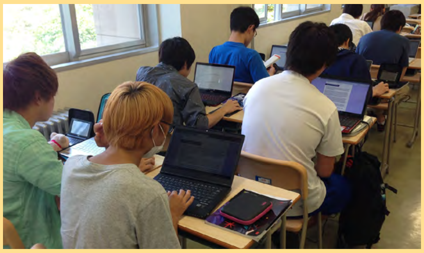
TEACHING with TECHNOLOGY 2020

Selected papers from the JALTCALL2020 Conference

JALTCALL 2020



Edo Forsythe, Editor-in-Chief

Associate Editors: Anthony Brian Gallagher
Douglas Jarrell
Branden Kirchmeyer
Louise Ohashi
James York

ISBN 978-4-901352-63-5

Teaching with Technology 2020
Selected papers from the JALTCALL2020 Conference

JALT CALL is a Special Interest Group (SIG) of the Japan Association for Language Teaching (JALT) that focuses on Computer-Assisted Language Learning (CALL) and technology in language learning.

http://jaltcall.org/

JALT is dedicated to the improvement of language teaching and learning.

JALT Central Office
Urban Edge Bldg. 5F, 1-37-9 Taito,
Taito-ku, Tokyo 110-0016, Japan

http://jalt.org/

First published in Japan in 2021 by the JALT CALL SIG.

Layout by Paul Mason

https://doi.org/10.37546/JALTSIG.CALL2020.6

6

Comparing Writing vs. Smartphone Tapping Speed

Bradford J. Lee, Fukui University of Technology

Abstract

As COVID-19 pushes the world into emergency remote teaching mode, many teachers struggle with designing online or computer-mediated language learning activities due to having little to no prior experience. It is imperative to understand how the use of technology affects not only the processes of learning, but also the outcomes. Particularly in Japan, where smartphone ownership among adults aged 18–34 topped 96% in 2018 (Pew Research Center, 2019), many students use their phones to access their schools' learning management systems (LMS) and complete assignments (i.e., mobile learning). The current study therefore sought to elucidate how different writing media can affect the execution of a simple writing task by examining the differences in transcription speeds between handwriting and 'tapping' on a smartphone. A total of 176 participants were divided into 3 groups (L1-English, writing in English; L1-Japanese, writing in Japanese; and L1-Japanese, writing in English), and their times-on-task were recorded. While no difference was found for the L1-English group, the L1-Japanese groups were found to be significantly faster at one task than the other (tapping in Japanese and writing in English). Pedagogical implications suggest the need for instructors to be aware of the extreme difficulty language learners may have when using mobile devices for writing tasks.

COVID-19が世界を緊急リモートティーチングモードに移行させるにつれ、多くの教師は、オンラインまたはコンピューターを介した言語学習活動の設計においてほとんどまたはまったく経験がないことに苦労しています。テクノロジーの使用が学習のプロセスだけでなく結果にもどのように影響するかを理解することが不可欠です。特に日本では、18歳から34歳の成人のスマートフォンの所有率が2018年に96%を超えたため（Pew Research Center、2019）、多くの生徒がスマートフォンを使用して、学校の学習管理システムや課題（モバイル学習など）にアクセスしています。したがって、現在の研究では、スマートフォンでの「タップ」と手書きの転写速度の違いを調べることにより、さまざまな書き込みメディアが単純な書き込みタスクの実行にどのように影響するかを解明しようとしました。合計176人の参加者を3つのグループ（L1英語、英語で書く、L1日本語、日本語で書く、およびL1日本語、英語で書く）に分けて、作業時間を記録しました。L1-Englishグループの違いは見つかりませんでしたが、L1-Japaneseグループは片っ方が遥かに速かったことがわかりました（日本語ではタップ、英語では手書き）。教育的影響としては、講師がモバイルデバイスを使用してタスクを作成する際に、言語学習者が抱える可能性のある非常に困難に気づく必要があることが挙げられます。

Keywords: **CALL, MALL, m-learning, smartphones, handwriting, tapping, writing tasks**

