

Measuring Reliability and Predictive Validity – An Analysis of Administered Educator Preparation Surveys

Ohio Department of Higher Education

Abstract

Objective – To assess the reliability and the content, face, and predictive validity of instruments used to measure teacher and principal satisfaction with their educator preparation program

Design – Examination and analysis of three-year ('12-'13, '13-'14, '14-'15) data pertaining to the Teacher Pre-Service, Resident Educator, and Principal Intern surveys

Main Measures – Cronbach's Alpha used for reliability and internal consistency, a rotated factor pattern analysis used for studying key issues, and a regression model used to assess the predictive nature of a survey

Results – For each of the survey instruments, Cronbach's Alpha measured 0.97, which indicates a strong internal consistency; factor explanations provided an understanding of the unique dimensions in the data, including questions that loaded equally high on the same factors across the two teacher instruments; moreover, several data points, such as the correlation coefficient (0.93658), supported the strong predictive nature between the Teacher Pre-Service and Resident Educator surveys

Conclusion – The various analytical studies demonstrated evidence that there are reliability and strong internal consistency within the educator preparation surveys; furthermore, there is support in the belief that the Teacher Pre-Service survey serves as a credible source for predicting Resident Educator satisfaction.

Keywords – teacher satisfaction, dimensions, variance in data, correlation, linear regression

Since 2012, the Ohio Department of Education (formerly known as the Ohio Board of Regents) has been administering targeted surveys to Ohio teacher and principal candidates and educators with the intent to gather information on their satisfaction with the quality of preparation provided by their education preparation programs. These self-reported data have served as key metrics for the annual Educator Performance Reports. The questions on these surveys are aligned with the Ohio Standards for the Teaching Profession (OSTP), Ohio licensure requirements, and elements of national accreditation.

On an annual basis, Ohio's education preparation programs are required to submit reports to the Council for the Accreditation of Educator Preparation (CAEP) for the purposes of measuring

such things as teacher effectiveness and completer satisfaction. It has been determined by the Ohio Department of Higher Education and a committee of representatives from Ohio higher education institutions that in order to utilize the educator preparation survey data in support of seeking accreditation, the survey instruments must be tested for reliability and validity. Providing evidence of internal consistency and strong relationships between specific measures will ensure the usefulness and accuracy of the survey results, leading to opportunities for program improvement.

Methods

Instrument Evaluation

(1) In determining the internal consistency of an instrument, Cronbach's Alpha is used to assess reliability by measuring the degree to which different items are correlated. In general, strong internal consistency is evident when Cronbach's Alpha exceeds 0.70.

(2) In addition to measuring the correlation among survey questions, it is important to uncover the factors that explain the correlations. By conducting a factor analysis for each survey, underlying concepts that influence educator responses can be identified.

(3) Lastly, to assess whether a measurement procedure can be used to make predictions, a linear regression model was built to test the predictive validity of teacher candidate and educator surveys. Building a case for predictive validity shows the usefulness of teacher candidate satisfaction to predict resident educator opinions of their teacher preparation program.

Data Analysis using SAS

Reliability

- Alpha option of PROC CORR
- Raw or Standardized variables can be used because all items have the same response options
- Compare Cronbach's Alpha to each variable

Factor Analysis

- PROC FACTOR using a VARIMAX rotation to maximize the variance of the columns of the factor pattern or to allow each variable to load moderate to high in only one factor
- Pre-select the number of factors based on the Scree plot of eigenvalues, in which the number of factors selected constitutes a majority of the explained variance (e.g., slope levels off as amount of variance explained by each eigenvalue becomes minimal)

- Categorize (factor) each variable where loadings equal to 0.60 or greater

Predictive Validity

- Create and input three-year averages per survey question for teacher candidate (pre-service) and (resident) educator surveys
- Build model using PROC REG and GLM
- Examine Pearson Correlation, R-Square, F-test, Type III SS, residuals, and outliers

Results

All of the questions pertaining to the teacher pre-service survey were found to be internally consistent. In this study, the raw variables or the standard variables can be examined because all of the items have the same response options. Looking at **Figure 1**, we can see that each variable in the survey has a relatively strong correlation with the total, and the removal of an item will not positively or negatively impact the strength of Cronbach's 0.97 alpha value, indicating the questions in the survey are appropriate to include as a tool for measuring teacher candidate satisfaction with their educator preparation programs.

