EF SET

EF STANDARD ENGLISH TEST

EFSET PLUS-TOEFL iBT CORRELATION STUDY REPORT

SEPTEMBER 2015

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B1 INTERMEDIATE
Your EFSET PLUS score out of 100 is
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EF 50
EF 49
EF 100

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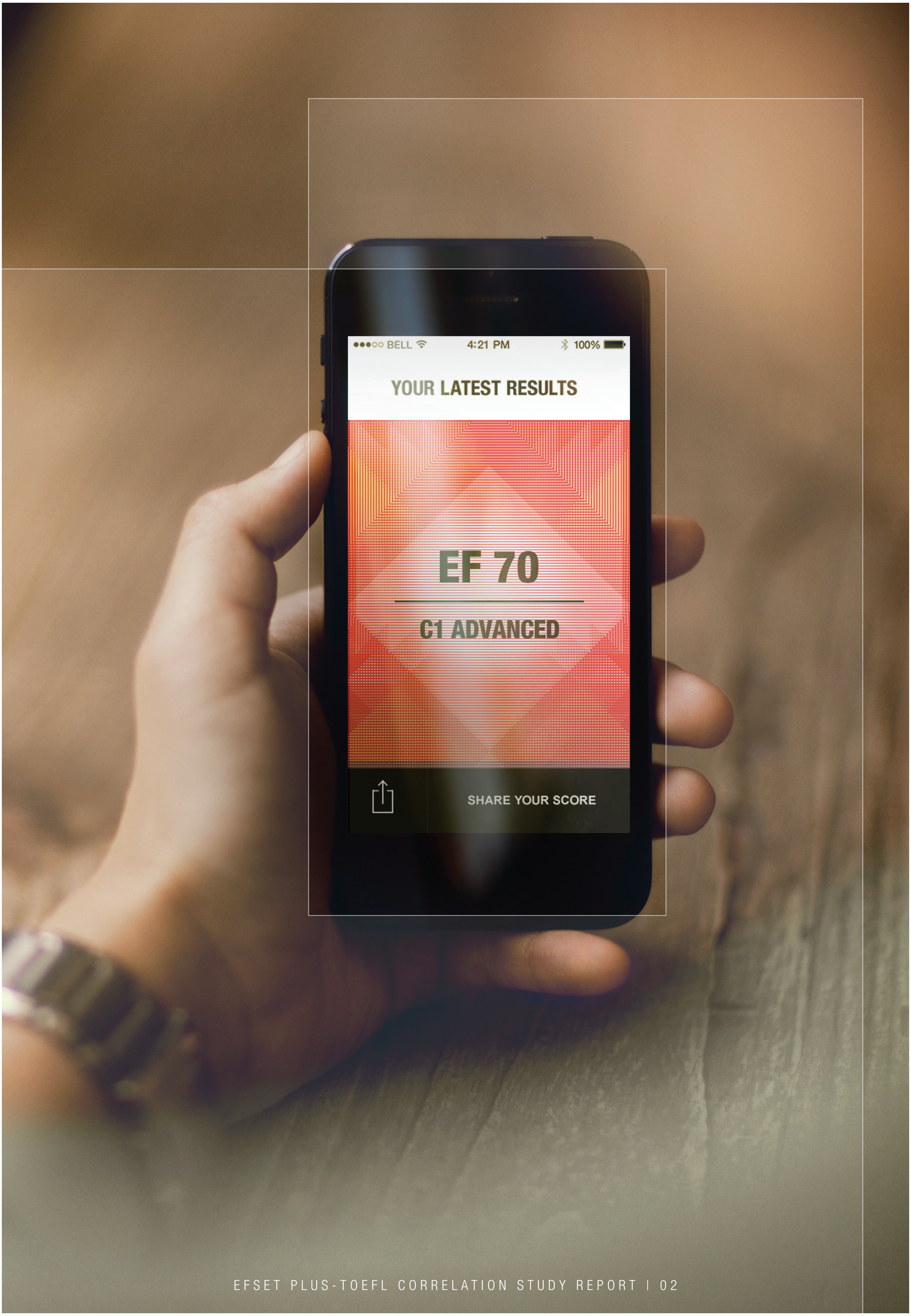
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YOUR LATEST RESULTS
EF 70
C1 ADVANCED
SHARE YOUR SCORE