Mobile learning (m-learning) has represented the next stage in the evolution of computer-mediated language learning, with most apps, websites, and most importantly, university learning management systems (LMS) now having interfaces for both forms of technology. This feature is specifically advertised by LMS providers as offering enhanced convenience for both teachers and students, ostensibly lowering the barrier for classrooms to transition online. This is no doubt in response to trends in global smartphone usage, represented in one survey which reported that 97.9% of users at one university (students and faculty/staff) spent more than 3.5 hours daily on their phones (Berolo et al., 2011). Particularly in Japan, where smartphone ownership among adults aged 18–34 surpassed 96% in 2018 (Pew Research Center, 2019), university students typically have portable Internet-capable devices (e.g., smartphones, tablets) with them in class at all times (e.g., 99.56%; Lee, 2019a). Precursor research, which asked university students if they would choose smartphone- over paper-based submission for English classwork if given the choice, found that 75.56% either said yes, or that they would have no issue against doing so (Lee, 2019a). When asked follow-up questions, such as if they thought using a smartphone would affect their written English production, 40% reported that they didn't think it would make a difference, along with 25.33% who thought that they would probably write *more* if they could compose on their phones (Lee, 2019a).

While the example provided above reflects the sentiment of students given a hypothetical situation, the actual reality of using smartphones for composition in an educational setting has largely been unexplored. In fact, those very same students who reported believing that composing on their smartphone would either make no difference, or allow them to write more, actually produced significantly *less* than their handwriting peers did (Lee, 2019b, 2019c). It should therefore be noted that a high degree of familiarity with smartphone technology should not preclude a careful examination of the cognitive intricacies when using it in a new way (i.e., for compositions of longer length), especially in the case of one's second language (L2). This study therefore set out to answer the following research questions:

1. How does transcription speed differ between handwriting and smartphone tapping for L1 speakers of English and Japanese, writing in their native languages?
2. How does transcription speed differ between handwriting and smartphone tapping for L1 speakers of Japanese, writing in an L2 (e.g., English)?

Review of the Literature

The Importance of Writing Speed/Fluency

Writing is the conversion of ideas and language into a tangible form that can be viewed on a page. Text generation can be conceptualized as necessitating four components: long-term memory (accessed while composing), short-term memory (activated while reviewing), executive functions (e.g., making use of strategies, revising), and the act of transcription itself (e.g., handwriting, keyboarding, or tapping) (Berninger et al., 2002). Of these four, transcription ability is the fundamental skill which needs to be developed, as without it, the other components are impossible. Once mastery of fluent and accurate handwriting is achieved (in addition to competence in spelling), then executive processes for composition writing can develop, which gradually transition to become more self-regulated (Berninger, 1999).

It has also been suggested that these components of writing all draw from the same limited cognitive resources of the writer. Essentially, increased demands by one skill (e.g., transcription), will cause other processes to suffer (i.e., executive control, planning) (Torrance & Galbraith, 2005). This has been demonstrated empirically in several ways. Studies of younger children (i.e., under age 11) have shown that they produce better essays when they dictate them, rather than write them (De La Paz & Graham, 1995), though this trend reverses past this age, as handwriting skills become more automated (Bereiter & Scardamalia, 1987). However, handwriting speed is still linked with overall exam quality into adulthood, with slower handwriting being correlated to lower performance on exam essays (Connelly et al., 2005).

Handwriting vs. Digital Writing

Manual and digital writing have several major differences, both physical and cognitive. Physically, writing by hand makes use of implements such as pencils, which are held in the hand and manipulated using fine-motor control to form letters on the page. Visual sensory feedback, as the writer monitors the written production, is integrated with kinesthetic feedback the writer receives through the tip of the pen to create accurate pressure, timing, and angles of movement (e.g., Mangen & Velay, 2010). Formation of the letters themselves evokes long-term memory as to their standard shape, combined with the writer's own stylistic qualities which make each person's handwriting unique. In addition to penmanship, other paralinguistic features are easily infused into a person's writing (sometimes unconsciously) which can indicate changes in emotive state (e.g., leisurely or hurried writing) or the desire to communicate intimacy or group membership, such as *marumoji* (rounded characters), a style of handwriting developed and used exclusively among young women and schoolgirls in Japan in the 1970s (see Hansen, 2015; Kataoka, 1997; Satake, 1980).

