Examining Upper and Lower Case Letter Knowledge with Item Response Theory

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Introduction

Considerable research suggests that alphabet knowledge is the best predictor of children's early literacy skills (Scarborough, 1998) and a key component of emergent literacy (Whitehurst & Lonigan, 1998). In fact a growing body of research shows a strong and likely causal relationship between letter knowledge and children's decoding skills (Adams, 1990; Scarborough, 1998). Research also suggests that children from different cultural and socioeconomic backgrounds demonstrate varying levels of alphabetic knowledge at entry to kindergarten (Lonigan, 2003; Zill & Resnick, 2006). Letter knowledge is typically conceptualized as total number of letters known (i.e. a simple sum score); therefore consideration of interletter differences in children's acquisition of letter knowledge is not taken into account. However, specific letter knowledge does vary in acquisition (Justice, Pence, Bowles, & Wiggins, 2006; McBride-Chang, 1999; Treiman, Cohen, Mulqueeny, Kessler, & Schechtman, 2007), indicating that interletter differences in knowledge should be considered by researchers and educators. Further, very few studies have investigated the interletter differences between upper and lower case letters. More sophisticated measurement techniques, such as those based on Item Response Theory (IRT), allow for a more nuanced and precise understanding of letter knowledge in

explicitly modeling the difficulties of acquiring letter knowledge. The purpose of the present study was to use IRT to further elucidate patterns in children's acquisition of letter knowledge and thus provide insight for alphabetic assessment. This study uses IRT to take advantage of a large sample of preschool children to further explore the developmental complexities of letter name acquisition. These children were part of a larger study that was designed to investigate the effects of regular whole group book reading sessions in preschool classrooms.

This study sought to answer the following four questions: (a) To what extent do the difficulty levels of lower and upper case letters vary?, (b) Do students with similar knowledge perform in similar ways on alphabet knowledge items regardless of gender?, (c) Do students with similar knowledge perform in similar ways on alphabet knowledge items regardless of group membership (i.e. treatment or control)?, and (d) Does item level difficulty for upper and lower case letters remain the same from the beginning to the end of the preschool year?

Methods

Study Description

This study involved a random selection of 551 children from 84 different classrooms located in two states. Data was collected across the 2005-2006 and 2006-2007 academic years. As participants in this study, teachers took part in a 30-week book reading program (Project STAR). The intervention involved two to four whole-class readings per week and was implemented to investigate the effects associated with conducting regular whole-group read alouds in preschool classrooms (for study details see Justice, Kaderavek, Fan, Sofka, & Hunt, 2009). Beginning and end of the year data

collected for the 551 children was utilized in the statistical analyses conducted in this study.

Participants

Of the 84 classrooms utilized in this study, 41% of the classrooms were affiliated with the Head Start program, 45% were state funded and 14% were part of private schools. 45% of the classrooms were located in a mid-Western state (Ohio) and 55% were located in a mid-Atlantic state (Virginia). The majority of classrooms were located in urban areas; although 14% were located in rural areas and 5% were located in suburban areas.

The 551 participating children were randomly selected from their classrooms to participate in ongoing assessments for this study. On average, six children were selected from each classroom. Requirements for eligibility included children who; 1) were between 3 years 6 months and 4 years 11 months upon study entry, 2) did not have an individualized education plan (IEP) for a cognitive social/emotional disability and 3) were able to be tested in English. 366 of the students were part of treatment classrooms and 184 were in control classrooms.

Gender was split evenly in the sample (51% male). The average age of participating children was 4 years, 4 months in the fall (*SD* = 4.6 months). The majority of children enrolled in the study were White, Non-Hispanic (42%, *n* = 229) or African American (37%, *n* = 206), with smaller percentages who were Multiracial (8%, *n* = 45), Hispanic (7%, *n* = 41), or Other (2%, *n* = 13). English was spoken in the home for 97% of the children involved in the study. Well over half (67%) of the children's families reported an annual income of less than $30,000 and only 9% reported an annual income

of over $60,000. Mother's education levels varied; 18% of mother's reported that they had not completed high school, 66% reported that they had received a high school degree, 9% reported receiving a 2-year degree and 7% reported earning a Bachelor's degree or advanced graduate degree.

Measures

In order to assess alphabet knowledge, children were given the *Phonological Awareness Literacy Screening for Preschool* (PALS-PreK) Upper Case Alphabet Recognition subtest (Invernizzi, Sullivan, Meier, & Swank, 2004), and the PALS-PreK Lower Case Alphabet Recognition subtest. The PALS-PreK Upper Case Alphabet Recognition subtest presents children with the 26 individual, upper case letters in random order on a single sheet and asks children to name each letter. The PALS-PreK Lower Case Alphabet Recognition subtest involves the same task with the 26 individual, lower case letters.

Procedures

For the measures of children's alphabet knowledge, children were tested individually in one session, which lasted approximately 10 minutes. The testing occurred over a 6-week period in the beginning of the school year (September) and follow-up testing occurred for another 6-week period at the end of the school year (May). Scoring and procedures set forth in the directions for the standardized assessments were followed.

Statistical Analyses

An IRT analysis was conducted on the dichotomously-scored letter sound data using Winsteps (Linacre, 2009). IRT is a model based measurement in which trait level

estimates depend on both persons' responses and on the properties of items that were administered (Embretson & Reise, 2000). Of particular interest in the current study, IRT provides parameters describing individual item functioning. Items may differ in difficulty or the point along the ability continuum at which examinees have a 50% chance of success in correctly responding to an item. Items may also differ in discrimination or how well the item differentiates examinees' abilities levels. In the present IRT analysis, upper and lower case letter alphabet recognition was the latent trait of interest, and upper and lower case letters comprised the 52 items. The item parameters thus describe the functioning of individual letters as they relate to children's letter naming abilities.

Results

Question 1

In order to address this study's first question regarding interletter difficulty levels for both upper and lower case letters, the fit of a one-parameter logistic model, or Rasch model, was examined. Data from beginning of the year alphabet assessments were used in this analysis. For this beginning of the year assessment, the mean score on the upper case alphabet recognition subtest was 8.69 letters correctly identified (SD = 9.19). For the lower case alphabet recognition subtest, the mean score was 6.66 (SD = 8.06). Upper and lower case letter items constructed one scale for this model, as the fit of the overall model was good when both upper and lower case items were run together. See Table 1 for model summary statistics. It was determined that the items fit the Rasch model well for several reasons. First, the model has a reliability value of .98 indicating that 98% variability among items is due to real item variance. Person reliability was also good, with a value of .89. Chronbach's alpha was .98, again suggesting that reliability measures

indicate that the model fit is good. Second, the model has a separation value of greater than 2 (7.13) which shows that true variability among items is much larger than the amount of error variability. Third, item fit for the model is good as determined by; (a) point measure correlations, and (b) infit and outfit measures. A point measure correlation is the correlation between the observations on an item and the corresponding person measures (Linacre, 2009, p. 253). A point measure correlation below .15 indicates a potentially misfitting item. Point measure correlations for this model are acceptable, as all items on the scale have point measure correlations above .15. Infit and outfit measures were also acceptable for all measures. Infit 'is a t standardized information-weighted mean square statistic, which is more sensitive to unexpected behavior affecting responses to items near the person's measure level' (Linacre, 2009, p.252). Outfit 'is a t standardized outlier-sensitive mean square fit statistic, more sensitive to unexpected behavior by persons on items far from the person's measure level' (Linacre, 2009, p.252). Infit and outfit values of less than 2 are considered acceptable. Infit measures for all items on this scale are less than 2 and therefore acceptable. Most outfit measures for items on the scale are less than 2 as well. Only, two items (lower case 'l' and lower case 'd') have outfit values larger than 2. However, these two items are also difficult (item measure values of 2.36 and 2.21 respectively) which could account for the high output values. Finally, the overall chi-square test for this model is non-significant indicating that the Rasch model fits these items well, χ^2 (21,253, N = 551) = 14,332.15, p =1.0.