EXTERNAL VALIDITY OF EF SET PLUS WITH TOEFL iBT

Abstract

This study was carried out to explore the statistical association between EF SET PLUS and TOEFL iBT scores. Three-hundred eighty four volunteer examinees participated in the study. The results suggest moderately strong, positive correlations between EF SET PLUS and TOEFL for both the reading and listening scales and provide solid evidence of convergent validity. The reliabilities for both the EF SET PLUS reading and listening score scales were also very high because of the adaptive nature of the test.

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INTRODUCTION

This report describes a validation study carried out in fall 2014 for the new EF Standard English Test PLUS (EF SET PLUS). This report presents empirical, external validity evidence regarding the relationship between EF SET PLUS proficiency scores and reported Test of English as a Foreign Language (TOEFL iBT™) scores. The TOEFL iBT is an internet-based test of English language proficiency developed and administered by Educational Testing Service. It is generally recognized as one of the premier tests of English language proficiency in the world. The TOEFL iBT version was released for operational use in 2005. Separate TOEFL component scores are reported for each of the four modalities (reading, listening, writing and speaking), each using a score scale ranging from 0 to 30. The composite scale is a simple sum of the component scores.

In contrast, EF SET PLUS is a free, online test designed to provide separate measures of English language reading and listening proficiency. The test is professionally developed and administered online with a computer interface that is standardized across computer platforms. The reading and listening sections of EF SET PLUS are adaptively tailored to each examinee's proficiency, providing an efficient and accurate way of assessing language skills. As an interpretive aid, performance scores on EF SET PLUS are directly aligned with six levels (A1 to C2) of the Council of Europe's *Common European Framework of Reference (CEFR) for languages.* For more information, visit: www.efset.org/english-score/cefr.

In this study, an international sample of non-native English language learners was recruited and screened over a period of months. Three-hundred eighty-four examinees who met the study eligibility requirements were administered both EF SET PLUS reading and listening tests. As part of the eligibility requirements, the examinees were required to upload a digital copy of their TOEFL iBT score report. Their scores on EF SET PLUS and their reported TOEFL listening and reading scores were then analyzed to investigate the degree of statistical correspondence between the tests. The study results confirm that the EF SET PLUS scores are highly reliable across the corresponding reading and listening score scales and maintain reasonable statistical correspondence (convergent validity) with TOEFL reading and listening scores.

This study found that EF SET PLUS scores correlated reasonably well with TOEFL iBT scores—somewhat better with the total TOEFL scores than with the separate reading and listening section scores. This provides fairly solid convergent validity evidence (see Cambell & Fiske, 1959), suggesting that the EF SET PLUS score scales are tapping into some of the same English language skills as TOEFL.

The next section of the paper describes the EF SET PLUS examinations and scoring process. It also describes the participant sample used for the validation study. Analysis and results are covered in the subsequent section.

INTRODUCTION

Description of the EF SET PLUS Tests and Score Scales

Separate reading and listening test forms which were statistically equivalent to the EF SET PLUS were used for this study. This was to ensure that there was no learning effect of the publicly available EF SET PLUS. The EF SET tests employ various types of selected-response item types, including multiple-selection items. A set of items is associated with a specific reading or listening stimulus to comprise a task.
In turn, one or more tasks are assembled as a unit to prescribed statistical and content specifications; these are called modules. The modules can vary in length, depending on the number of items associated with each task. Because of the extra time needed to listen to the task-based aural stimuli, the listening modules tend to have slightly fewer items than the reading modules. In general, the reading modules for this study had from 16 to 24 items. The listening modules each had between 12 and 18 items.
In aggregate, each examinee was administered a three-stage test consisting of one module per stage.