Compared to the nuanced and emotive dimensions of handwriting, digital text entry is merely an exercise in simple memory. There is no graphomotor component as typing/tapping requires only the press of a button; the only difference between irrespective letters is their physical locations on the keyboard and the fingers used to press them. This involves much less muscle activity than writing and does not require fine motor control (Ko et al., 2015). Haptic feedback varies depending on the choice of keyboard and disappears altogether in the case of smartphones which have virtual keypads. (Note that smartphones typically make electronic keyboard clicks to simulate haptics, but these can be eliminated by turning the phone to silent/manner mode.) One key difference with regard to keyboard typing is the separation of the visual and motor spaces, that is, a fluent typist typically watches the letters appear on the monitor while the hands/fingers operate the keyboard out of view. This spatio-temporal separation contrasts with handwriting, where the visual and motor spaces are unified on the tip of the writing implement. In the case of smartphone users, the visual and motor spaces are much closer together, though most users cannot blind type and therefore must look at their fingers while tapping. Typing posture also varies significantly between users, for example, one- vs. two-finger, thumb vs. index finger, right- vs. left-handed, and so forth. (Palin et al., 2019).

In Japan, a special smartphone keyboard has been developed, resembling a 10-key keypad (see Figure 1). Each key represents the top consonant phoneme (i.e., /~a/), with the other phonotactically possible variations (i.e., /~i/, /~u/, /~e/, and /~o/ appearing as a sub-menu in a cross-pattern (see Figure 2), making selection possible with either a tapping or a swiping motion.

Figure 1

Japanese Smartphone (iPhone) Keyboard

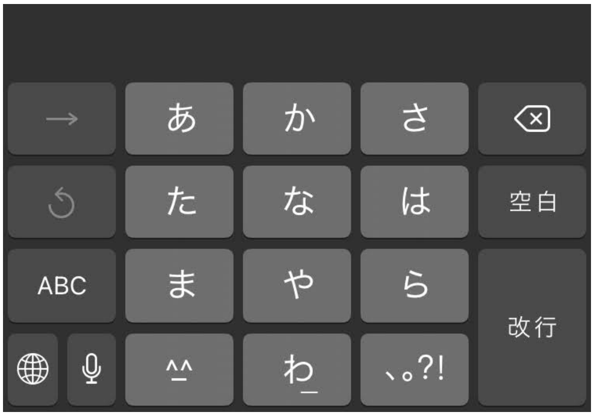
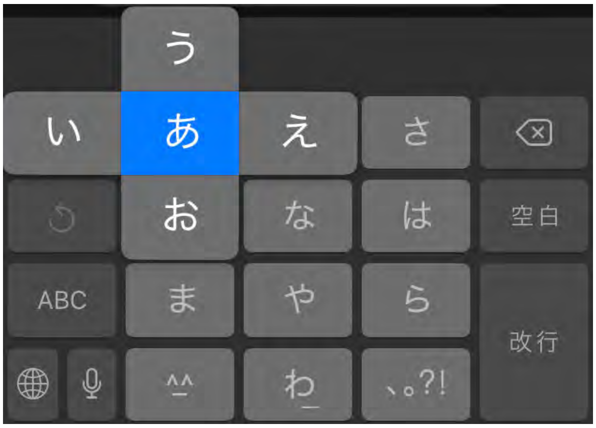


Figure 2

Japanese iPhone Keyboard with Phonotactic Variations Displayed



Unfortunately, while the main topic of this study is smartphone tapping speed, very little work has been done in this area. At the time of this writing, the study by Palin et al. (2019) is the only known large-scale investigation into smartphone tapping proficiency. In their study, they reported an average tapping speed of 36.2 WPM (words per minute) with 2.3% uncorrected errors. However, L1 speakers of English were much faster than speakers of other languages who did not typically type in English (M = 37.8 vs. 25.6, respectively). In addition, while tapping style impacted performance, keyboard typing skills (i.e., touch-typing ability) did not. Support for these findings can be found from an ergonomic perspective, as two-handed typing at chest level has been shown to activate the least muscle activity in the trapezius (the muscles which connect the shoulders and neck) and the fastest typing speed, with the slowest being single-hand thumb tapping (Ko et al., 2015). Interestingly, Palin et al., (2019) suggested that intelligent text entry methods of smartphones affected performance in various ways; autocorrection positively affected speed while word prediction actually hindered it.

Study Design

Participants

The main site for recruitment of the L1 Japanese speakers in the current study was the self-access language learning center of a small, private Japanese university which specializes in engineering and industrial sciences. A total of 144 volunteers agreed to take part, comprised of first-year (n = 39), second-year (n = 61), and third-year (n = 44) students (i.e., 18–21 years of age). The rural location and low number of L1 English residents in the area make for an English as a foreign language (EFL) condition, as students at the university have very few opportunities to use English outside of class. In addition, as this university does not have an English degree program, all participants were majoring in other disciplines and only enroll in English courses to satisfy their basic requirements for graduation. All participants were Japanese nationals with no history of living in any other country.