To determine variability in upper and lower case item letter difficulty, item measure values were investigated. See Table 2 for the item/person map for this model. Results showed that the most difficult items (i.e., those items with the largest item

measures) were all lower case letters (e.g., lower case ‘q’, ‘g’, ‘t’, and ‘d’ all had item measure values greater than 2). The least difficult items (i.e., those items with the smallest item measures) were mostly upper case letters (e.g., upper case ‘b’, ‘x’, and ‘o’ all had item measure values less than -2). Therefore, in general, upper case letters were less difficult than lower case letters. However, some lower case letters were in fact easier than upper case letters (e.g.., lower case ‘o’ and ‘x’). Interestingly, these letters were the least difficult upper case letters as well; suggesting that it was specific letter characteristics that contributed to item difficulty in terms of both upper and lower case forms. It may be that ‘x’ and ‘o’ were less difficult in upper and lower case forms because their basic visual characteristics stay constant across both upper and lower cases. Additionally, their forms may be familiar to most preschool children and thus easier to remember. Among the most difficult upper case letters were upper case ‘V’ and upper case ‘U’ (item measure values of .78 and .63 respectively). It could be that these upper case letters were the most difficult for this sample of preschool children because of their relative infrequency in words children are often exposed to.

Question 2

To ascertain whether or not item calibrations for upper and lower case letters were differential based upon gender, a differential item functioning (DIF) analysis was conducted. DIF analysis is an examination of sample-invariant calibration when it is defined as item performance differences between persons with equivalent locations on the latent variable (Engelhard, 2009). Therefore, DIF analysis provides information on whether or not an item functions differently for one group of individuals relative to another group while holding overall proficiency level (theta) constant. Data from

beginning of the year alphabet assessments were also used in this portion of the analyses. The mean alphabet knowledge score (sum of upper and lower case alphabet recognition subtests) was 14.52 (*SD* = 16.08) for females and 15.02 (*SD* = 17.51) for males. In order to determine items that were significantly different based upon gender, individual item t-values were examined. To control for family wise error, a Bonferroni correction was used to establish alpha. Therefore, each of the individual tests were evaluated at a significance level of (α/n). Using an overall alpha level of .15, a corrected level of .003 was calculated (.15/52). Both Welch's and Mantel Haenszel t-test results revealed no significant differences between males and females, as all t-tests were non-significant at the .003 level. See Table 3 for the Item DIF table for gender. Therefore, it appears that gender differences in letter name recognition knowledge are not present for this sample of students.

Question 3

An additional DIF analysis was conducted to answer the third question regarding whether or not students with similar ability levels performed the same on alphabet knowledge items regardless of group membership (i.e., control or treatment). For this set of analyses, data from the end of the year was utilized. The mean alphabet knowledge score (sum of upper and lower case alphabet recognition subtests) was 32.28 (*SD* = 18.73) for the control group and 31.59 (*SD* = 17.87) for the treatment group. The overall fit of this model was determined to be good for the following reasons; the separation value is above 2 (7.05 for this model), the item reliability value is above .8 (.98 for this model), the person reliability level is .93, Chronbach's alpha is .98, and the overall Chi-square is non-significant (χ^2 = 14754.92, df =20858, p=1.0). Additionally, most items

have output measures below 2 and acceptable point measure correlations (i.e., point measure correlations above .15). See Table 4 for summary statistics for this model.

In order to determine items that were significantly different based upon treatment group, individual item t-values were examined. Again, to control for family wise error, a Bonferonni correction was conducted and a .003 alpha level was utilized. Both Welch's and Mantel Haenszel t-test results revealed no significant differences between groups. All t-tests were non-significant at the .003 level. See Table 5 for the Item DIF table for group membership. Thus, students in both treatment and control groups with similar ability levels performed the same on alphabet recognition items, suggesting that the treatment did not effect performance on this alphabet recognition assessment. These results are not surprising, as this intervention was not specifically designed to target children's alphabet knowledge.

Question 4

To address the fourth question regarding the stability of item level difficulty for upper and lower case letters from the beginning to the end of the preschool year, an IRT analysis was conducted using end of the year data with fall scores anchored. Two separate models were utilized; one model for end of the year upper case alphabet recognition and another for end of the year lower case alphabet recognition. Both of the models were found to be good-fitting. First, the overall fit of the end of the year upper case recognition model was determined to be acceptable for the following reasons; the separation value is above 2 (4.9 for this model), the item reliability value is above .8 (.96 for this model), the person reliability level is .83, Chronbach's alpha is .97, and the overall Chi-square is non-significant (χ^2 = 6,633.1, df =7,824, p=1.0). Additionally, most

items have output measures below 2 and acceptable point measure correlations (i.e. point measure correlations above .15). See Table 6 for summary statistics for this model. Second, the overall fit of the spring lower case recognition model was determined to be good for the following reasons; the separation value is above 2 (7.75 for this model), the item reliability value is above .8 (.96 for this model), the person reliability level is .89, Chronbach's alpha is .97, and the overall Chi-square is non-significant (χ^2 = 7,478.6, df =9,450, p=1.0). Additionally, most items have output measures below 2 and acceptable point measure correlations (i.e., point measure correlations above .15). See Table 7 for summary statistics for this model.

In order to determine the stability of item level difficulty from fall to spring for these two models, item displacement values were examined (See Table 8 for upper case letter displacement values and Table 9 for lower case letter displacement values). Results showed that item level difficulty for both upper and lower case letters did not change substantially for most items from fall to spring. Therefore, in general, items that were difficult for students in the fall remained difficult for students in the spring. In order to determine if displacement values were significantly different the following equation was utilized to calculate a t-value:

$$\text{displacement value} / \sqrt{(\text{s.e.}^2 * 2)}$$

The only upper case letter displacement values that produced a t-value greater than 2 were upper case 'B' and upper case 'Y' with t-values of 2.76 and -2 respectively. Upper case 'B' became significantly more difficult over time; whereas upper case 'Y' became less difficult. In terms of lower case letters, only lower case 'b' and lower case 'l' changed significantly with calculated t-values of 2.07 and -2 respectively. Lower case 'l'

became significantly easier over time. Interestingly, lower case ‘b’ became more difficult. As both upper case ‘B’ and lower case ‘b’ became more difficult, it could be hypothesized that these letters were becoming more confusing for preschool students over time. One explanation could be that the letter ‘b’ was being confused for ‘d’ as these letter forms are very similar.

Conclusion

Findings from this study contribute to the growing body of research exploring the nature of alphabet learning in young children, and have implications for both assessment and instructional practice. Given the results of this study that the difficulty levels of upper and lower case letters do vary, screening measures might target selected letters representing the full ability continuum. Alphabet assessments might differentially weight individual letters to best characterize children’s abilities. This and future studies could enable teachers to better tailor alphabet instruction to students’ needs. It might also inform teachers’ consideration of the most effective methods for teaching children both upper and lower case letters. Additionally, the fact students with similar knowledge perform in similar ways on alphabet knowledge items regardless of gender suggests that instruction does not need to be tailored based upon gender. This study also found that students with similar knowledge perform in similar ways on alphabet knowledge items regardless of group membership (i.e., treatment or control); which may indicate that interventions that involve whole group read-alouds in the preschool classroom may not impact students’ alphabet recognition knowledge unless this skill is specifically targeted. Finally, the fact that item level difficulty for upper and lower case letters remained generally the same from the beginning to the end of the preschool year suggests that

some letters will require additional instructional attention due to difficulty levels throughout the school year for preschoolers.

