CONCLUSION

The research demonstrates different piano keyboard techniques that may help improve typing speed and accuracy. Learning piano keyboarding techniques can be useful in teaching computer or other keyboarding techniques especially when seeking speed and accuracy. For less technically oriented generations, the skills may be improved with the application of piano keyboarding techniques while training the brain neuro system to correspond and order the muscles to perform specific key strokes. The practice could possibly improve the keyboarding skills from different angles that are not traditionally used in computer keyboarding, such as the blind familiarity with the keys while maintaining speed. The piano keyboarding allows the player to use one or both hands at the same time pressing multiple keyboard keys at the same time. The skill over time orients the neuro system to anticipate the next stroke very fast. A skill like this in computer keyboarding is beneficial; even though not used in the same fashion as the keys on the keyboard are pressed separately. Thus, in many unexpected ways, technologists may benefit from the example of artistic practitioners, achieving improved productivity.

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