Each year, students are given an abridged TOEIC® (Test of English for International Communication) Bridge test (only the listening and reading sections), the scores of which are used for class placement. The four class divisions, and their approximate level according to the Common European Framework of Reference for Languages (CEFR) are as follows: High (CEFR-B1 and higher), Medium (CEFR-A2 to B1), Low (CEFR-A2), and Basic (CEFR-A1 and lower). While each participant's English proficiency was not assessed as part of this study, their class affiliations allow for the assumption that they are generally between CEFR-A2 and B1 (High, n = 3; Medium, n = 76; Low, n = 53; Basic, n = 12), though levels are an aggregate of their listening and reading abilities.

The L1 English speakers were recruited electronically through postings on social media sites for English-speaking expatriates living in the same area as the university. All 32 respondents were EFL instructors (age: M = 28.4) who had come to Japan from inner circle countries (see Kachru, 1990) as adults.

Materials and Methods

Currently, among researchers of typing speed/proficiency, there is no standard consensus regarding exactly how measurements should be taken. For example, some researchers count the number of words produced in the first two minutes of writing (e.g., Phelps et al., 1985; Wallen et al., 1996), or the number of times the alphabet can be written in lower- and upper-case in a one-minute span (e.g., Berninger et al., 1991). However, as this study sought to simulate students transcribing a text shown to them in class (akin to notetaking), it was decided that the time would be measured by how long it took for students to reproduce the entire text.

Two original passages were created, one in English (Appendix A) and the other in Japanese (Appendix B). Care was taken in the design of the English passage to ensure that: a) it contained all 26 letters of the alphabet, b) it contained both capital and lowercase, c) it contained numerals, d) it contained several types of punctuation, and e) it was graded at Level 3 of the New General Service List (Browne et al., 2013). These considerations were made to account for the fact that smartphone keyboards hold items such as punctuation, numerals, and uppercase letters on different screens, necessitating extra keystrokes for their input that proficient typists must master. In addition, while the study was one of transcription, not comprehension, it was believed that vocabulary items that were too far outside of the participants' English level may have affected transcription speeds if students struggled to hold new words in their working memories. The use of a transcription exercise versus a free writing one has the advantage of eliminating thinking time which would possibly confound the results (see also Horne et al., 2011).

The English passage was 164 words long, with a direct translation serving as the Japanese passage. The Japanese version consisted of 337 characters, which included all three forms of writing: logographic kanji and syllabic hiragana/katakana. All of the punctuation and numerals were carried over directly to mirror the English version.

Participants from each group were given their respective reading passages on a sheet of A4-sized paper and told that they would be asked to time how long it took for them to transcribe them as quickly and as accurately as possible. The instructions were explicit that the text was to be transcribed exactly as is, including punctuation, spacing, and capitalizations, and if any mistakes were made during the process, they were required to correct them immediately. However, as it was a timed exercise, they were encouraged to proceed as quickly as possible and stop their timers immediately upon completion. Once manual transcription tasks were completed, the smartphone input was collected by way of an online Google Doc which participants opened by scanning a QR code. The instructions were the same as the writing task; all typos had to be immediately corrected and final times were recorded directly onto the Google Doc and submitted along with the tapped text. The order of data collection was counterbalanced so that half of the participants from each group did the smartphone entry first, followed by the handwriting task. All submissions were post-evaluated to ensure accuracy of reproduction; any errors detected were accounted for by adding one second to the reported time for that submission.

Results

Overall Results

All times were converted into seconds and rounded to two decimal places. These figures were then input into a dataset for IBM's Statistical Package for the Social Sciences (SPSS), Version 24. All statistical calculations were performed using this software. Descriptive statistics (*M* and *SD*) were calculated, as reported below (Table 1).