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Table 1

Summary Statistics for Beginning of the Year Model (Upper and Lower Case Letters)

SUMMARY OF 525 MEASURED (EXTREME AND NON-EXTREME) PERSONS

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	14.8	49.7	-1.90	.76				
S.D.	16.8	7.4	2.84	.53				
MAX.	52.0	52.0	5.86	1.86				
MIN.	.0	16.0	-5.73	.31				

REAL RMSE	.93	ADJ.SD	2.69	SEPARATION 2.88	PERSON RELIABILITY	.89
MODEL RMSE	.93	ADJ.SD	2.69	SEPARATION 2.90	PERSON RELIABILITY	.89
S.E. OF PERSON MEAN = .12						

PERSON RAW SCORE-TO-MEASURE CORRELATION = .96 (approximate due to missing data)
CRONBACH ALPHA (KR-20) PERSON RAW SCORE RELIABILITY = .98 (approximate due to missing data)

SUMMARY OF 52 MEASURED (NON-EXTREME) ITEMS

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	149.2	502.1	.00	.16	1.00	-.1	1.11	.0
S.D.	49.9	22.5	1.16	.02	.16	1.8	.67	1.5
MAX.	266.0	525.0	2.89	.21	1.59	5.1	4.30	4.2
MIN.	48.0	479.0	-2.28	.13	.71	-3.8	.47	-2.9

REAL RMSE	.16	ADJ.SD	1.15	SEPARATION 7.13	ITEM RELIABILITY	.98
MODEL RMSE	.16	ADJ.SD	1.15	SEPARATION 7.37	ITEM RELIABILITY	.98
S.E. OF ITEM MEAN = .16						

UMEAN=.000 USCALE=1.000
ITEM RAW SCORE-TO-MEASURE CORRELATION = -.99 (approximate due to missing data)
21752 DATA POINTS. LOG-LIKELIHOOD CHI-SQUARE: 14332.15 with 21263 d.f. p=1.0000

Table 2

Item/Person Map for Beginning of the Year Model (Upper and Lower Case Letters)

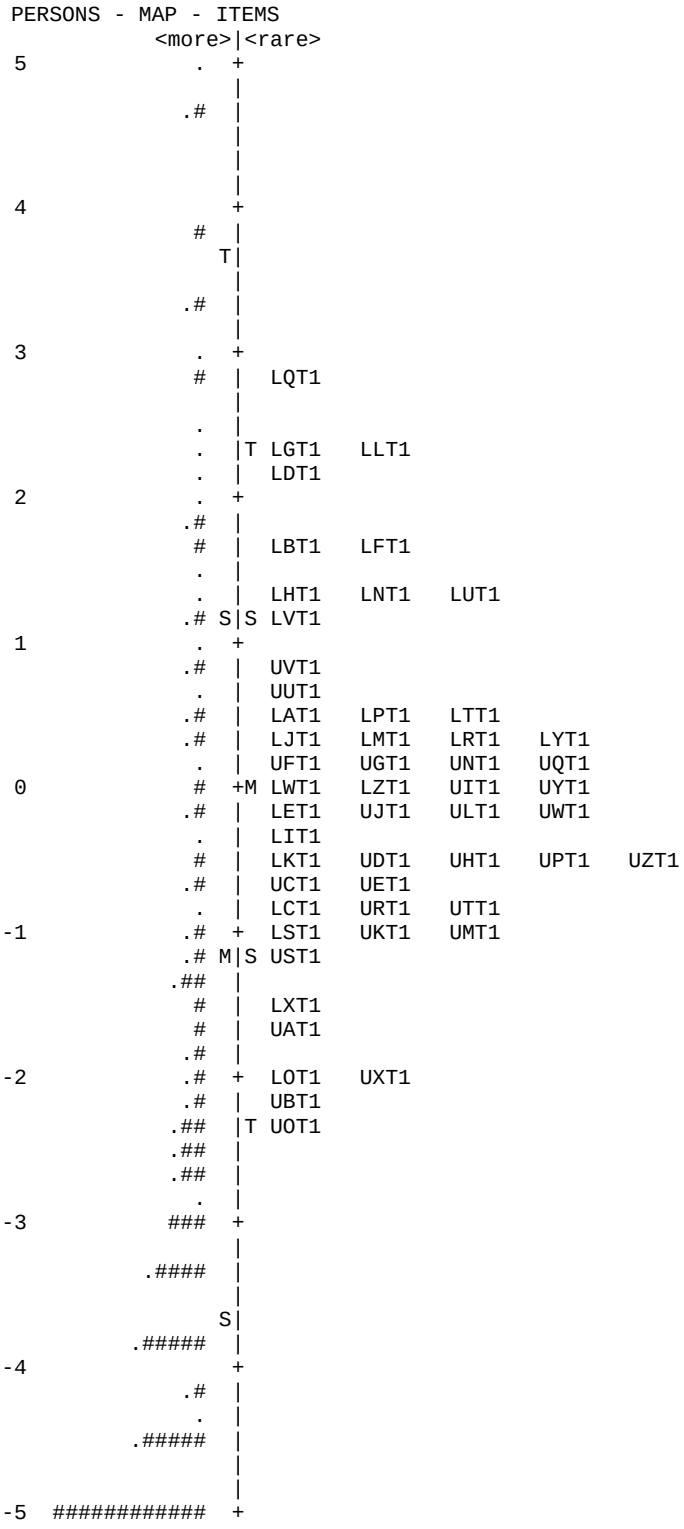

Table 3

Item DIF Table for Gender

PERSON CLASS	DIF MEASURE	DIF S.E.	PERSON CLASS	DIF MEASURE	DIF S.E.	DIF CONTRAST	JOINT S.E.	t	Welch d.f.	Welch Prob.	MantelHanzl Prob.	ITEM Size	ITEM Number	ITEM Name
0	-1.17	.19	1	-.62	.21	-.54	.28	-1.94	434	.0529	.1562	-.13	1	UMT1
1	-.62	.21	0	-1.17	.19	.54	.28	1.94	434	.0529	.1562	.13	1	UMT1
0	.10	.21	1	.16	.22	-.05	.30	-.18	435	.8561	.5834	-.82	2	UGT1
1	.16	.22	0	.10	.21	.05	.30	.18	435	.8561	.5834	.82	2	UGT1
0	-1.27	.18	1	-.97	.21	-.30	.28	-1.09	434	.2760	.1405	.10	3	UST1
1	-.97	.21	0	-1.27	.18	.30	.28	1.09	434	.2760	.1405	-.10	3	UST1
0	.15	.21	1	-.13	.22	.27	.30	.90	435	.3676	.6176	.60	4	UIT1
1	-.13	.22	0	.15	.21	-.27	.30	-.90	435	.3676	.6176	-.60	4	UIT1
0	-2.23	.18	1	-2.08	.19	-.15	.26	-.55	435	.5811	.7129	-.30	5	UBT1
1	-2.08	.19	0	-2.23	.18	.15	.26	.55	435	.5811	.7129	.30	5	UBT1
0	-1.84	.18	1	-2.19	.19	.36	.26	1.34	435	.1794	.0175	.12	6	UXT1
1	-2.19	.19	0	-1.84	.18	-.36	.26	-1.34	435	.1794	.0175	-.12	6	UXT1
0	.06	.21	1	-.49	.21	.55	.30	1.85	435	.0652	.2795	-.47	7	ULT1
1	-.49	.21	0	.06	.21	-.55	.30	-1.85	435	.0652	.2795	.47	7	ULT1
0	.28	.21	1	-.08	.22	.36	.30	1.18	435	.2368	.6326	-.44	8	UQT1
1	-.08	.22	0	.28	.21	-.36	.30	-1.18	435	.2368	.6326	.44	8	UQT1
0	-.59	.19	1	-.45	.21	-.14	.29	-.50	435	.6176	.3872	.45	9	UHT1
1	-.45	.21	0	-.59	.19	.14	.29	.50	435	.6176	.3872	-.45	9	UHT1
0	-.19	.20	1	-.26	.21	.07	.29	.23	435	.8147	.8902	.23	10	UWT1
1	-.26	.21	0	-.19	.20	-.07	.29	-.23	435	.8147	.8902	-.23	10	UWT1
0	-.70	.19	1	-.97	.21	.27	.28	.95	435	.3439	.9276	.09	11	UTT1
1	-.97	.21	0	-.70	.19	-.27	.28	-.95	435	.3439	.9276	-.09	11	UTT1
0	-.63	.19	1	-.93	.21	.30	.28	1.06	435	.2908	.9904	-.06	12	URT1
1	-.93	.21	0	-.63	.19	-.30	.28	-1.06	435	.2908	.9904	.06	12	URT1
0	-.28	.20	1	-.17	.21	-.10	.29	-.35	435	.7231	.4313	.16	13	UJT1
1	-.17	.21	0	-.28	.20	.10	.29	.35	435	.7231	.4313	-.16	13	UJT1
0	-.63	.19	1	-.58	.21	-.05	.29	-.17	435	.8674	.4427	.52	14	UCT1
1	-.58	.21	0	-.63	.19	.05	.29	.17	435	.8674	.4427	-.52	14	UCT1
0	-2.06	.18	1	-2.52	.19	.46	.26	1.75	435	.0812	.0837	.89	15	UOT1
1	-2.52	.19	0	-2.06	.18	-.46	.26	-1.75	435	.0812	.0837	-.89	15	UOT1