The actual test forms for EF SET and EF SET PLUS are administered using an adaptive framework known as computerized adaptive multistage testing or ca-MST (Luecht & Nungester, 1998; Luecht, 2000; Zenisky, Hambleton & Luecht, 2010; Luecht, 2014a). Ca-MST is a psychometrically powerful and flexible test design that provides each examinee with a test form customized for his or her demonstrated level of language proficiency. For this study, each EF SET examinee was administered a three-stage 1-3-4 ca-MST panel with three levels of difficulty at stage 2 and four levels of difficulty at stage 3 as shown in Figure 1. The panels are self-adapting. Once assigned to an examinee, each panel has internal routing instructions that create a statistically optimal pathway for that examinee through the panel. The statistical optimization of the routing maximizes the precision of every examinee's final score.

As Figure 1 demonstrates, all examinees assigned a particular panel start with the same module at Stage 1 (M1, a medium difficulty module). Based on their performance on the M1 module, they are then routed to either module E2, M2 or D2 at Stage 2. The panel routes the lowest performing examinees to E2 and the highest performing examinees to D2. All others are routed to M2. Combining performance from both Stages 1 and 2, each examinee is then routed to module VE3, ME3, MD3, or VD3 for the final stage of testing. This type of adaptive routing has been demonstrated to significantly improve the precision of the final score estimates compared to a fixed (non-adaptive) test form of comparable length (Luecht & Nungester, 1998). The cut scores used for routing are established when the panel is constructed and statistically optimize the precision of each pathway through the panel.

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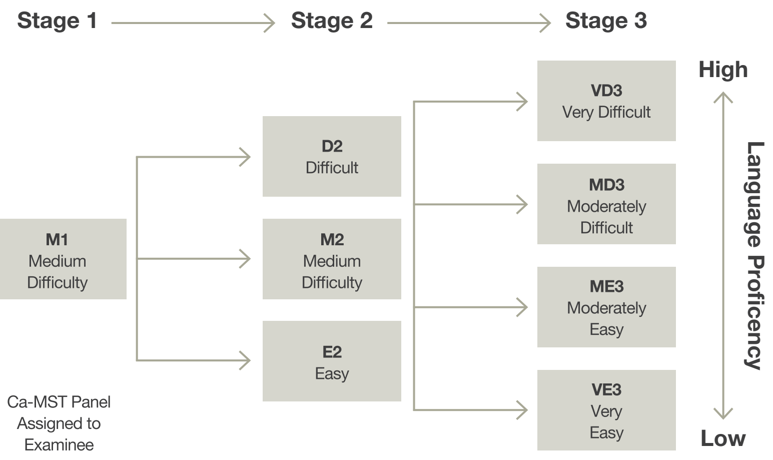

Figure1. An Example of a 1-3-4 ca-MST Panel

All EF SET items are statistically calibrated to the EF reading and listening score scales. The calibration process employs item response theory (IRT) to determine the difficulty of each item relative to all other items. The IRT-calibrated items and tasks for the reading and listening panels used in this study were previously administered to large samples of EF examinees and calibrated using the Rasch calibration software program WINSTEPS (Linacre, 2014). This software is used world-wide for IRT calibrations. The IRT model used for the calibrations is known as the partial-credit model or PCM (Wright & Masters, 1982; Masters, 2010). The partial-credit model can be written as follows:

$$P\left(x = X \middle| \theta; b_i, \mathbf{d}_i\right) \equiv P_{ix}\left(\theta\right) = \frac{\exp\left[\sum_{k=0}^{x} \theta - \left(b_i + d_{ik}\right)\right]}{\sum_{j=0}^{m} \exp\left[\sum_{k=0}^{j} \theta - \left(b_i + d_{ik}\right)\right]}$$

Equation 1

where θ is the examinee's proficiency score, b_i denotes an item difficulty or location for item i, and d_{ik} denotes two or more threshold parameters associated with separations of the category points for items that use three or more score points (k=0,…,xi). All reading items and tasks for the EF Standard Setting (EF SET, 2104 - section 10) were calibrated to one IRT scale, θ_R. All listening items and tasks were calibrated to another IRT scale, θ_L.

Using the calibrated PCM items and tasks, a language proficiency score on either the θ_R or θ_L scale can be readily estimated regardless of whether a particular examinee follows an easier or more difficult route through the panel (i.e. the routes or pathways denoted by the arrows in Figure 1). The differences in module difficulty within each panel are automatically managed by a well-established IRT scoring process known as maximum likelihood estimation (MLE).

