RESEARCH

DIFFERENCES IN STUDENT PERFORMANCE

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Learning CW is often described as a journey. For some students, the journey is relatively quick and pleasant. For others, the journey can be long and arduous. A great deal of study has gone into understanding and predicting the differences. The determinant factors responsible for the differences in student performance are aptitude, the distribution and quality of practice, and the degree of motivation.

The same could be said of other pursuits from academics to athletics, but rarely does aptitude play such a dominant role. According to Taylor,[1] individuals vary greatly in their ability to learn the code. Many do not possess the necessary aptitude. Of the men entering schools of radiotelegraphy from 3Ø to 6Ø percent fail to become proficient operators.

In 1968, the US Army[2] reported a broad range in student performance. On average, it took 55 hours of study to achieve proficiency at 12 WPM. Fast learners achieved proficiency in 18 hours and slow learners took up to 11Ø hours.

PREDICTING APTITUDE:

The most accurate predictor of aptitude and student performance is the speed with which a student learns their initial 4 to 5 characters.

The 1919 Thurstone[3] report is the first known study of the diagnostic value of mental tests for predicting ability to learn telegraphy. The 165 men tested had been drafted into the Army from varied backgrounds including

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[1] Taylor, D. W. (1943). Learning Telegraphic Code. Psychological Bulletin, 4Ø(7), 461- 487.
[2] Department of the Army (1968). Technical Manual No. 11-459.
[3] Thurstone, L. L. (1919). The learning curve equation. Psychological Monographs, 26(3), i–51.
[4] Lipmann, *op. cit.*

mechanical and electrical trades, building and steel trades, engineers, chemists, salesmen, and bookkeepers. The range in age was 21 to 31. Thurstone concluded there was no occupational differentiation in the ability to learn telegraphy and age has no diagnostic value in predicting ability in telegraphy within the age limits of 21 and 31.

The level of education was equally varied ranging from high school dropouts to college graduates. Thurstone concluded ability in telegraphy cannot be predicted on the basis of general schooling: "*The fact that years of schooling does not agree with ability to learn telegraphy indicates that this is a special ability."*

Mental tests were given in rhythm, opposites, analogies, Gordon directions, Trabue completion, spelling, arithmetic, and sentence. The rhythm and opposites tests had the highest correlation to ability in telegraphy, but based on the scores, Thurstone concluded: *"The general intelligence tests are not as valuable for diagnosing ability to learn telegraphy as for measuring general intelligence. Ability in telegraphy is probably a special ability."*

In his 1928 article, Lipmann[4] suggested the progress of students over a period of months could be predicted on the basis of the speed with which they initially learned a particular number of characters. To 71 subjects he gave a certain amount of practice in learning five characters. According to Lipmann, the exam consisted of giving the examinee a changing and obscure sequence under experimental circumstances.

In his 1932 report, Koch[4] provided similar findings: "*We were able to determine that those persons who did not learn the recording of 4 characters at a speed of 12 WPM in the first 2 half hours, despite all efforts they were even grouped in a small special course to meet all their difficulties, could never be brought to a mastery of the auditory recording. So we came to the conclusion that we can consider the first 2 half hours of the learning (learning of 4-5 characters) at a speed of 12 WPM as a proficiency test.*"

[4] 5 Koch, *op. cit.*

In 1942, the U.S. Armed Forces[5] implemented the Signal Corps Code Aptitude tests. It was comprised of 78 pairs of patterns of dots and dashes sent at 2Ø WPM. The task of the student was simply to record whether each pair were different or the same.

In his 1943 thesis, Taylor[6] administered the Signal Corps Code Aptitude tests to 59 men and the results indicated the test was unreliable and inadequate for use in personnel selection.

Taylor devised an Initial Learning Test to validate Lipmann and Koch's hypothesis that a valid estimate of a man's ability to learn to receive may be made on the basis of the speed with which he learns the first few characters of the code. The test was designed to provide one measure of the speed with which students learn under controlled conditions eight characters: F, C, 2, 9, period, comma, question mark, and fraction bar. Those particular eight characters were selected only because they are among those usually unknown to beginning students.

Taylor also conducted 11 auditory tests. Those showing the highest correlation with achievement in code were the Seashore tests.

The Seashore Measurements of Musical Talents[7] initially published in 1919, was comprised of six measurements:

(1) Sense of pitch; Pairs of notes differing in frequency; is the second is higher or lower than the first?
(2) Sense of Loudness of Strength; Pairs of notes differing in intensity; is the second stronger or weaker than the first?
(3) Sense of Rhythm; Pairs of rhythmic patterns; are they the same or different?
(4) Sense of Time: Pairs of notes differing in duration; is the second longer or shorter than the first?

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[5] *U.S. Armed Forces Institute Basic Radio Code*. (n.d.). INTERNET ARCHIVE. Retrieved July 5, 2Ø22, from https://archive.org/details/U.S._Armed_Forces_Institute_Basic_Radio_Code_ca1942

[6] Taylor, D. W. (1943). Learning Telegraphic Code. Psychological Bulletin, 4Ø(7), 461- 487.

[7] C. E, Seashore, Manual for Measures of Musical Talent. 1919.

(5) Timbre: Pairs of notes. each of which is made up of the fundamental and first five harmonics, the intensities of the third and fourth harmonics being varied; are the two notes the same or different?

(6) Tonal Memory: Pairs of note sequences. Ten item search of three, four, and five notes; which note is different?

The subjects were 21 professional musicians (11 men and 1Ø women) all members of an acclaimed symphony orchestra. Their scores were compared to a normal population derived from high school and college students whose ages ranged from 11 to 24 years.

The results show the professional musicians were better than the estimate of the normal population in only three tests: pitch discrimination, rhythm, and tonal memory. Those attributes may have the highest correlation to performance in learning code.

Among all the tests given by Taylor, the Initial Learning Test was found to yield the best prediction of eventual achievement in code: "*It is high both in reliability and in validity and is the best test yet developed for use in the selection of men for training in code. Its use in personnel selection may be expected to reduce greatly the proportion of failures among men in training*."