	0	.71	.22	1	.85	.23	-.14	.32	-.43	435	.6676	.4701	.32	16 UVT1	
	1	.85	.23	0	.71	.22	.14	.32	.43	435	.6676	.4701	-.32	16 UVT1	
	0	-.32	.20	1	-.62	.21	.31	.29	1.06	435	.2905	.7469	.72	17 UPT1	
	1	-.62	.21	0	-.32	.20	-.31	.29	-1.06	435	.2905	.7469	-.72	17 UPT1	
	0	.24	.21	1	-.03	.22	.27	.30	.88	435	.3780	.4294	.39	18 UFT1	
	1	-.03	.22	0	.24	.21	-.27	.30	-.88	435	.3780	.4294	-.39	18 UFT1	
	0	-.44	.20	1	-.71	.21	.28	.29	.96	435	.3378	.4797	-.17	19 UDT1	
	1	-.71	.21	0	-.44	.20	-.28	.29	-.96	435	.3378	.4797	.17	19 UDT1	
	0	.63	.22	1	.63	.22	.00	.32	.00	435	1.000	.5623	-.29	20 UUT1	
	1	.63	.22	0	.63	.22	.00	.32	.00	435	1.000	.5623	.29	20 UUT1	
	0	-1.80	.18	1	-1.54	.20	-.26	.27	-.98	434	.3298	.6113	-.41	21 UAT1	
	1	-1.54	.20	0	-1.80	.18	.26	.27	.98	434	.3298	.6113	.41	21 UAT1	
	0	-.28	.20	1	.30	.22	-.58	.30	-1.94	434	.0533	.0201	-.49	22 UYT1	
	1	.30	.22	0	-.28	.20	.58	.30	1.94	434	.0533	.0201	.49	22 UYT1	
	0	.37	.22	1	-.03	.22	.41	.31	1.33	435	.1856	.2096	.46	23 UNT1	
	1	-.03	.22	0	.37	.22	-.41	.31	-1.33	435	.1856	.2096	-.46	23 UNT1	
	0	-.51	.20	1	-.40	.21	-.11	.29	-.39	435	.6977	.9937	.20	24 UZT1	
	1	-.40	.21	0	-.51	.20	.11	.29	.39	435	.6977	.9937	-.20	24 UZT1	
	0	-1.31	.18	1	-.80	.21	-.51	.28	-1.82	434	.0687	.0956	-.21	25 UKT1	
	1	-.80	.21	0	-1.31	.18	.51	.28	1.82	434	.0687	.0956	.21	25 UKT1	
	0	-.74	.19	1	-.53	.21	-.20	.29	-.72	434	.4746	.1153	.35	26 UET1	
	1	-.53	.21	0	-.74	.19	.20	.29	.72	434	.4746	.1153	-.35	26 UET1	
	0	-1.10	.20	1	-.88	.22	-.22	.30	-.73	395	.4660	.3178	.69	27 LST1	
	1	-.88	.22	0	-1.10	.20	.22	.30	.73	395	.4660	.3178	-.69	27 LST1	
	0	2.23	.28	1	2.41	.27	-.18	.39	-.48	396	.6349	.3928	.32	28 LGT1	
	1	2.41	.27	0	2.23	.28	.18	.39	.48	396	.6349	.3928	-.32	28 LGT1	
	0	-.05	.21	1	.60	.23	-.65	.32	-2.06	396	.0405	.2863	.03	29 LMT1	
	1	.60	.23	0	-.05	.21	.65	.32	2.06	396	.0405	.2863	-.03	29 LMT1	
	0	-.27	.21	1	-.44	.22	.17	.31	.54	396	.5898	.4231	.21	30 LIT1	
	1	-.44	.22	0	-.27	.21	-.17	.31	-.54	396	.5898	.4231	-.21	30 LIT1	
	0	1.78	.26	1	1.62	.25	.16	.36	.44	396	.6627	.3315	1.20	31 LBT1	
	1	1.62	.25	0	1.78	.26	-.16	.36	-.44	396	.6627	.3315	-1.20	31 LBT1	
	0	.14	.22	1	.55	.23	-.41	.32	-1.28	396	.2004	.1634	-.01	32 LRT1	
	1	.55	.23	0	.14	.22	.41	.32	1.28	396	.2004	.1634	.01	32 LRT1	
	0	2.23	.28	1	2.48	.27	-.26	.39	-.66	396	.5107	.7453	.32	33 LLT1	
	1	2.48	.27	0	2.23	.28	.26	.39	.66	396	.5107	.7453	-.32	33 LLT1	
	0	1.58	.26	1	1.81	.25	-.23	.36	-.64	396	.5205	.5056	-.25	34 LFT1	
	1	1.81	.25	0	1.58	.26	.23	.36	.64	396	.5205	.5056	.25	34 LFT1	