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MLE scoring takes the various calibrated item difficulties along each panel route directly into account when estimating each examinee's reading or listening score.

As noted earlier, the EF score scales for reading and listening are aligned to the Council of Europe's Common European Framework of Reference (CEFR) for languages. The CEFR provides a set of conceptual guidelines that describe the expected proficiency of language learners at six levels, A1 to C2 (see Figure 2).

Type of Language User	Level	Code	Description
Basic	Beginner	A1	Understands familiar everyday words, expressions and very basic phrases aimed at the satisfaction of needs of a concrete type
	Elementary	A2	Understands sentences and frequently used expressions (e.g. personal and family information, shopping, local geography, employment)
Independent	Intermediate	B1	Understand the main points of clear, standard input on familiar matters regularly encountered in work, school, leisure, etc.
	Upper Intermediate	B2	Understands main ideas of complex text or speech on both concrete and abstract topics, including technical discussions in field of specialisation
Proficient	Advanced	C1	Understands a wide range of demanding, longer texts, and recognises implicit or nuanced meanings
	Mastery	C2	Understands with ease virtually every form of material read, including abstract or linguistically complex text such as manuals, specialised articles and literary works, and any kind of spoken language, including live broadcasts delivered at native speed

Figure 2. Six CEFR Language Proficiency Levels. Visit www.efset.org/english-score/cefr for more information.

The content validity of the EF SET ca-MST modules and panels is well-established and follows state-of-the-art task and test design principles established by world experts on language and adaptive assessment design. The EF SET Technical Background Report (EF SET, 2014) provides a comprehensive overview of the test development process. It should be noted that the EF SET and EF SET PLUS alignment to the CEFR levels was established through a formal standard-setting process (Luecht, 2014c; EF SET, 2014).

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Validation Study Sample

Examinees were recruited to participate in the online EF validation study. The primary eligibility requirements were: (a) having a valid email address and (b) being able to provide by digital upload an official TOEFL iBT score report showing recent reading and listening scores. “Recent” was operationally defined as having taken the TOEFL iBT modules within the past 18 months. All potential examinees completed a brief survey to establish their eligibility and then uploaded a digital copy of their TOEFL iBT score report. Only eligible candidates were allowed to proceed to the next phase and actually take the EF SET PLUS reading and listening forms. This validation study testing was carried out during fall 2014.

The examinees were administered and completed both an EFSET PLUS reading and listening panel. Every examinee that completed both EFSET PLUS panels within the testing window and whose performance demonstrated reasonable effort[1] was compensated with a voucher for £50. Ultimately, there were 384 participants with complete data[2].

Demographically, the sample was comprised of 197 (51.3%) women and 187 (48.7%) men. Ages of the examinees ranged from 16 to 33 years; the average age was 22.26 with a standard deviation of 1.95 years. Twenty-nine nationalities were represented in this study. The majority of the study participants (227 or 59.1%) listed their nationality as Brazilian. Other relatively high-percentage nationalities listed were China (11.5%), India (7.8%), and Germany (3.6%). The remaining participants were from other Asian countries, as well as various European, African and South American nations. Education and English as a second language (ESL) experience of the sample are jointly summarized in Table 1. In general, the sample was comprised primarily of well-educated, young Brazilian adults with somewhat extensive ESL experience. The gender mix was about equal.

[1] *Examinees who left entire modules blank or who otherwise exhibited an obvious lack of effort were excluded. The application process carefully explained the study participation “rules” to each examinee.*

[2] *One examinee had taken the paper-and-pencil TOEFL, rather than the newer internet version. That individual was excluded from the study.*

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Table 1. Language Experience and Educational Information for the Sample (N=384)