Table 1

Descriptive Statistics of Transcription Times (in seconds)

	Handwriting		Tapping	
Group	***M***	***SD***	***M***	***SD***
L1-E (*n* = 32)	333.31	58.34	367.62	131.12
L1-J (*n* = 74)	419.70	99.29	351.05	108.63
L2-JE (*n* = 70)	492.26	119.83	1104.40	344.38

Note. L1-E: L1 speakers of English; L1-J: L1 speakers of Japanese; L2-JE: L1 speakers of Japanese, transcribing English

As can be seen by the times reported in Table 1, groups L1-E and L2-JE were faster at transcribing their passages by hand (333.31 vs. 367.62 and 492.26 vs. 1104.40, respectively), while group L1-J showed faster times when tapping on their smartphones (419.70 vs. 351.05). Shapiro-Wilk tests for normality revealed that all groups were non-normally distributed (see Table 2).

Table 2

Shapiro-Wilk Normality of Distribution Output

	Handwriting			Tapping		
Group	**Statistic**	***df***	***p***	**Statistic**	***df***	***p***
L1-E	.93*	32	.05	.92*	32	.03
L1-J	.80*	74	< .001	.96*	74	.02
L2-JE	.94*	70	.002	.90*	70	< .001

Note. * indicates rejection of the null hypothesis, i.e., data is non-normally distributed

Despite the results shown in Table 2 indicating that the data were all in a non-normal distribution, it was decided that paired-samples *t*-tests were suitable to compare the differences in means between the handwriting and tapping speeds for each group. Traditionally, parametric tests such as *t*-tests and analysis of variance (ANOVA) assume a normal distribution. However, it has been suggested that these tests are robust enough to be used with non-normal data, especially in the case of large sample sizes (i.e., over $n = 50$), as was the case with the two experimental groups involving Japanese students (see Du et al., 2017; Lix et al., 1996). Statistical significance of the differences in means was therefore assessed by paired-samples *t*-tests, with effect sizes expressed as Cohen's *d* values, shown in Table 3.

Table 3

Output of t-Tests (Comparing Handwriting to Tapping Speeds)

	T	*df*	*p*	*d* [95% *CI*]
L1-E	−1.74	31	.09	.30 [−.06, .65]
L1-J	4.27**	73	< .001	.66 [.32, 1.00]
L2-JE	−15.87**	69	< .001	2.16 [1.67, 2.66]

** denotes significance at the p < .001 level

As can be seen in the output of the *t*-tests in Table 3, the difference between the means for group L1-E was non-significant ($p = .09$), resulting in an effect size of $d = .30$ with 95% confidence intervals (*CI*) falling on both sides of zero. Taken together, this strongly indicates that statistically, there was no difference between the mean times native speakers of English take to write by hand versus by smartphone.

The results for groups L1-J and L2-JE did, however, result in statistically significant differences between means. Both groups had an extremely small p-value (< .001) and effect sizes with both 95% *CI*s above zero. From these results, it can be concluded that members of group L1-J were able to transcribe the Japanese text significantly faster by smartphone to a medium effect size of $d = .66$. Conversely, members of L2-JE transcribed the English text significantly faster manually to an extremely large effect size of $d = 2.16$ (for L2-research field specific interpretations of effect sizes, see Plonsky & Oswald, 2014).

Discussion

The results presented in the previous section were significant for several reasons. First, the finding that transcription speeds of English among L1 speakers were not significantly different between paper and smartphone media was informative and contributes to the scant literature examining smartphone tapping speeds. While there can be no doubt that fluent typists (i.e., on a typewriter/computer) can type faster than a person can write, it seems that this advantage is severely reduced, or disappears entirely, when using a smartphone's keyboard, falling in line with Palin et al.'s (2019) findings. It is reasonable to assume that the smaller size of a smartphone, which reduces the use of all 10 fingers to just one or two, would result in a reduction of typing fluency, though it was surprising that the reduction was so great as to achieve parity with handwriting. However, it should be mentioned that even at the relatively short length of the sample passage (i.e., 164 words for English; 337 characters for Japanese), fatigue of the hand and fingers became an issue as some participants could be observed rubbing or shaking their hands while writing. As this sort of fine-motor control is not utilized in tapping/typing, it is probable that average handwriting speeds would decline over a longer span while tapping speeds would not; future research is needed to confirm this, or at what point a decline in speed begins to occur.