0	1.14	.24	1	1.69	.25	-.54	.35	-1.56	396	.1189	.2920	.67	35 LHT1
1	1.69	.25	0	1.14	.24	.54	.35	1.56	396	.1189	.2920	-.67	35 LHT1
0	.09	.22	1	-.03	.23	.12	.31	.39	396	.6954	.2783	-.02	36 LWT1
1	-.03	.23	0	.09	.22	-.12	.31	-.39	396	.6954	.2783	.02	36 LWT1
0	.59	.23	1	.44	.23	.15	.32	.45	396	.6502	.8068	-.09	37 LTT1
1	.44	.23	0	.59	.23	-.15	.32	-.45	396	.6502	.8068	.09	37 LTT1
0	3.15	.33	1	2.71	.28	.44	.43	1.02	394	.3063	.1769	-.25	38 LQT1
1	2.71	.28	0	3.15	.33	-.44	.43	-1.02	394	.3063	.1769	.25	38 LQT1
0	.44	.22	1	.39	.23	.05	.32	.14	396	.8855	.9058	.20	39 LJT1
1	.39	.23	0	.44	.22	-.05	.32	-.14	396	.8855	.9058	-.20	39 LJT1
0	-.98	.20	1	-.69	.22	-.29	.30	-.98	395	.3259	.2660	.09	40 LCT1
1	-.69	.22	0	-.98	.20	.29	.30	.98	395	.3259	.2660	-.09	40 LCT1
0	-1.70	.19	1	-2.27	.21	.57	.28	2.04	396	.0416	.0063	.85	41 LOT1
1	-2.27	.21	0	-1.70	.19	-.57	.28	-2.04	396	.0416	.0063	-.85	41 LOT1
0	1.39	.25	1	.88	.23	.51	.34	1.49	396	.1367	.0323	.89	42 LVT1
1	.88	.23	0	1.39	.25	-.51	.34	-1.49	396	.1367	.0323	-.89	42 LVT1
0	.59	.23	1	.28	.23	.31	.32	.94	395	.3454	.1392	-.35	43 LPT1
1	.28	.23	0	.59	.23	-.31	.32	-.94	395	.3454	.1392	.35	43 LPT1
0	-1.37	.19	1	-1.53	.21	.17	.29	.58	395	.5598	.1721	.02	44 LXT1
1	-1.53	.21	0	-1.37	.19	-.17	.29	-.58	395	.5598	.1721	-.02	44 LXT1
0	2.07	.27	1	2.34	.27	-.27	.38	-.70	395	.4823	.9340	-.32	45 LDT1
1	2.34	.27	0	2.07	.27	.27	.38	.70	395	.4823	.9340	.32	45 LDT1
0	1.51	.25	1	1.04	.24	.47	.35	1.36	395	.1753	.3266	-1.24	46 LUT1
1	1.04	.24	0	1.51	.25	-.47	.35	-1.36	395	.1753	.3266	1.24	46 LUT1
0	.33	.22	1	.71	.23	-.38	.32	-1.17	395	.2437	.1420	1.18	47 LAT1
1	.71	.23	0	.33	.22	.38	.32	1.17	395	.2437	.1420	-1.18	47 LAT1
0	.14	.22	1	.55	.23	-.41	.32	-1.28	395	.1999	.1367	.69	48 LYT1
1	.55	.23	0	.14	.22	.41	.32	1.28	395	.1999	.1367	-.69	48 LYT1
0	1.65	.26	1	.99	.24	.66	.35	1.88	395	.0603	.0508	.53	49 LNT1
1	.99	.24	0	1.65	.26	-.66	.35	-1.88	395	.0603	.0508	-.53	49 LNT1
0	.05	.22	1	-.03	.23	.08	.31	.24	395	.8097	.1341	.00	50 LZT1
1	-.03	.23	0	.05	.22	-.08	.31	-.24	395	.8097	.1341	.00	50 LZT1
0	-.78	.20	1	-.34	.22	-.44	.30	-1.47	394	.1431	.3637	.18	51 LKT1
1	-.34	.22	0	-.78	.20	.44	.30	1.47	394	.1431	.3637	-.18	51 LKT1
0	-.23	.21	1	.07	.23	-.30	.31	-.97	395	.3318	.5699	-.46	52 LET1
1	.07	.23	0	-.23	.21	.30	.31	.97	395	.3318	.5699	.46	52 LET1

Table 4

Summary Statistics for End of the Year Model (Upper and Lower Case Letters)

SUMMARY OF 456 MEASURED (EXTREME AND NON-EXTREME) PERSONS

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	31.8	51.9	.95	.64				
S.D.	18.1	1.3	2.90	.45				
MAX.	52.0	52.0	5.83	1.84				
MIN.	.0	25.0	-5.66	.31				

REAL RMSE	.79	ADJ.SD	2.79	SEPARATION	3.52	PERSON RELIABILITY .93
MODEL RMSE	.79	ADJ.SD	2.80	SEPARATION	3.56	PERSON RELIABILITY .93
S.E. OF PERSON MEAN = .14						

PERSON RAW SCORE-TO-MEASURE CORRELATION = .97 (approximate due to missing data)
CRONBACH ALPHA (KR-20) PERSON RAW SCORE RELIABILITY = .98 (approximate due to missing data)

SUMMARY OF 52 MEASURED (NON-EXTREME) ITEMS

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	278.9	455.4	.00	.15	1.00	.0	1.02	-.1
S.D.	50.2	.6	1.10	.01	.15	1.8	.47	1.5
MAX.	362.0	456.0	2.96	.17	1.42	5.3	2.73	4.4
MIN.	137.0	454.0	-1.98	.14	.76	-3.0	.48	-2.7

REAL RMSE	.15	ADJ.SD	1.09	SEPARATION	7.05	ITEM RELIABILITY .98
MODEL RMSE	.15	ADJ.SD	1.09	SEPARATION	7.24	ITEM RELIABILITY .98
S.E. OF ITEM MEAN = .15						

UMEAN=.000 USCALE=1.000
ITEM RAW SCORE-TO-MEASURE CORRELATION = -1.00 (approximate due to missing data)
21319 DATA POINTS. LOG-LIKELIHOOD CHI-SQUARE: 14754.92 with 20858 d.f. p=1.0000

Table 5

Item DIF Table for Group Membership

PERSON CLASS	DIF MEASURE	DIF S.E.	PERSON CLASS	DIF MEASURE	DIF S.E.	DIF CONTRAST	JOINT S.E.	t	Welch d.f.	Welch Prob.	MantelHanzl Prob.	ITEM Size	ITEM Number	Name
0.00	-.51	.29	1.00	-.72	.18	.20	.34	.60	281	.5513	.4593	-.09	1	UMT2
1.00	-.72	.18	0.00	-.51	.29	-.20	.34	-.60	281	.5513	.4593	.09	1	UMT2
0.00	.15	.28	1.00	.04	.17	.11	.33	.34	282	.7373	.1551	1.30	2	UGT2
1.00	.04	.17	0.00	.15	.28	-.11	.33	-.34	282	.7373	.1551	-1.30	2	UGT2
0.00	-.77	.30	1.00	-1.35	.19	.58	.35	1.66	284	.0986	.1572	.21	3	UST2
1.00	-1.35	.19	0.00	-.77	.30	-.58	.35	-1.66	284	.0986	.1572	-.21	3	UST2
0.00	.15	.28	1.00	.43	.17	-.28	.33	-.85	281	.3946	.4741	-.13	4	UIT2
1.00	.43	.17	0.00	.15	.28	.28	.33	.85	281	.3946	.4741	.13	4	UIT2
0.00	-1.31	.30	1.00	-1.71	.19	.40	.36	1.11	285	.2680	.5816	-.24	5	UBT2
1.00	-1.71	.19	0.00	-1.31	.30	-.40	.36	-1.11	285	.2680	.5816	.24	5	UBT2
0.00	-2.40	.33	1.00	-1.82	.20	-.57	.38	-1.51	277	.1335	.5837	.07	6	UXT2
1.00	-1.82	.20	0.00	-2.40	.33	.57	.38	1.51	277	.1335	.5837	-.07	6	UXT2
0.00	-.18	.29	1.00	-.22	.18	.05	.34	.14	281	.8893	.3402	-.74	7	ULT2
1.00	-.22	.18	0.00	-.18	.29	-.05	.34	-.14	281	.8893	.3402	.74	7	ULT2
0.00	.15	.28	1.00	.28	.17	-.13	.33	-.40	281	.6911	.7533	-.33	8	UQT2
1.00	.28	.17	0.00	.15	.28	.13	.33	.40	281	.6911	.7533	.33	8	UQT2
0.00	-.77	.30	1.00	-.18	.18	-.59	.34	-1.72	276	.0870	.3004	.08	9	UHT2
1.00	-.18	.18	0.00	-.77	.30	.59	.34	1.72	276	.0870	.3004	-.08	9	UHT2
0.00	-.68	.29	1.00	-.30	.18	-.38	.34	-1.11	277	.2700	.5957	-.38	10	UWT2
1.00	-.30	.18	0.00	-.68	.29	.38	.34	1.11	277	.2700	.5957	.38	10	UWT2
0.00	-.51	.29	1.00	-1.01	.18	.50	.34	1.45	283	.1483	.4237	.04	11	UTT2
1.00	-1.01	.18	0.00	-.51	.29	-.50	.34	-1.45	283	.1483	.4237	-.04	11	UTT2
0.00	-.01	.28	1.00	-.49	.18	.48	.34	1.43	283	.1538	.1298	1.10	12	URT2
1.00	-.49	.18	0.00	-.01	.28	-.48	.34	-1.43	283	.1538	.1298	-1.10	12	URT2
0.00	.23	.28	1.00	-.06	.18	.28	.33	.85	283	.3941	.4680	.66	13	UJT2
1.00	-.06	.18	0.00	.23	.28	-.28	.33	-.85	283	.3941	.4680	-.66	13	UJT2
0.00	-.68	.29	1.00	-.88	.18	.19	.35	.56	280	.5734	.8235	-.46	14	UCT2
1.00	-.88	.18	0.00	-.68	.29	-.19	.35	-.56	280	.5734	.8235	.46	14	UCT2
0.00	-1.69	.31	1.00	-2.10	.20	.41	.37	1.11	288	.2691	.6886	.10	15	UOT2
1.00	-2.10	.20	0.00	-1.69	.31	-.41	.37	-1.11	288	.2691	.6886	-.10	15	UOT2