Figure 1 – Teacher Pre-Service Reliability

Cronbach Coefficient Alpha	
Variables	Alpha
Raw	0.975836
Standardized	0.976866

Cronbach Coefficient Alpha with Deleted Variable				
Deleted Variable	Raw Variables		Standardized Variables	
	Correlation with Total	Alpha	Correlation with Total	Alpha
Q8_1	0.693297	0.975303	0.697865	0.976327
Q8_2	0.633781	0.975426	0.634962	0.976494
Q8_3	0.618673	0.975471	0.619741	0.976535
Q8_4	0.691419	0.975276	0.696121	0.976331
Q8_5	0.67695	0.975311	0.679987	0.976374
Q9_1	0.629803	0.975439	0.635269	0.976493
Q9_2	0.655641	0.975368	0.65944	0.976429
Q9_3	0.679986	0.97531	0.683596	0.976365
Q9_4	0.742161	0.97517	0.748244	0.976192
Q9_5	0.664555	0.975343	0.668028	0.976406

Cronbach Coefficient Alpha with Deleted Variable				
Deleted Variable	Raw Variables		Standardized Variables	
	Correlation with Total	Alpha	Correlation with Total	Alpha
Q10_1	0.709639	0.975222	0.710728	0.976293
Q10_2	0.732685	0.9752	0.739276	0.976216
Q10_3	0.655632	0.975383	0.656574	0.976437
Q10_4	0.728605	0.975198	0.734195	0.97623
Q10_5	0.692398	0.975273	0.697439	0.976328
Q10_6	0.680922	0.975334	0.688503	0.976352
Q10_7	0.679963	0.975304	0.684242	0.976363
Q10_8	0.727754	0.975224	0.735085	0.976227
Q11_1	0.677876	0.97531	0.680758	0.976372
Q11_2	0.709391	0.975299	0.718678	0.976271
Q11_3	0.620252	0.975479	0.619927	0.976534
Q11_4	0.730233	0.975168	0.732108	0.976235
Q11_5	0.720721	0.975195	0.722226	0.976262
Q12_1	0.638402	0.975454	0.628837	0.97651
Q12_2	0.651245	0.975425	0.638479	0.976485
Q12_3	0.594509	0.975658	0.581646	0.976636
Q12_4	0.669592	0.975339	0.659106	0.97643
Q12_5	0.666774	0.975365	0.654178	0.976443
Q12_6	0.642284	0.975404	0.643659	0.976471
Q12_7	0.593901	0.975645	0.582412	0.976634
Q13_1	0.648379	0.975394	0.652902	0.976447
Q13_2	0.542104	0.975775	0.541374	0.976742
Q13_3	0.641297	0.975416	0.647262	0.976462
Q13_4	0.54348	0.975654	0.54825	0.976724
Q13_5	0.598263	0.97552	0.601563	0.976583
Q14_1	0.672955	0.975321	0.672377	0.976395
Q14_2	0.702159	0.975245	0.701125	0.976318
Q14_3	0.661799	0.975364	0.657071	0.976435
Q14_4	0.668954	0.975338	0.664275	0.976416
Q14_5	0.661349	0.975357	0.657161	0.976435
Q15_1	0.72596	0.975217	0.731407	0.976237
Q15_2	0.741622	0.975134	0.743861	0.976204
Q15_3	0.724113	0.975214	0.729129	0.976243
Q15_4	0.744539	0.975128	0.746006	0.976198
Q15_5	0.696176	0.975257	0.696545	0.97633
Q15_6	0.682143	0.975323	0.687934	0.976353
Q16_1	0.70776	0.97522	0.703568	0.976312
Q16_2	0.657506	0.975429	0.651566	0.97645
Q16_3	0.683983	0.975292	0.680023	0.976374

Similar results were produced when the resident educator survey was tested for internal consistency. As can be seen from **Figure 2**, each survey question shows a strong and consistent pattern of item-total correlation coefficients. None of the

items, if deleted, would statistically (+/-) impact the strength of the instrument.