The result that Japanese L1 speakers can tap in Japanese faster than they can write fell in line with predictions. As Japanese is a logographic language which uses multi-stroked characters, a single graph can often be extremely complex, requiring a high degree of dexterity and fine-motor control to write. In comparison, smartphone input in Japanese is done phonetically, in combination with a form of word prediction, resulting in a much faster input requiring significantly less motions. For example, the Japanese word, 鬱 (*utsu* = depression) requires 29 separate strokes of a pen, but only three taps (including selection from a prediction list) to enter on a smartphone. While such an extreme case was not present in the current study, several basic words in the text were over 10 strokes each, including 新, 業, 頑, 損, and 暇, which are 13 stroke characters (see Appendix B).

Finally, the finding that Japanese L1 speakers' transcription speed of L2 English is significantly slower on smartphone when compared to handwriting is a novel finding. As the exercise was one of simple transcription, issues such as lexical familiarity and spelling can be ruled out as a source of the significant speed reduction. The fundamental issue is therefore believed to be one of English keyboard familiarity. This finding departs somewhat from Palin et al.'s (2019) suggestion that touch-typing training did not impact tapping speed. However, as the smartphone version of a Japanese keyboard is entirely different from an English one (see Figures 1 & 2), it would be reasonable to assume that Japanese users may face at least some level of difficulty in acclimating to a different keyboard (although computer keyboards in Japan are in the standard QWERTY layout). A multivariate experiment involving handwriting, smartphone tapping, and computer typing could possibly elucidate whether this is the case, or if the issue lies elsewhere.

This result could also possibly explain the results of precursor research that found that Japanese L1 smartphone tappers produced significantly less text than their handwriting counterparts (Lee, 2019b; 2019c). As tapping appears to take significantly more time, cognitive resources can be argued to be thus diverted from the language task towards the mechanical task of tapping. This would reduce the quality/quantity of prose that could be produced, especially if assuming approximately equivalent lengths of time-on-task (precursor research involved free-writing tasks where students could stop writing at any time).

Pedagogical Implications

Pedagogically speaking, this study has several implications for language classrooms. Precursor research revealed that most Japanese students view smartphone use for completing English writing assignments favorably (Lee, 2019a). This view is supported by the current study which demonstrated that in Japanese, tapping on a smartphone is a significantly faster method of text generation. However, the assumption that the same would hold true for English L2 production would be a serious miscalculation on the students' part. From the language teachers' perspective, based on the finding that the writing medium does not significantly affect writing speed for English L1 speakers, it is possible that instructors will not realize that it makes a significant difference for their students. Instructors (including Japanese L1 instructors of English) need to be cognizant of the confounding variable that writing medium introduces into the performance of an L2 writing task.

Limitations and Future Directions

This study had several methodological limitations, many of which have already been detailed. As the outcome measure of the task was time, the creation of the transcription text had a slight impact on the results. The English text was purposely composed to include features such as capitalizations, numerals, and punctuation; the absence of these features would most likely result in shorter transcription times on the smartphone as they required extra keystrokes. The Japanese text also is slightly dependent on the choice of lexical items, as some Japanese characters are more complicated than others. The inclusion of extremely complex characters would therefore increase the time it takes to manually write them, though this would not affect smartphone input to the same degree. Future studies should experiment with different materials, such as authentic texts, to see if similar patterns can be detected to improve generalizability.

The length of the text, and the way the times were measured are also potential limitations. As mentioned in the Materials and Methods section above, the current study utilized one of many possible methods of determining tapping/writing fluency. As calculations of writing speed vary widely between studies, this somewhat limits generalizations that can be made. However, the materials and methods employed in this case were representative of a typical scenario that students at this university could be expected to face, and therefore meaningful in the current context.

One final consideration is that the participants in the study were aware that they were being timed. They were therefore fully intent on the task and cognizant of the clock, with many writers commenting afterwards that their hands began to cramp, but they persevered on to achieve the best time possible. The results produced here can therefore be thought of as the maximum speed for the respective media. However, as natural production would not take place at such break-neck speeds, it would be informative to measure writing times under more realistic circumstances. While handwriting times would most definitely increase, it would be interesting to see how tapping speeds would be affected.