0.00	.90	.27	1.00	.67	.17	.23	.32	.72	287	.4714	.2246	-.18	16 UVT2
1.00	.67	.17	0.00	.90	.27	-.23	.32	-.72	287	.4714	.2246	.18	16 UVT2
0.00	-.01	.28	1.00	-.24	.18	.23	.33	.68	282	.4948	.6906	.92	17 UPT2
1.00	-.24	.18	0.00	-.01	.28	-.23	.33	-.68	282	.4948	.6906	-.92	17 UPT2
0.00	.07	.28	1.00	.04	.17	.02	.33	.07	281	.9458	.6827	1.19	18 UFT2
1.00	.04	.17	0.00	.07	.28	-.02	.33	-.07	281	.9458	.6827	-1.19	18 UFT2
0.00	-.60	.29	1.00	-.33	.18	-.26	.34	-.76	278	.4450	.4350	-.62	19 UDT2
1.00	-.33	.18	0.00	-.60	.29	.26	.34	.76	278	.4450	.4350	.62	19 UDT2
0.00	.53	.27	1.00	.84	.17	-.31	.32	-.96	283	.3375	.6777	-.24	20 UUT2
1.00	.84	.17	0.00	.53	.27	.31	.32	.96	283	.3375	.6777	.24	20 UUT2
0.00	-1.78	.31	1.00	-1.81	.20	.03	.37	.07	283	.9459	.4631	-.47	21 UAT2
1.00	-1.81	.20	0.00	-1.78	.31	-.03	.37	-.07	283	.9459	.4631	.47	21 UAT2
0.00	.07	.28	1.00	-.68	.18	.75	.33	2.24	285	.0256	.0309	-.33	22 UYT2
1.00	-.68	.18	0.00	.07	.28	-.75	.33	-2.24	285	.0256	.0309	.33	22 UYT2
0.00	.75	.27	1.00	.34	.17	.42	.32	1.30	287	.1959	.0954	-.08	23 UNT2
1.00	.34	.17	0.00	.75	.27	-.42	.32	-1.30	287	.1959	.0954	.08	23 UNT2
0.00	-.60	.29	1.00	-.46	.18	-.14	.34	-.40	279	.6913	.5110	.78	24 UZT2
1.00	-.46	.18	0.00	-.60	.29	.14	.34	.40	279	.6913	.5110	-.78	24 UZT2
0.00	-1.31	.30	1.00	-.75	.18	-.56	.35	-1.59	276	.1127	.0837	-.32	25 UKT2
1.00	-.75	.18	0.00	-1.31	.30	.56	.35	1.59	276	.1127	.0837	.32	25 UKT2
0.00	-.26	.29	1.00	-.65	.18	.39	.34	1.16	282	.2479	.0748	-.39	26 UET2
1.00	-.65	.18	0.00	-.26	.29	-.39	.34	-1.16	282	.2479	.0748	.39	26 UET2
0.00	-.95	.30	1.00	-.78	.18	-.17	.35	-.48	278	.6328	.4887	-.92	27 LST2
1.00	-.78	.18	0.00	-.95	.30	.17	.35	.48	278	.6328	.4887	.92	27 LST2
0.00	1.64	.25	1.00	2.23	.17	-.59	.31	-1.93	293	.0541	.0500	-.43	28 LGT2
1.00	2.23	.17	0.00	1.64	.25	.59	.31	1.93	293	.0541	.0500	.43	28 LGT2
0.00	.15	.28	1.00	.11	.17	.04	.33	.11	282	.9133	.3903	-.14	29 LMT2
1.00	.11	.17	0.00	.15	.28	-.04	.33	-.11	282	.9133	.3903	.14	29 LMT2
0.00	-.26	.29	1.00	-.29	.18	.03	.34	.09	280	.9245	.4642	-.16	30 LIT2
1.00	-.29	.18	0.00	-.26	.29	-.03	.34	-.09	280	.9245	.4642	.16	30 LIT2
0.00	1.96	.25	1.00	2.06	.17	-.10	.30	-.33	294	.7428	.3409	-.36	31 LBT2
1.00	2.06	.17	0.00	1.96	.25	.10	.30	.33	294	.7428	.3409	.36	31 LBT2
0.00	.07	.28	1.00	-.21	.18	.28	.33	.83	282	.4049	.6303	.69	32 LRT2
1.00	-.21	.18	0.00	.07	.28	-.28	.33	-.83	282	.4049	.6303	-.69	32 LRT2
0.00	1.90	.25	1.00	1.85	.17	.05	.30	.16	293	.8707	.5999	-.20	33 LLT2
1.00	1.85	.17	0.00	1.90	.25	-.05	.30	-.16	293	.8707	.5999	.20	33 LLT2
0.00	1.45	.26	1.00	1.57	.17	-.12	.31	-.40	290	.6913	.5977	-.88	34 LFT2
1.00	1.57	.17	0.00	1.45	.26	.12	.31	.40	290	.6913	.5977	.88	34 LFT2

