

# **Protocol for the Measurement of the Performance of the TACTUS™ Keyboard in Elementary Schools**

## **OBJECTIVE OF STUDY**

The objective of the study is to measure the improvement in keyboarding speed and accuracy in a group of elementary schools subjects, when the TACTUS™ Keyboard is used in place of a standard keyboard.

## **STUDY DESIGN**

The study consists in imparting touch keyboarding instructions, in accordance with the standard school curriculum, to two groups of students, one of which uses the standard keyboard and the other the TACTUS keyboard. The total number of standard words typed by each subject, in a given period of time, is used as a measure of performance.

The first day, all subjects are asked to complete a Questionnaire. The subjects are then given an Entrance Test, which consists in copying, in whatever typing style the subjects prefer, a given piece of text in a set period of time.

On the basis of the information from the questionnaire and of the result of the entrance test, subjects are assigned to either the Control Group or the Test Group, in a manner that ensures that the two groups are balanced.

After the entrance test is completed, half of the keyboards in the classroom are replaced with TACTUS keyboards. The teacher must ensure that subjects always use the same computer to which they are assigned at the beginning of the study and that no switching takes places during the study.

The study should run until at least 12 hours of touch keyboarding tuition are cumulated. At the end of this period, an Exit Test is administered in the same manner as the entrance test.

The improvement in speed and accuracy is measured for each subject and analysed.

## **ENTRY QUESTIONNAIRE**

The questionnaire is designed to gather information about each subject that can assist with the balancing of the control group and the test group. A suggested questionnaire is attached.

## **SUBJECTS**

Subjects enrolled in the study are the students attending touch keyboarding class. It is recommended that all students in the class participate to the study even though some

subjects may have to be excluded from the results for a specific reason (e.g., manual dexterity considerably below class average).

It is not a requirement of the study that the subjects participating to the study have not received prior touch keyboarding instruction. NOTE: subjects participating to the study cannot be competent touch typists.

### **TEST GROUP AND CONTROL GROUP**

The control group and the test group must be balanced. This is achieved by analysing the entry questionnaires and the results of the entrance test.

Subjects are assigned to either the test group or the control group so that the two groups are balanced in regards to:

- Gender
- Age
- Typing speed at entry
- Manual dexterity<sup>1</sup>
- Computer ownership at home

The task of processing the information from the questionnaires and the entrance tests and assigning each subject to the control group or the test group may take several hours. Therefore keyboarding practice commences with the second lesson.

### **DURATION OF STUDY**

The study should run until a minimum of 12 hours of touch keyboarding tuition is cumulated.

### **COMPUTER ASSIGNMENT**

After assigning the subject to a specific computer, the teacher should make a note of which subject is using which machine and ensure that the same machine is used by each subject for the duration of the study.

### **MEASUREMENT OF KEYBOARDING SPEED AND ACCURACY**

#### Entrance Test

The test consists of copying text from a copy sheet and will last 10 minutes. Subjects start the test at the same time. At the end of the test, subjects move away from their computers to allow a technician to access the computers and save the file on a diskette.

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<sup>1</sup> The Edimburgh Inventory (R. C. Olfied, 1971, Neuropsychologica, 9, 97-113) has been used in keyboarding studies to measure handedness.

Since some subjects may not be familiar with the word processor, a short practice session is conducted with the word processor before the entrance test is administered. The entrance test is conducted immediately after this session.

### Procedure for Administering the Entrance Test

1. Turn ON all computers and launch the word processor (this task is best done prior to class).
2. Tell subjects to type the following keys as you call them:

a [space] s [space] d [space] f [space] j [space] k [space] l [space] ; [enter]

[Repeat this a few times until you see that subjects are comfortable with the keying process]

3. Tell subjects to close the document without saving it and to open a new document.
4. Tell subjects to type their name and then tap the ENTER key twice.
5. Tell subjects NEVER to use the ENTER key again during the test.
6. Distribute the copy sheet.
7. Tell subjects to look at the copy sheet for 1 minute.
8. Tell subjects to copy as much as they can and to correct any errors, as they go, using the BACKSPACE key.
9. Tell subjects to start copying from the test paper when you say “START”.
10. Start the clock and say “START”.
11. When the time is up, stop the clock, say “STOP” and tell subjects to get up from their desks.
12. Save the file. If the word processor used is Microsoft™ Windows the best way to do this is to accept the file name that Windows proposes as this will automatically save the file under the name of each subject.

### Exit Test

The exit test consists of copying text similar to the text used for the entrance test. The test lasts 10 minutes.

### Procedure for Administering the Exit Test

The exit test is administered in the same way as the entrance test with the exception that the word processor practice is omitted.

### Text for Typing Speed Tests

The text for all typing tests should be chosen so that the subjects will be familiar with the words to type but not familiar with the text itself. The passage will contain only lower case letters and semicolons. The test material will not contain titles, paragraph breaks or numbers. The text will be calibrated against the frequency of letters as they appear in the English language (Donald Milliken, Elementary Cryptography and Cryptanalysis, 1942 in U.S. Patent 5,718,590).