Figure 2 – Resident Educator Reliability

Cronbach Coefficient Alpha	
Variables	Alpha
Raw	0.977033
Standardized	0.978193

Cronbach Coefficient Alpha with Deleted Variable				
Deleted Variable	Raw Variables		Standardized Variables	
	Correlation with Total	Alpha	Correlation with Total	Alpha
Q8_1	0.713376	0.976505	0.716824	0.977664
Q8_2	0.665196	0.97659	0.667632	0.977789
Q8_3	0.629688	0.976683	0.631421	0.977881
Q8_4	0.698279	0.976506	0.702836	0.977699
Q8_5	0.707046	0.976484	0.708259	0.977686
Q9_1	0.636572	0.976678	0.634902	0.977872
Q9_2	0.706942	0.976476	0.708807	0.977684
Q9_3	0.711908	0.976469	0.712357	0.977675
Q9_4	0.775986	0.976343	0.779456	0.977504
Q9_5	0.704579	0.976482	0.706945	0.977689
Q10_1	0.727848	0.97643	0.729309	0.977632
Q10_2	0.747055	0.976405	0.751262	0.977576
Q10_3	0.6644	0.976594	0.666984	0.977791
Q10_4	0.764059	0.976371	0.770544	0.977527
Q10_5	0.715851	0.976471	0.720889	0.977653
Q10_6	0.683196	0.976579	0.690181	0.977732
Q10_7	0.727019	0.976428	0.729497	0.977631
Q11_1	0.693973	0.976515	0.696718	0.977715
Q11_2	0.71964	0.976515	0.728331	0.977634
Q11_3	0.68133	0.976546	0.67999	0.977758
Q11_4	0.748675	0.976387	0.751522	0.977575
Q11_5	0.716077	0.97646	0.717879	0.977661
Q12_1	0.640957	0.97669	0.6314	0.977881
Q12_2	0.657711	0.976646	0.645281	0.977846
Q12_3	0.502254	0.977361	0.489825	0.978238
Q12_4	0.673489	0.976575	0.662211	0.977803
Q12_5	0.663581	0.976629	0.65094	0.977831
Q12_6	0.611844	0.976775	0.604563	0.977949
Q12_7	0.578935	0.976957	0.565429	0.978048
Q13_1	0.662962	0.976608	0.66977	0.977783
Q13_2	0.58003	0.97686	0.581192	0.978008
Q13_3	0.636595	0.976665	0.643178	0.977851
Q13_4	0.572442	0.976819	0.578269	0.978015
Q13_5	0.627407	0.976684	0.632925	0.977877
Q14_1	0.692189	0.976519	0.693661	0.977723
Q14_2	0.696092	0.976509	0.695737	0.977717

Cronbach Coefficient Alpha with Deleted Variable				
Deleted Variable	Raw Variables		Standardized Variables	
	Correlation with Total	Alpha	Correlation with Total	Alpha
Q14_3	0.680972	0.976547	0.679056	0.97776
Q14_4	0.681199	0.976547	0.679931	0.977758
Q14_5	0.692328	0.976516	0.692234	0.977726
Q15_1	0.715075	0.976491	0.723016	0.977648
Q15_2	0.754939	0.976369	0.761463	0.97755
Q15_3	0.705728	0.976513	0.712862	0.977674
Q15_4	0.708523	0.976479	0.711799	0.977677
Q15_5	0.678831	0.976552	0.680462	0.977756
Q15_6	0.667769	0.976606	0.676158	0.977767
Q16_1	0.729467	0.976424	0.728689	0.977634
Q16_2	0.695099	0.976516	0.691995	0.977727
Q16_3	0.708654	0.976478	0.708329	0.977685
Q16_4	0.711118	0.976468	0.707098	0.977689