0.00	.61	.27	1.00	1.37	.17	-.76	.32	-2.36	282	.0188	.0387	.00	35 LHT2
1.00	1.37	.17	0.00	.61	.27	.76	.32	2.36	282	.0188	.0387	.00	35 LHT2
0.00	-.34	.29	1.00	-.29	.18	-.05	.34	-.15	279	.8796	.9560	-.52	36 LWT2
1.00	-.29	.18	0.00	-.34	.29	.05	.34	.15	279	.8796	.9560	.52	36 LWT2
0.00	.30	.28	1.00	.46	.17	-.15	.33	-.47	282	.6371	.1369	-.08	37 LTT2
1.00	.46	.17	0.00	.30	.28	.15	.33	.47	282	.6371	.1369	.08	37 LTT2
0.00	3.22	.26	1.00	2.84	.18	.38	.31	1.22	295	.2220	.3316	.42	38 LQT2
1.00	2.84	.18	0.00	3.22	.26	-.38	.31	-1.22	295	.2220	.3316	-.42	38 LQT2
0.00	.23	.28	1.00	.64	.17	-.41	.33	-1.25	281	.2120	.2355	.24	39 LJT2
1.00	.64	.17	0.00	.23	.28	.41	.33	1.25	281	.2120	.2355	-.24	39 LJT2
0.00	-.60	.29	1.00	-.81	.18	.22	.34	.63	281	.5310	.3674	.09	40 LCT2
1.00	-.81	.18	0.00	-.60	.29	-.22	.34	-.63	281	.5310	.3674	-.09	40 LCT2
0.00	-1.98	.32	1.00	-1.95	.20	-.03	.37	-.09	283	.9272	.5065	.39	41 LOT2
1.00	-1.95	.20	0.00	-1.98	.32	.03	.37	.09	283	.9272	.5065	-.39	41 LOT2
0.00	.97	.27	1.00	.70	.17	.27	.32	.86	288	.3887	.1906	-.08	42 LVT2
1.00	.70	.17	0.00	.97	.27	-.27	.32	-.86	288	.3887	.1906	.08	42 LVT2
0.00	.38	.28	1.00	.52	.17	-.14	.33	-.42	282	.6743	.7438	.33	43 LPT2
1.00	.52	.17	0.00	.38	.28	.14	.33	.42	282	.6743	.7438	-.33	43 LPT2
0.00	-2.29	.32	1.00	-1.14	.18	-1.14	.37	-3.07	270	.0023	.0215	.07	44 LXT2
1.00	-1.14	.18	0.00	-2.29	.32	1.14	.37	3.07	270	.0023	.0215	-.07	44 LXT2
0.00	2.70	.25	1.00	2.35	.17	.35	.30	1.17	296	.2449	.5380	.43	45 LDT2
1.00	2.35	.17	0.00	2.70	.25	-.35	.30	-1.17	296	.2449	.5380	-.43	45 LDT2
0.00	1.38	.26	1.00	1.51	.17	-.13	.31	-.42	290	.6716	.7703	.64	46 LUT2
1.00	1.51	.17	0.00	1.38	.26	.13	.31	.42	290	.6716	.7703	-.64	46 LUT2
0.00	.15	.28	1.00	.37	.17	-.22	.33	-.67	281	.5028	.3065	.00	47 LAT2
1.00	.37	.17	0.00	.15	.28	.22	.33	.67	281	.5028	.3065	.00	47 LAT2
0.00	.23	.28	1.00	-.12	.18	.34	.33	1.04	283	.2996	.2416	.19	48 LYT2
1.00	-.12	.18	0.00	.23	.28	-.34	.33	-1.04	283	.2996	.2416	-.19	48 LYT2
0.00	1.11	.26	1.00	.96	.17	.15	.31	.47	288	.6367	.2525	.71	49 LNT2
1.00	.96	.17	0.00	1.11	.26	-.15	.31	-.47	288	.6367	.2525	-.71	49 LNT2
0.00	-.09	.29	1.00	-.30	.18	.21	.34	.62	281	.5327	.4334	.41	50 LZT2
1.00	-.30	.18	0.00	-.09	.29	-.21	.34	-.62	281	.5327	.4334	-.41	50 LZT2
0.00	-.77	.30	1.00	-.37	.18	-.40	.34	-1.17	277	.2419	.1330	-.80	51 LKT2
1.00	-.37	.18	0.00	-.77	.30	.40	.34	1.17	277	.2419	.1330	.80	51 LKT2
0.00	-.18	.29	1.00	-.13	.18	-.04	.34	-.13	280	.8985	.7385	.16	52 LET2
1.00	-.13	.18	0.00	-.18	.29	.04	.34	.13	280	.8985	.7385	-.16	52 LET2

Table 6

Summary Statistics for End of the Year Model (Upper Case Letters)

SUMMARY OF 456 MEASURED (EXTREME AND NON-EXTREME) PERSONS

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	17.2	26.0	1.41	1.00				
S.D.	9.2	.1	2.86	.58				
MAX.	26.0	26.0	4.70	1.82				
MIN.	.0	25.0	-4.77	.42				

REAL RMSE	1.17	ADJ.SD	2.61	SEPARATION	2.24	PERSON RELIABILITY .83
MODEL RMSE	1.16	ADJ.SD	2.61	SEPARATION	2.25	PERSON RELIABILITY .84
S.E. OF PERSON MEAN = .13						

PERSON RAW SCORE-TO-MEASURE CORRELATION = .98 (approximate due to missing data)
CRONBACH ALPHA (KR-20) PERSON RAW SCORE RELIABILITY = .97 (approximate due to missing data)

SUMMARY OF 26 MEASURED (NON-EXTREME) ITEMS

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	301.2	455.9	.00	.16	1.01	.1	1.06	.1
S.D.	31.9	.2	.81	.01	.12	1.4	.37	1.3
MAX.	362.0	456.0	1.43	.17	1.28	3.1	2.44	3.1
MIN.	246.0	455.0	-1.77	.15	.84	-2.0	.72	-1.7

REAL RMSE	.16	ADJ.SD	.80	SEPARATION	4.90	ITEM RELIABILITY .96
MODEL RMSE	.16	ADJ.SD	.80	SEPARATION	5.05	ITEM RELIABILITY .96
S.E. OF ITEM MEAN = .16						

UMEAN=.000 USCALE=1.000
ITEM RAW SCORE-TO-MEASURE CORRELATION = -.96 (approximate due to missing data)
8163 DATA POINTS. LOG-LIKELIHOOD CHI-SQUARE: 6633.10 with 7824 d.f. p=1.0000

Table 7

Summary Statistics for End of the Year Model (Lower Case Letters)

SUMMARY OF 455 MEASURED (EXTREME AND NON-EXTREME) PERSONS

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	14.7	26.0	.43	.83				
S.D.	9.1	.1	2.90	.48				
MAX.	26.0	26.0	5.08	1.84				
MIN.	.0	23.0	-5.12	.45				

REAL RMSE	.98	ADJ.SD	2.73	SEPARATION	2.79	PERSON RELIABILITY .89
MODEL RMSE	.96	ADJ.SD	2.74	SEPARATION	2.84	PERSON RELIABILITY .89
S.E. OF PERSON MEAN = .14						

PERSON RAW SCORE-TO-MEASURE CORRELATION = .98
CRONBACH ALPHA (KR-20) PERSON RAW SCORE RELIABILITY = .97

SUMMARY OF 26 MEASURED (NON-EXTREME) ITEMS

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	256.5	454.9	.00	.15	1.00	.0	1.10	.2
S.D.	55.0	.3	1.21	.01	.15	1.9	.47	1.7
MAX.	361.0	455.0	2.32	.18	1.40	5.0	2.17	4.0
MIN.	137.0	454.0	-2.62	.14	.75	-3.2	.45	-2.6

REAL RMSE	.15	ADJ.SD	1.20	SEPARATION	7.75	ITEM RELIABILITY	.98
MODEL RMSE	.15	ADJ.SD	1.20	SEPARATION	7.97	ITEM RELIABILITY	.98
S.E. OF ITEM MEAN = .24							

UMEAN=.000 USCALE=1.000
ITEM RAW SCORE-TO-MEASURE CORRELATION = -.98
9854 DATA POINTS. LOG-LIKELIHOOD CHI-SQUARE: 7478.68 with 9450 d.f. p=1.0000