Language Experience	**Frequency**	**Percent**
Less than 1 yr.	11	2.9%
1-3 years	54	14.1%
4-6 years	97	25.3%
7-9 years	88	22.9%
More than 9 yrs.	134	34.9%
Degree	**Frequency**	**Percent**
Did not finish high/secondary school	5	1.3%
High/secondary school	168	43.8%
Further education: some college	70	18.2%
Bachelor’s degree	122	31.8%
Master’s degree	1	0.3%
Other degrees	18	4.7%
Major Area of Study	**Frequency**	**Percent**
Sciences	164	42.7%
Business	33	8.6%
Art and design	29	7.6%
Mathematics	24	6.3%
Social Sciences	16	4.2%
Languages	15	3.9%
Humanities	29	1.3%
Politics	3	0.8%
Electrical engineering	1	0.3%
Geoinformatic systems	1	0.3%
Law	1	0.3%
Missing or other	**92**	**24.0%**

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TOEFL iBT™ scores for the 384 participants are summarized in Table 2. Note that one examinee was missing a valid TOEFL reading score; another was missing a valid TOEFL listening score. Therefore, the counts for the TOEFL components are only $N_R=N_L$=383. On average, the participants in this study would be classified as having "high" TOEFL reading and listening proficiency[3], although the ranges of scores definitely cover reasonable spreads of English language knowledge and skill.

Table 2. Summary of TOEFL Performance

Statistics	Reported TOEFL Score		
	Reading	Listening	Total
Count	383	383	384
Mean	23.167	23.065	89.964
Std. Deviation	4.877	4.959	15.000
Minimum	7	6	34
Maximum	30	30	120

The EF SET PLUS descriptive statistics on the key proficiency-related variables, estimated reliability coefficients, correlations (observed and disattentuated), and some auxiliary performance comparisons between the validation study participants' EF SET PLUS listening and reading scores and TOEFL iBT scores are presented in the next section.

[3] *Based on interpretive irormation published by ETS (www.ets.org/toefl/institutions/scores/interpret/)*

ANALYSIS AND RESULTS

Descriptive statistics for the EF SET PLUS scores are shown in Table 3 for the 384 examinees that participated in this study. The variables "Reading θ_R" and "Listening θ_L" are the two EF SET PLUS proficiency scores. By IRT convention, proficiency scores estimates are often denoted by the Greek letter θ ("theta"). Note that in practice, these IRT scores are rescaled to a more convenient and somewhat more interpretable set of scale values (0 to 100). For various technical statistical reasons, that rescaling was not applied for purposes of this study. Here, it is sufficient to note that the score estimates of θ_R and θ_L can be negative or positive[4], where higher positive numbers denote better language proficiency as measured by the EF SET PLUS ca-MST panels.
Because of the adaptive multistage test design used for EF SET PLUS, the reliabilities of the EF SET PLUS reading and listening scores are excellent and provide accurate measures across the scales.

Table 3. EF SET PPLUS Descriptive Statistics for EF SET PLUS IRT Proficiency Scores (N=384)

Statistics	**Reading** θ_R	**Listening** θ_L
Mean	0.867	1.308
Std. Deviation	0.859	0.856
Minimum	-1.791	-0.930
Maximum	3.123	3.204

As suggested by Table 2 (shown earlier), the sample appeared to be highly proficient in English on average. Table 3 again confirms that finding. Consider that the EF SET PLUS means and standard deviations for extremely large samples of more than 37,000 examinees were, respectively, -0.10 and 1.09 for reading and -0.16 and 1.14 for listening. The implication is that, compared to those very large sample statistics, these 384 study participants were, on average, at the 81st percentile for reading and at the 90th percentile for listening[5].

[4] *The IRT calibration software, WINSTEPS (Linacre, 2014) scales the EF SET PLUS item banks to have a mean item difficulty parameter estimates (scale locations centersozero. The examinees' scores are not centered or otherwise standardized to zero and should not be interpreted as "z-scores" or other normal-curve equivalents.*

[5] *These comparative results are based on normal approximation percentiles, using the large-sample means and standard deviations as reasonable estimates of the population distributional parameters.*