Cronbach Coefficient Alpha with Deleted Variable				
Deleted Variable	Raw Variables		Standardized Variables	
	Correlation with Total	Alpha	Correlation with Total	Alpha
IN_7	0.809866	0.971945	0.808164	0.972504
OP_1	0.786229	0.972164	0.787397	0.972674
OP_2	0.770721	0.972273	0.772501	0.972796
OP_3	0.732308	0.972652	0.731731	0.973128
OP_4	0.759886	0.972385	0.763014	0.972874
CO_1	0.760373	0.972412	0.764406	0.972862
CO_2	0.779522	0.972226	0.783717	0.972705
CO_3	0.800945	0.972099	0.804945	0.972531
CO_4	0.823419	0.971857	0.827214	0.972348
CO_5	0.796022	0.972104	0.799399	0.972576
PAR_1	0.701784	0.972918	0.700896	0.973379
PAR_2	0.767047	0.972303	0.767132	0.97284
PAR_3	0.721824	0.972704	0.721758	0.97321
PAR_4	0.792442	0.972092	0.791699	0.972639

Item-total correlation coefficients ranging from 0.70-0.83 (seen in **Figure 3**) within the principal intern survey reveal a strong internal correlation among the variables. Furthermore, the removal of a question will not increase or decrease Cronbach's Coefficient Alpha, ensuring the case for internal consistency and validating the instrument's reliability.

Figure 3 – Principal Intern Reliability

Cronbach Coefficient Alpha	
Variables	Alpha
Raw	0.97343
Standardized	0.973922

Cronbach Coefficient Alpha with Deleted Variable				
Deleted Variable	Raw Variables		Standardized Variables	
	Correlation with Total	Alpha	Correlation with Total	Alpha
CI_1	0.78516	0.972161	0.784626	0.972697
CI_2	0.795929	0.972074	0.795304	0.97261
CI_3	0.801674	0.972027	0.800853	0.972564
IN_1	0.768321	0.972308	0.765064	0.972857
IN_2	0.751346	0.972528	0.74836	0.972993
IN_3	0.832855	0.971741	0.829904	0.972326
IN_4	0.769072	0.97229	0.767744	0.972835
IN_5	0.746202	0.972478	0.744623	0.973024
IN_6	0.788985	0.972121	0.786362	0.972683

A factor analysis test run on the teacher pre-service survey revealed five factors accounting for over 90% of the variance explained. Variables with a load factor of 0.60 or higher were determined to be those with at least a moderately high “loading” indicating a higher than average correlation between a variable and a factor.

Figure 1 on the following page shows each item and its corresponding “loading” for each factor. Each variable was reviewed and categorized for factor purposes. As mentioned, five factors emerged from the analysis, the largest of which, Pedagogy and Assessment (Factor 1), accounted for nearly 80% of the variance (as seen in **Figure 2 below**). The remaining four factors, Ohio-Specific Requirements, Program Faculty, Cultural Diversity, and Field and Clinical, each had a proportional contribution of less than ten percent. Determining the minimum number of factors that could account for most of the variance in the data allows for a more meaningful interpretation of the data.

Figure 2 – Teacher Pre-Service Factor Analysis

Eigenvalues of the Reduced Correlation Matrix: Total = 29.1060806 Average = 0.59400164 Variance Explained Prior to Rotation				
Top Factors	Eigenvalue	Difference	Proportion	Cumulative
1	22.933292	21.059783	0.7879	0.7879
2	1.8735093	0.3806806	0.0644	0.8523
3	1.4928288	0.3331606	0.0513	0.9036
4	1.1596681	0.3017716	0.0398	0.9434
5	0.8578966	0.2802464	0.0295	0.9729
28.317195				
Rotated Variance Explained by Each Factor				
Factor1	Factor2	Factor3	Factor4	Factor5
10.492769	5.46321	4.994799	4.146989	3.219429
28.31719				

Similar results were produced for the resident educator survey when conducting a factor analysis test, in part due to the same questions being asked, albeit, at a later point in time. As can be seen from **Figure 3**, five factors accounted for over a 90% cumulative proportion of the data variance.