The passage will be typewritten on plain white paper in Courier size 16 and will be organised in lines each containing 40-50 characters per line. The total text will comprise approximately 50 standard words. A typical text for the typing test is attached.

### Measurement of Typing Speed

The typing speed is calculated as follows:

- a) Open the test file and print it.
- b) Calculate the total number of keystrokes. If the word processor used is Microsoft Word™, this can be done as follows. Delete the name of the subject. Click File/Properties/Statistics and look at the total number of characters (with spaces). Note this number on the test paper. Close the file WITHOUT saving the changes.
- c) Calculate the number of errors (see following paragraph).
- d) Calculate the Error Rate by dividing the total number of errors into the total number of characters keyed. For instance, if the total number of characters keyed is 262 and the total number of errors is 20, the error rate is  $20/262 \times 100 = 7.6\%$ .
- e) Multiply the total number of characters by 100-error rate. This number represents the total number of characters adjusted for accuracy. In the example above this is:  
 $262 \times (100 - 7.6) / 100 = 242$ .
- f) Divide this number by five (to arrive at the number of standard words), then by ten (to arrive at the number of standard words per minute) and then round it to one decimal place. The number thus obtained represents the speed in standard words per minute (wpm) corrected for accuracy. In the example above this is:  $242 / 5 / 10 = 4.8 \text{ wpm}$ .

### Counting of Errors

Errors are marked on the printed copy of the test of each subject and the result noted. The following protocol is used for marking errors (a typical marked-up test paper is attached).

1. Only one error shall be counted in any one word. Any word omitted, inserted, or in any way changed from the test material shall be counted as one error except as specified below.
2. Spaces and punctuation marks are treated as part of the preceding word. Any punctuation mark that is incorrectly made, inserted or omitted or in any manner changed from the test material, shall be counted as one error unless an error has already been counted for the preceding word. Spacing between sentences shall be consistent throughout the document.
3. An error in the test material may be corrected or keyed in as it appears.
4. An error made in the last word keyed in, whether the last word is completed or not, shall be counted.
5. Any irregular line spacing shall be counted as one error, in addition to all other errors in the same line.
6. A change to a different but constant line spacing shall be counted as one error.
7. Each irregularity in the left-hand margin shall be counted as one error.

8. An error in paragraphing shall be counted as one error, in addition to any other errors in that line.
9. A word broken incorrectly at the end of a line shall be counted as one error.
10. Letters transposed in any word shall be counted as one error. Where complete words are transposed, each transposition shall be counted as one error, in addition to any errors in the actual words. Where complete lines are transposed, each transposition shall be counted as two errors, in addition to any errors in the actual words.
11. The omission of a line or a block of three or more consecutive words shall be counted as two errors.
12. The repeating of a line or a block of three or more consecutive words shall be counted as two errors.

## **EQUIPMENT**

### Computer Hardware

The study is performed on PC's equipped with TACTUS keyboards for the test group and on PC's equipped with a standard QWERTY keyboard for the control group. (Note: "Natural" or "Ergonomic" keyboards are not considered "standard" keyboards for the purpose of this study. Laptops cannot be used for the study). The TACTUS keyboards are installed after the subjects have completed the entrance test and are left in place for the duration of the study.

### Word Processing Software

Any word processor can be used. If the word processor is Windows™ Word, it is recommended that it is standardized as follows:

- Line Spacing: 1.5
- Alignment: LEFT
- Hyphenation: OFF
- Zoom: 150%
- Switches (in the View/Toolbars menu): all OFF

### Touch Keyboarding Program

Any touch keyboarding program can be used. However, learning to type with the TACTUS Keyboard is greatly facilitated if, prior to starting on the touch keyboarding program, the subjects become familiar with the ridges on the keyboard. A method to achieve this is described in the TACTUS web site at ([www.tactuskeyboard.com/schools\\_kids\\_exercise\\_1.htm](http://www.tactuskeyboard.com/schools_kids_exercise_1.htm)). The exercise must be carried out by both the test group and the control group.

## **ATTENDANCE OF SUBJECTS TO STUDY**

It is possible that some subjects may not be able to attend all classes. Because this will affect the results, the researcher should note in a log the attendance for each subject. If a

subject misses more than 20% of the classes, the subject should be excluded from the computation of the results.

### **KEYBOARD PRACTICE OUTSIDE THE STUDY**

It is possible that some students will practice keyboarding at home. To take into account practice done outside the class, the researcher should keep track of the approximate hours of practice logged on by each subject. To obtain this information, the researcher should ask each subject, at the beginning of each lesson, how many hours of practice the subject has accumulated since the prior lesson and enter this number in the study log. Subjects with outside hours of practice 20% or more above or below the class average, should be excluded from the computation of results.

### **EXPECTED RESULTS**

The simplest way to evaluate the results of the study is to apply the “t-Test” to the increases in words per minute of the test group and the control group. A study which starts with a total of 24 subjects is likely to yield 9-11 subjects in each the control group and the test group. This number is too small to produce statistically meaningful results. Therefore the study should be repeated until at least 25 subjects in each group are cumulated.