ANALYSIS AND RESULTS

An important benefit of the multistage test design used for EF SET PLUS is evident when considering the impact on score accuracy or *reliability*. The adaptive EF SET PLUS panels (see Figure 1) are specifically designed to provide somewhat more uniform precision ACROSS entire the score scale—providing the best possible precision of the estimates of θ_R and θ_L. It is common to report a score reliability coefficient as an omnibus index of score accuracy—one of the most commonly reported types of reliability coefficient is called Cronbach's α ("alpha",). Cronbach's α provides a somewhat conservative estimate of the average consistency of scores across the scale (Haertel, 2006). Values above 0.9 are considered to be very good. Because of the adaptive nature of the EF SET PLUS panels, traditional reliability coefficients can only be approximated using what is termed a *marginal reliability coefficient*. This type of reliability of coefficient is computed as

$$\rho^2\left(\hat{\theta},\theta\right)=1-\frac{E\left[\sigma^2\left(\hat{\theta}|\theta\right)\right]}{\sigma^2\left(\hat{\theta}\right)}$$

Equation 2

where the numerator of the rightmost term is the average error variance of estimate for the IRT proficiency scores and the denominator of the rightmost term is the variance of the estimated IRT θ scores (Lord & Novick, 1968). Provided that the data fit the IRT model used for calibration and scoring—the PCM in the case of EF SET PLUS—this marginal reliability is usually very comparable to Cronbach's α coefficient. The marginal reliability coefficients for EF SET PLUS are 0.949 for reading and 0.944 for listening, based on samples of more than 37,000 examinees. This implies excellent reliability across the score scale—a direct and entirely expected outcome of using an adaptive multistage testing design. The reliability coefficients are used to adjust the correlations between EF SET PLUS and TOEFL, as discussed below.

Pairwise Pearson product-moment correlations were computed between five score variables: (i) TOEFL iBT reading scores; (ii) TOEFL iBT listening scores; (iii) TOEFL iBT total scores; (iv) EF SET PLUS IRT score estimates for θ_R (reading); and (iv) EF SET PLUS score estimates of θ_L for listening. Correlations denote the degree of statistical linear association between pairs of variables. Values near 1.0 indicate an almost perfect linear relationship between the variable pair. Values near zero indicate almost no linear association and values near –1.0 indicate a nearly perfect inverse relationship (i.e. increasing values on one variable are strongly associated with decreasing values on the second variable). Validity studies such as this often result in "moderate", positive correlations (e.g. 0.4 to 0.7). The product-moment correlations between the observed TOEFL and EF SET PLUS scores are shown in the lower "triangle" of the correlation matrix in Table 4 (i.e. in the unshaded cells below the diagonal of the matrix). There is one correlation for each pairing of the five variables.

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	TOEFL iBT Scores			EFSET PLUS Scores	
Score Variables	**Reading**	**Listening**	**Total**	$\boldsymbol{\theta_R}$	$\boldsymbol{\theta_L}$
TOEFL Reading	**0.85**	0.89	0.98	**0.70**	0.65
TOEFL Listening	0.75	**0.85**	1.00	0.66	**0.77**
TOEFL IBT Total	0.88	0.90	**0.94**	0.66	0.68
EF SET PLUS Reading θ_R	0.63	0.60	0.63	**0.95**	0.76
EFS ET PLUS Reading θ_L	0.58	0.69	0.64	0.72	**0.94**

Table 4. Correlations Between TOEFL and EF SET PLUS Scores
(Disattenuated Correlations Above the Diagonal, Reliability Coefficients on the Diagonal othe Matrix

The correlations in the upper (shaded) section of the matrix in Table 4 are called disattentuated correlations. That is, they estimate the statistical relationships between the five scores if measurement or score estimation errors were eliminated all-together. The disattenuated correlations are computed by dividing each observed product-moment correlation by the square root of the product of the reliability coefficients for each score included in the pairing (Haertel, 2006, p. 85). Because the reliability coefficients for the TOELF iBT and EF SET PLUS scores are all relatively high, the magnitude of increase in the true-score [disattentuated] correlations is not much larger than the observed correlations in the lower section of the matrix. It should be further apparent that the EF SET PLUS reading and listening scores are at a comparable level of reliability to the total (composite) TOEFL iBT scores. The most relevant correlations from a validity perspective are the two disattentuated correlations between the TOEFL iBT reading and estimated EF SET PLUS θ_R scores (0.70) and between the TOEFL listening and estimated EF SET PLUS θ_L scores (0.77). Those correlations suggest a fairly strong, positive linear association between the TOEFL iBT and EF SET PLUS scores.