Figure 3 – Resident Educator Factor Analysis

Eigenvalues of the Reduced Correlation Matrix: Total = 31.7677806 Average = 0.64832205 Variance Explained Prior to Rotation				
Top Factors	Eigenvalue	Difference	Proportion	Cumulative
1	23.738773	21.7765121	0.7473	0.7473
2	1.962261	0.3004581	0.0618	0.809
3	1.6618028	0.3356224	0.0523	0.8613
4	1.3261804	0.1800442	0.0417	0.9031
5	1.1461362	0.494796	0.0361	0.9392
29.8351534				
Rotated Variance Explained by Each Factor				
Factor1	Factor2	Factor3	Factor4	Factor5
10.131912	5.86853	5.235395	4.758853	3.840463
29.83515				

A factor summary on the following page depicted by **Figure 4 on Page 7** shows the same unique dimensions that were categorized in the teacher pre-service survey. Similar to the prior factor analysis test, only variable loadings of 0.60 were analyzed after rotation, resulting in nearly all of the same questions loading on the same factors with Factor 1, Pedagogy and Assessment, accounting for the largest proportion of variance in the data.

Figure 1 – Teacher Pre-Service Factor Analysis

Teacher Pre-Service Survey (2012-2015)						
Rotated Factor Pattern Analysis						
Category	Variable	Factor1	Factor2	Factor3	Factor4	Factor5
Pedagogy and Assessment	Q9_4	0.71132	0.22013	0.20204	0.16989	0.19462
Pedagogy and Assessment	Q10_2	0.63665	0.18688	0.26933	0.19271	0.24382
Pedagogy and Assessment	Q10_8	0.6336	0.17307	0.27916	0.19947	0.23559
Pedagogy and Assessment	Q9_3	0.63198	0.25457	0.17613	0.14389	0.16628
Pedagogy and Assessment	Q9_5	0.6299	0.21848	0.14639	0.21511	0.12755
Pedagogy and Assessment	Q9_2	0.62513	0.24738	0.16507	0.11579	0.16153
Pedagogy and Assessment	Q8_1	0.62335	0.22691	0.21988	0.17687	0.16867
Pedagogy and Assessment	Q10_4	0.62015	0.19734	0.27039	0.21789	0.21834
Pedagogy and Assessment	Q8_4	0.61698	0.2174	0.25445	0.15289	0.17154
Pedagogy and Assessment	Q11_2	0.61166	0.10983	0.31557	0.19563	0.27224
Pedagogy and Assessment	Q10_5	0.60753	0.17813	0.22877	0.26048	0.16045
Pedagogy and Assessment	Q8_5	0.60134	0.24194	0.18956	0.21507	0.13211
Pedagogy and Assessment	Q10_7	0.58962	0.24154	0.23238	0.13964	0.20004
Pedagogy and Assessment	Q10_1	0.58023	0.28139	0.22846	0.25058	0.12889
Academic Content Stnds	Q9_1	0.57522	0.23884	0.19433	0.03688	0.24769