Conclusion

Smartphone tapping speed is an area that has still yet to be thoroughly investigated. While some studies have sought to measure the various speeds of different tapping styles or body positions (e.g., Ko et al., 2015; Palin et al., 2019), this is the first known study which examined how tapping speed compared to writing speed in participants' L1 versus an L2. To measure writing speeds without confounding variables such as creativity, lexical choice/knowledge, and spelling proficiency, graded passages were created for participants to transcribe, either by hand or by smartphone. The results suggested that there was no difference in speed between the two media for L1 speakers of English. However, L1 speakers of Japanese were found to be significantly faster at tapping by smartphone. It is believed that despite the complexity of the Japanese writing system, the ease of digital entry (using a phonetic system along with a specialized smartphone keyboard layout) contributed to this speed advantage. Most importantly, it was found that this trend was reversed when L1 speakers of Japanese wrote in L2 English. When writing in English, Japanese participants were significantly slower tapping on their phones, to a very large effect size (d = 2.16). This study hopes to elucidate potential problem areas for language instructors to consider while creating lessons and assessments during online learning.

References

Bereiter, C., & Scardamalia, M. (1987). *Psychology of written composition*. Erlbaum.

Berninger, V.W. (1999). Coordinating transcription and text generation in working memory during composing: Automatic and constructive processes. *Learning Disability Quarterly, 22*(2), 99–112. **https://doi.org/10.2307%2F1511269**

Berninger, V. W., Mizoikowa, D.T., & Bragg, R. (1991). Scientific practitioner: Theory-based diagnosis and remediation of writing disabilities. *Journal of School Psychology, 29*(1), 57–59. **http://doi.org/10.1016/0022-4405(91)90016-K**

Berninger, V., Vaughan, K., Abbott, R., Begay, K., Byrd, K., Curtin, G., Minnich, J., & Graham, S. (2002). Teaching spelling composition alone and together: Implications for the simple view of writing. *Journal of Educational Psychology, 94*(2), 291–304. **https://doi.org/10.1037/0022-0663.94.2.291**

Berolo, S., Wells, R.P., & Amick, B.C. III. (2011). Musculoskeletal symptoms among mobile hand-held device users and their relationship to device use: A preliminary study in a Canadian university population. *Applied Ergonomics, 42*(2), 371–378. **https://doi.org/10.1016/j.apergo.2010.08.010**

Browne, C., Culligan, B., & Phillips, J. (2013). The New General Service List. **http://www.newgeneralservicelist.org/**

Connelly, V., Dockrell, J., & Barnett, J. (2005). The slow handwriting of undergraduate students constrains overall performance in exam essays. *Educational Psychology, 25*(1), 99–107. **https://doi.org/10.1080/0144341042000294912**

De La Paz, S., & Graham, S. (1995). Dictation: Applications to writing for students with learning disabilities. In T. Scruggs & M. Mastropieri (Eds.), *Advances in learning and behavioral disabilities* (pp. 227–247). JAI Press.

Du, H., Zhang, Z., Yuan, K.H. (2017). Power analysis for t-Test with non-normal data and unequal variances. In L.A. van der Ark, M. Wilberg, S.A. Culpepper, J.A. Douglas, & W.C. Wang (Eds.), *Quantitative psychology* (pp. 373–380). Springer: Springer Proceedings in Mathematics & Statistics: Vol. 196. **https://doi.org/10.1007/978-3-319-56294-0_32**

Hansen, K. (2015). Authenticity in Japanese cell phone novel discourse. *US–Japan Women's Journal, 48*(2015), 60–78. **https://doi.org/10.1353/jwj.2015.0004**

Horne, J., Ferrier, J., Singleton, C., & Read, C. (2011). Computerized assessment of handwriting and typing speed. *Educational & Child Psychology, 28*(2), 52–66.

Kachru, B. (1990). World Englishes and applied linguistics. *World Englishes, 9*(1), 3–30. **https://doi.org/10.1111/j.1467-971X.1990.tb00683.x**

Kataoka, K. (1997). Affect and letter writing: Unconventional conventions in casual writing by young Japanese women. *Language in Society, 26*(1), 103–136. **https://doi.org/10.1017/S0047404500019424**

Ko, P-H., Hwang, Y-H., & Liang, H-W. (2015). Influence of smartphone use styles on typing performance and biomechanical exposure. *Ergonomics, 59*(6), 821–828. **https://doi.org/10.1080/00140139.2015.1088075**

Lee, B. (2019a). Japanese tertiary students' access to smartphone and their feelings regarding their use in the EFL classroom. *Memoirs of Fukui University of Technology, 49,* 216–224. **http://hdl.handle.net/10461/29134**

Lee, B. (2019b). A case study of writing task performance: Smartphone input vs. handwriting. *Memoirs of Fukui University of Technology, 49,* 225–231. **http://hdl.handle.net/10461/29135**