Figures 3 and 4 respectively show the scatter plots for the observed reading and listening scores. The TOEFL iBT scores are plotted relative to the horizontal axis in each plot. The EF SET PLUS scores are plotted relative to the vertical axis. The best-fitting regression line is also shown for each pair of score variables. It should be apparent that the EF SET PLUS scores are somewhat more variable than the reported TOEFL iBT scores.

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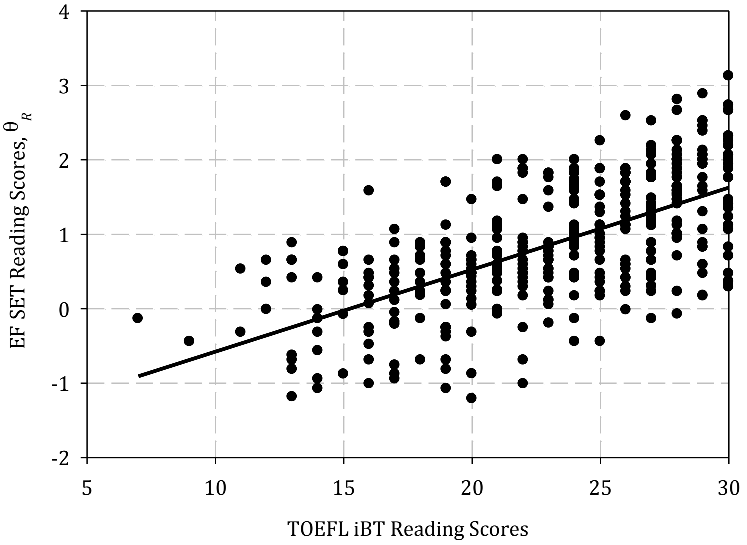

Figure 3. Scatterplot of EF SET PLUS (Vertical) by TOEFL iBT Reading Scores

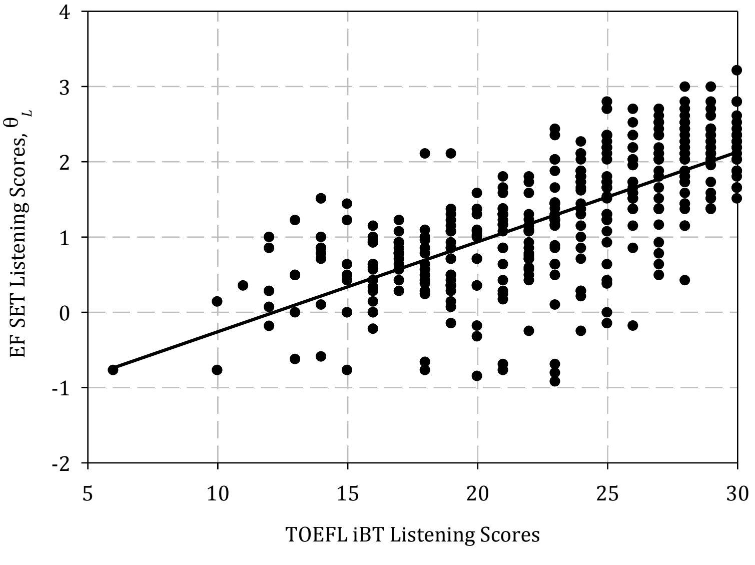

Figure 4. Scatterplot of EF SET PLUS (Vertical) by TOEFL iBT Reading Scores

It would not be realistic to expect perfect correspondence between EF SET PLUS and TOEFL scores. The tests are different but appear to measure some of the same composites of English reading and listening skills. The fact that there are only moderately high, positive, disattentuated correlations between TOEFL and EF SET PLUS scores may be due to a plethora of factors ranging from some restriction of the variation in the scores due to study eligibility requirements to the scaling and rounding of the TOEFL section scores to integer values ranging from 0 to 30. Or, the EF SET PLUS tasks and scales may simply be getting a slightly different constellation of English language traits. In any case, these results provide fairly solid convergent validity evidence.