Ethics	Q10_6	0.57209	0.16368	0.31557	0.14325	0.24264
Pedagogy and Assessment	Q8_2	0.56407	0.24084	0.13979	0.25219	0.09164
Collaboration	Q11_4	0.5455	0.26511	0.27439	0.29958	0.17053
Learning Environment	Q10_3	0.52679	0.26343	0.18611	0.2394	0.1576
Cultural Diversity	Q11_1	0.52309	0.19017	0.22991	0.38248	0.12313
Candidate Assess Fairly	Q11_5	0.51148	0.28892	0.29272	0.24483	0.21059
Academic Content Stnds	Q8_3	0.46604	0.28374	0.23159	0.15142	0.17376
Academic Content Stnds	Q12_6	0.44296	0.36776	0.243	0.06577	0.27084
Technology	Q11_3	0.41684	0.28115	0.30091	0.22245	0.11029
Ohio-Specific Requirements	Q12_5	0.2666	0.76553	0.17175	0.17596	0.11761
Ohio-Specific Requirements	Q12_4	0.30073	0.71754	0.18668	0.13421	0.1532
Ohio-Specific Requirements	Q12_3	0.20865	0.71255	0.14947	0.17546	0.09829
Ohio-Specific Requirements	Q12_2	0.27652	0.70622	0.15546	0.2173	0.0933
Ohio-Specific Requirements	Q12_7	0.24841	0.64633	0.14654	0.18464	0.09615
Ohio-Specific Requirements	Q12_1	0.30422	0.62984	0.16879	0.16857	0.14141
Program Faculty	Q15_3	0.36642	0.15899	0.6431	0.26186	0.23343
Program Faculty	Q15_6	0.35229	0.14762	0.63799	0.15232	0.27696
Program Faculty	Q15_1	0.40097	0.17876	0.63136	0.17731	0.25438
Program Faculty	Q15_2	0.38312	0.24941	0.62947	0.2222	0.18602
Program Faculty	Q15_4	0.37394	0.23729	0.56931	0.34652	0.16387
Program Faculty	Q15_5	0.34484	0.26195	0.56771	0.24091	0.15475
Program Support	Q16_3	0.27527	0.38413	0.50518	0.18775	0.22676
Program Support	Q16_1	0.3119	0.40899	0.48754	0.19891	0.20099
Program Support	Q16_2	0.24245	0.42656	0.44546	0.23141	0.17293
Cultural Diversity	Q14_3	0.24229	0.24573	0.18875	0.76142	0.18187
Cultural Diversity	Q14_4	0.24504	0.24666	0.21144	0.76012	0.17042
Cultural Diversity	Q14_5	0.27263	0.25373	0.24163	0.65669	0.14997
Cultural Diversity	Q14_2	0.37091	0.21162	0.24466	0.59657	0.2066
Learning Differences	Q14_1	0.35143	0.20906	0.22715	0.5133	0.27048
Field and Clinical	Q13_3	0.34392	0.12827	0.2144	0.19168	0.70036
Field and Clinical	Q13_4	0.24667	0.12628	0.19575	0.15832	0.649
Field and Clinical	Q13_1	0.34768	0.16615	0.23926	0.20747	0.6039
Field and Clinical	Q13_5	0.28735	0.18079	0.31804	0.16757	0.48157
Field and Clinical	Q13_2	0.21733	0.22603	0.16761	0.31443	0.40328