Lee, B.J. (2019c). Smartphone tapping vs. handwriting: A comparison of writing medium. *EuroCALL Review, 28*(1), 15–25. **https://doi.org/10.4995/eurocall.2020.12036**

Lix, L.M., Keselman, J.C., & Keselman, H.J. (1996). Consequences of assumption violations revisited: A quantitative review of alternatives to the one-way analysis of variance "F" test. *Review of Educational Research, 66*(4), 579–619. **https://doi.org/10.3102%2F00346543066004579**

Mangen, A., & Velay, J. (2010). Digitizing literacy: Reflections on the haptics of writing. In M.H. Zadeh (Ed.), *Advances in haptics* (pp. 385–401). IntechOpen. **https://doi.org/10.5772/8710**

Palin, K., Feit, A.M., Kim, S., Kristensson, P.O., & Oulasvirta, A. (2019). How do people type on mobile devices? Observations from a study with 37,000 volunteers. In *MobileHCI '19: Proceedings of the 21st international conference on human-computer interaction with mobile devices and services* (pp. 1–12). ACM. **https://doi.org/10.1145/3338286.3340120**

Pew Research Center. (2019). *Spring 2018 Global Attitudes Survey.* [Q.46]. Available from Pew Research Center Website: **https://www.pewresearch.org/global/2019/02/05/smartphone-ownership-is-growing-rapidly-around-the-world-but-not-always-equally/pg_global-technology-use-2018_2019-02-05_0-03/**

Phelps, J., Stempel, L., & Speck, G. (1985). The children's handwriting scale: A new diagnostic tool. *Journal of Educational Research, 79*(1), 46–50. **https://doi.org/10.1080/00220671.1985.10885646**

Plonsky, L., & Oswald, F.L. (2014). How big is "big"? Interpreting effect sizes in L2 research. *Language Learning, 64*(4), 878–912. **https://doi.org/10.1111/lang.12079**

Satake, H. (1980). Wakamono zasshi no kotoba: Shin-genbun itchi-tai (The language of youth magazines: A new form of *genbun itchi*). *Gengo Seikatsu, 343*, 46–52.

Torrance, M. & Galbraith, D. (2005). The processing demands in writing. In C. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research.* Guilford Press.

Wallen, M., Bonney, M., & Lennox, L. (1996). *The Handwriting speed test.* Helios.

Appendix A

Text for Transcription (English)

My New Year's Resolutions for 2020

This year, I made 3 New Year's Resolutions. First, I want to exercise more! Last year, I gained about 5kgs because I was lazy and didn't exercise much. I think I should start weight training and go jogging at least 2 times a week. My goal is to lose 10kgs by December 31st.

Next, I will try hard at my job. I want to take a trip with my family to the United States of America in this Fall. My family has 6 members: me, my mother and father, my sister and brother, and my grandmother. I need to save about 1 million yen!

Finally, I want to keep healthy this year. Last year, I caught influenza in the winter, and I couldn't go to school for a full week. I was quite bored staying home alone, and I missed a lot of work. This year I will eat healthy food and exercise to make my body strong.

Appendix B

Text for Transcription (Japanese)

新年の抱負、2020年！

さぁ、今年はどんな1年になるでしょう？まずは健康を大切にしたいと思っています。去年はずっと運動できず5キロほど太ってしまいましたので今年こそはまじまじと運動したいと思います。毎週少なくとも２回ジョギングすることと筋トレを励みたいところです。

次は、仕事も頑張りたいです。今年の夏か秋あたりにアメリカへの家族旅行をしたいなぁ～。家族は６人：自分、父、母、お姉ちゃんと弟、そしておばあちゃん。全員を連れて行くとすると、百万円が必要ですね。

最後に、風邪を引かないように気を付けます！去年の冬にインフルエンザをかかって、一週間ずっと学校に行けなかった。暇過ぎて退屈だったし、その分授業に出られなかったので損しました。今年は健康的な食事と体を動かすことで健康を守ります！

Author's Bio

Dr. Bradford J. Lee, Ed.D. is an associate professor in the Organization of Fundamental Education at Fukui University of Technology (Fukui Kogyo Daigaku) in Fukui City, Japan. His main research interests are phonetics/phonology and pronunciation instruction. Motivation, noticing, and writing media have also been explored.