Table 8

Upper Case Letters Displacement Values

ENTRY NUMBER	TOTAL SCORE	COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	DISPLACE	ITEM	G
5	348	456	-1.64A	.17	1.20	2.1	2.44	3.1	A .67	.66	82.8	84.6	.48	UBT2	0
1	310	456	-.38A	.16	1.28	3.1	1.70	3.0	B .69	.73	76.8	81.7	.19	UMT2	0
13	280	456	.36A	.15	1.18	2.1	1.53	2.7	C .73	.76	78.0	81.3	.17	UJT2	0
16	246	455	1.43A	.16	1.17	1.9	1.46	1.8	D .74	.77	78.0	81.6	-.09	UVT2	0
6	362	456	-1.48A	.17	1.25	2.6	1.30	1.0	E .62	.67	78.7	84.2	-.09	UXT2	0
14	317	456	-.04A	.16	1.03	.4	1.19	1.1	F .72	.75	80.9	81.6	-.33	UCT2	0
8	270	456	.71A	.15	1.16	1.8	1.13	.7	G .74	.77	76.1	81.0	.06	UQT2	0
3	332	456	-.59A	.16	.89	-1.3	1.10	.5	H .73	.72	85.7	81.9	-.16	UST2	0
10	299	456	.36A	.15	1.03	.4	1.09	.6	I .75	.76	80.3	81.3	-.28	UWT2	0
9	296	456	.04A	.16	.96	-.5	1.04	.3	J .76	.75	83.1	81.6	.11	UHT2	0
22	302	456	.59A	.15	1.04	.5	.92	-.4	K .75	.76	79.9	81.1	-.58	UYT2	0
24	303	455	.11A	.16	1.03	.4	.96	-.2	L .74	.75	79.0	81.5	-.13	UZT2	0
19	299	456	.00A	.16	1.02	.3	.86	-.7	M .75	.75	79.6	81.6	.07	UDT2	0
15	362	456	-1.77A	.17	1.02	.2	.74	-.6	m .68	.66	84.1	85.1	.22	UOT2	0
11	319	456	-.27A	.16	1.00	.1	.96	-.1	l .73	.74	81.2	81.6	-.15	UTT2	0
17	289	456	.11A	.16	.97	-.4	.99	.0	k .77	.75	83.4	81.5	.20	UPT2	0
4	265	456	.61A	.15	.97	-.3	.86	-.8	j .78	.76	80.9	81.1	.28	UIT2	0
2	278	456	.73A	.15	.96	-.4	.88	-.7	i .77	.77	82.5	81.0	-.15	UGT2	0
20	246	456	1.27A	.16	.96	-.5	.82	-.8	h .78	.77	81.8	81.4	.08	UUT2	0
25	320	456	-.54A	.16	.96	-.5	.79	-1.0	g .74	.73	82.5	81.8	.10	UKT2	0
18	279	456	.71A	.15	.94	-.7	.86	-.8	f .77	.77	82.8	81.0	-.15	UFT2	0
26	305	456	-.08A	.16	.88	-1.5	.94	-.3	e .76	.75	86.0	81.6	.01	UET2	0
21	356	456	-1.16A	.16	.91	-1.1	.72	-1.0	d .69	.69	85.7	83.2	-.24	UAT2	0
23	260	456	.78A	.15	.87	-1.7	.72	-1.7	c .80	.77	83.4	81.1	.23	UNT2	0
7	291	456	.38A	.15	.86	-1.7	.73	-1.6	b .78	.76	83.1	81.2	-.11	ULT2	0
12	297	456	-.21A	.16	.84	-2.0	.78	-1.3	a .79	.74	86.3	81.6	.33	URT2	0
MEAN	301.2	455.9	.00	.16	1.01	.1	1.06	.1			81.6	81.9			
S.D.	31.9	.2	.81	.01	.12	1.4	.37	1.3			2.8	1.1			

Table 9

Lower Case Letters Displacement Values

ENTRY NUMBER	TOTAL SCORE	COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	DISPLACE	ITEM	G
12	137	455	2.32A	.14	1.05	.8	2.17	3.1	A .61	.64	79.7	81.2	.14	LQT2	0
18	342	455	-2.04A	.17	1.17	1.8	2.16	2.4	B .68	.71	85.5	87.1	.04	LXT2	0
5	183	455	1.13A	.14	1.40	5.0	2.01	4.0	C .60	.70	73.1	80.7	.41	LBT2	0
13	257	455	-.15A	.15	1.39	4.2	1.79	3.7	D .66	.74	76.0	83.3	.21	LJT2	0
25	301	454	-1.14A	.16	1.08	.9	1.40	1.4	E .72	.73	84.2	85.3	.19	LKT2	0
1	317	455	-1.57A	.16	1.03	.4	1.37	1.1	F .73	.72	84.4	85.8	.25	LST2	0
2	182	455	1.75A	.14	1.03	.5	1.29	1.1	G .68	.67	80.2	80.2	-.17	LGT2	0
7	192	455	1.79A	.14	1.19	2.6	1.24	.9	H .66	.67	76.0	80.2	-.38	LLT2	0
17	259	455	-.13A	.15	1.03	.4	1.20	1.1	I .73	.74	81.3	83.2	.15	LPT2	0
19	161	455	1.64A	.14	1.16	2.2	1.13	.6	J .63	.68	76.3	80.2	.33	LDT2	0
9	227	455	.85A	.14	.96	-.5	1.13	.8	K .72	.71	82.8	81.1	-.15	LHT2	0
21	267	455	-.05A	.15	.96	-.5	1.09	.5	L .74	.73	82.8	83.0	-.10	LAT2	0
11	262	455	-.05A	.15	.98	-.2	.81	-1.1	M .74	.73	82.1	83.0	.01	LTT2	0
10	294	455	-.53A	.15	.98	-.2	.97	-.1	m .74	.74	84.4	84.2	-.23	LWT2	0
24	291	454	-.55A	.15	.97	-.3	.85	-.7	l .74	.74	85.0	84.3	-.16	LZT2	0
20	211	455	.70A	.14	.93	-.9	.76	-1.4	k .73	.72	83.4	81.3	.29	LUT2	0
16	245	455	.55A	.14	.93	-.9	.83	-1.0	j .74	.72	82.6	81.6	-.22	LVT2	0
23	234	455	.73A	.14	.90	-1.4	.92	-.4	i .74	.72	82.1	81.3	-.18	LNT2	0
26	286	454	-.65A	.15	.91	-1.0	.73	-1.4	h .76	.74	84.4	84.5	.05	LET2	0
4	294	455	-.91A	.16	.91	-1.0	.82	-.7	g .76	.73	87.3	84.9	.15	LIT2	0
3	276	455	-.30A	.15	.91	-1.1	.81	-1.0	f .75	.74	85.5	83.7	-.05	LMT2	0
15	361	455	-2.62A	.18	.90	-1.0	.45	-1.4	e .71	.69	90.2	89.2	.02	LOT2	0
22	282	455	-.23A	.15	.89	-1.3	.72	-1.7	d .76	.74	85.0	83.5	-.25	LYT2	0
8	208	455	1.13A	.14	.85	-2.2	.77	-1.2	c .73	.70	83.9	80.7	-.06	LFT2	0
14	314	455	-1.42A	.16	.81	-2.2	.58	-1.5	b .77	.73	89.2	85.6	.18	LCT2	0
6	287	455	-.23A	.15	.75	-3.2	.59	-2.6	a .78	.74	89.4	83.5	-.36	LRT2	0
MEAN	256.5	454.9	.00	.15	1.00	.0	1.10	.2			83.0	83.2			
S.D.	55.0	.3	1.21	.01	.15	1.9	.47	1.7			4.1	2.3			