Figure 4 – Resident Educator Factor Analysis

Resident Educator Survey (2012-2015)						
Rotated Factor Pattern Analysis						
Category	Variable	Factor1	Factor2	Factor3	Factor4	Factor5
Pedagogy and Assessment	Q9_4	0.70462	0.25407	0.24784	0.23395	0.15426
Pedagogy and Assessment	Q10_4	0.66325	0.20458	0.30018	0.20337	0.2386
Pedagogy and Assessment	Q9_2	0.64976	0.27301	0.21231	0.17186	0.13505
Pedagogy and Assessment	Q10_2	0.64122	0.25388	0.25372	0.16909	0.25102
Pedagogy and Assessment	Q8_4	0.63271	0.21833	0.26034	0.14689	0.18587
Pedagogy and Assessment	Q9_3	0.63227	0.31128	0.21119	0.17599	0.12094
Pedagogy and Assessment	Q9_5	0.61756	0.23422	0.19994	0.27286	0.13674
Pedagogy and Assessment	Q8_5	0.61694	0.29409	0.21499	0.19604	0.1302
Pedagogy and Assessment	Q11_2	0.61693	0.12839	0.26862	0.1904	0.35166
Pedagogy and Assessment	Q8_1	0.61441	0.23245	0.25315	0.21276	0.17402
Pedagogy and Assessment	Q10_7	0.60777	0.27197	0.26858	0.19383	0.17561
Pedagogy and Assessment	Q10_5	0.60647	0.22506	0.24806	0.22537	0.20905
Pedagogy and Assessment	Q10_1	0.59285	0.29251	0.22718	0.24905	0.16628
Ethics	Q10_6	0.59025	0.18093	0.24247	0.12583	0.32424
Pedagogy and Assessment	Q8_2	0.57323	0.20444	0.20358	0.29017	0.1151
Learning Environment	Q10_3	0.55064	0.25241	0.22096	0.18276	0.19307
Collaboration	Q11_4	0.5335	0.28473	0.23706	0.30538	0.27455
Candidate Assessed Fairly	Q11_5	0.53098	0.28388	0.21929	0.25995	0.25051
Academic Content Stds	Q9_1	0.5201	0.37233	0.14639	0.10054	0.18073
Academic Content Stds	Q8_3	0.48399	0.27564	0.21521	0.13559	0.23633
Technology	Q11_3	0.43328	0.34474	0.23896	0.29226	0.18247
Ohio-Specific Requirements	Q12_5	0.2703	0.73782	0.15576	0.17913	0.12366
Ohio-Specific Requirements	Q12_4	0.2863	0.70439	0.19093	0.11781	0.19368
Ohio-Specific Requirements	Q12_2	0.28757	0.6801	0.11662	0.24893	0.11575
Ohio-Specific Requirements	Q12_7	0.22474	0.67261	0.10965	0.17713	0.08626
Ohio-Specific Requirements	Q12_3	0.16082	0.66719	0.12271	0.12163	0.03533
Ohio-Specific Requirements	Q12_1	0.29656	0.61505	0.16271	0.1952	0.14275
Academic Content Stds	Q12_6	0.33609	0.5283	0.15865	0.10069	0.20861
RE Overall	Q16_4	0.3588	0.4496	0.38492	0.19636	0.18421
Program Faculty	Q15_1	0.37258	0.15237	0.6984	0.14364	0.28325
Program Faculty	Q15_3	0.32966	0.13933	0.69292	0.27328	0.2107
Program Faculty	Q15_2	0.4069	0.20338	0.67304	0.22553	0.20496
Program Faculty	Q15_6	0.33002	0.12643	0.6642	0.11848	0.32519
Program Faculty	Q15_4	0.34218	0.21863	0.57715	0.37527	0.10556
Program Faculty	Q15_5	0.31964	0.27217	0.53184	0.30008	0.12253
Program Support	Q16_3	0.31947	0.3848	0.51938	0.1587	0.23521
Program Support	Q16_1	0.34592	0.39666	0.497	0.20037	0.21002
Program Support	Q16_2	0.28478	0.43922	0.47403	0.22612	0.15838
Cultural Diversity	Q14_4	0.24007	0.23505	0.20838	0.79626	0.17258
Cultural Diversity	Q14_3	0.23134	0.25115	0.18065	0.79354	0.20073
Cultural Diversity	Q14_5	0.28887	0.21292	0.26556	0.72438	0.15125
Cultural Diversity	Q14_2	0.33219	0.21871	0.18847	0.68229	0.21205
Learning Differences	Q14_1	0.34119	0.19728	0.24862	0.54583	0.28823
Cultural Diversity	Q11_1	0.47913	0.19419	0.17857	0.48876	0.20023
Field and Clinical	Q13_3	0.30638	0.13809	0.18811	0.19592	0.75396
Field and Clinical	Q13_1	0.33847	0.14548	0.23673	0.20835	0.68638
Field and Clinical	Q13_4	0.2352	0.14957	0.22092	0.15177	0.68155
Field and Clinical	Q13_5	0.26817	0.18746	0.34941	0.17455	0.54269
Field and Clinical	Q13_2	0.19947	0.23862	0.13165	0.35293	0.5162