DISCUSSION

It is important to understand that there are no absolute assessment quality standards for measuring English language proficiency. The Standards for Educational and Psychological Testing (AERA, APA, NCME, 2014) and the International Test Commission Guidelines (ITC, 2008) stress the need for ongoing validity evidence gathering as a responsible measurement practice. In that spirit, test developers do the best they can to provide engaging and fair assessments that yield reasonably reliable and valid scores. TOEFL is a well-known and mature test with a world-wide user base. In contrast, EF SET PLUS is still a relatively new testing program. Both tests produce very accurate scores of reading and listening. Given the adaptive nature of EF SETPLUS, it should not be surprising that its reliabilities for the reading and listening score scales may actually be slightly higher than their TOEFL counterparts and comparable in magnitude to the reliability of TOEFL iBT total scores (see the reliability coefficients in Table 4, for example). None of those results imply that one test is better than the other, however.

Scores on the two tests are definitely related to one another and provide persuasive convergent validity evidence. That is, the correlations reported provide some compelling evidence that TOEFL and EF SET PLUS are “converging” toward measuring common reading and listening proficiency traits. However, the results do not imply that one test is more valid than the other.

Notably, given the moderate, positive correlations reported here, it may seem reasonable to try to establish some type of statistical concordance relationship between the TOEFL and EF SET PLUS score scales. That is, score users might want to have some method of direct translating between the points on the EF SET PLUS and on the TOEFL score scales. At present, there is no policy intent to provide that type of direct statistical alignment between the TOEFL and EF SET PLUS score scales. Given the small sample size in this study and the only moderate positive correlations reported, any statistical concordance would not be psychometrically appropriate[6] and could be misleading.

[6] *Score or classification concordance tables are sometimes created to show the approximate equivalence oscores on two scales that measure similar—but not necessarily the same—constructs. An example would be the well-known concordance between college admissions tests like the ACT Assessment (Act, Inc.and the Scholastic Aptitude Test (SATin the US. Basing concordance on tests with only moderate correlations can lead to misuse othe scores isome users consider the scores to actually be exchangeable. Concorded scores are not exchangeable (Kolen & Brennan, 2014). A policy decision was therefore made NOT to provide concordance information between TOEFL and EF SE T PLUS until additional evidence is gathered.*

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Ric has published numerous articles and book chapters on technical measurement issues. He has been a technical consultant and advisor for many state department of education testing agencies and large-scale testing organizations, including New York, Pennsylvania, Delaware, Georgia, North Carolina, South Carolina, New Jersey, Puerto Rico, The College Board, Educational Testing Service, HUMRRO, the Partnership for Assessment of Readiness for College and Career (PARCC), the National Center and State Collaborative (NCSC), the American Institute of Certified Public Accountants, the National Board on Professional Teaching Standards, Cisco Corporation, the Defense Language Institute, the National Commission on the Certification of Physicians Assistants, and Education First (EF SET).

He has been an active participant previously at the National Council of Measurement in Education (NCME), American Educational Research Association (AERA) and Association of Test Publishers (ATP)meetings, teaching workshops and giving presentations on topics such as assessment engineering and principled assessment design, computer-based testing, multistage testing design and implementation, standard setting, automated test assembly, IRT calibration, scale maintenance and scoring, designing complex performance assessments, diagnostic testing, multidimensional IRT, and language testing.

Before joining UNCG, Ric was the Director for Computerized Adaptive Testing Research and Senior Psychometrician at the National Board of Medical Examiners where he oversaw psychometric processing for the United States Medical Licensing Examination (USMLE) Step and numerous subject examinations, as well being instrumental in the design of systems and technologies for the migration of the United States Medical Licensing Examination programs to computerized delivery. He has also designed software systems and algorithms for large-scale automated test assembly and devised a computerized adaptive multistage testing implementation framework that is used by a number of large-scale testing programs. His most recent work involves the development of a comprehensive framework and associated methodologies for a new approach to large-scale formative assessment design and implementation called assessment engineering (AE).

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