A final factor analysis test was performed on the principal intern survey. Results from the PROC FACTOR output in **Figure 5** show that three factors alone accounted for virtually all of the data variance explained. A similar rotation in the factor pattern was implemented to allow for unique factor descriptions. Again, only moderately high to high “loadings” of 0.60 or greater were selected because it signifies a stronger correlation between a variable and a factor. The factor summary table in **Figure 6** displays the three unique categories (factors) generated from testing the survey instrument. Instructional Leadership (Factor 1) alone accounted for 90.5% of the variance in the data while Collaborative Environment (5.4%) and Communication and Partnerships (3.1%) explained the remainder (aside from the 1% of unnecessary information that did not warrant inclusion for analysis).

Figure 5 – Principal Intern Factor Analysis

Eigenvalues of the Reduced Correlation Matrix: Total = 15.8206078 Average = 0.68785251 Variance Explained Prior to Rotation				
Top Factors	Eigenvalue	Difference	Proportion	Cumulative
1	14.3261703	13.467596	0.9055	0.9055
2	0.8585746	0.3679625	0.0543	0.9598
3	0.4906121	0.0971306	0.031	0.9908
15.675357				
Rotated Variance Explained by Each Factor				
Factor1	Factor2	Factor3		
6.9567125	5.5386459	3.1799985	15.675357	

Figure 6 – Principal Intern Factor Analysis

Principal Intern Survey (2012-2015) Rotated Factor Pattern Analysis				
Category	Variable	Factor1	Factor2	Factor3
IL	Instruct_3	0.73754	0.3465	0.31893
IL	Instruct_2	0.70131	0.27246	0.28886
IL	Cont_Imp_3	0.69816	0.38645	0.2614
IL	Cont_Imp_2	0.69732	0.38035	0.26028
IL	Instruct_1	0.69678	0.30148	0.29397
IL	Instruct_6	0.68841	0.34877	0.29224
IL	Cont_Imp_1	0.67922	0.38588	0.25802
IL	Instruct_7	0.67039	0.40909	0.28678
IL	Instruct_4	0.65634	0.36177	0.27629
IL	Instruct_5	0.62226	0.35674	0.28363
	Op_Res_Env_3	0.53686	0.40473	0.31651

CE	Co_Sh_Lead_3	0.37915	0.74576	0.27802
CE	Co_Sh_Lead_2	0.35442	0.71422	0.30683
CE	Co_Sh_Lead_4	0.41207	0.69868	0.33803
CE	Co_Sh_Lead_1	0.33612	0.69685	0.31375
CE	Co_Sh_Lead_5	0.39018	0.67879	0.3306
CE	Op_Res_Env_4	0.41479	0.62435	0.28215
	Op_Res_Env_2	0.48237	0.55834	0.29019
	Op_Res_Env_1	0.51385	0.55473	0.28054
CP	Par_Comm_3	0.33182	0.36154	0.67418
CP	Par_Comm_2	0.35034	0.44172	0.63857
CP	Par_Comm_1	0.38216	0.31167	0.61275
	Par_Comm_4	0.46776	0.40815	0.55449

IL = Instructional Leadership

CE = Collaborative Environment

CP = Communication and Partnerships

Results from the correlation and linear regression tests indicated there is a strong relationship between the teacher pre-service and resident educator surveys. An r value (correlation coefficient in **Figure 1**) of 0.93658 between the candidate and resident educator surveys signifies the strength of association between the independent and dependent variables is very high.

Figure 1 – Pre-Service and Resident Educator Predictive Validity

Pearson Correlation Coefficients, N = 48		
Prob > r under H0: Rho=0		
	Pre-Service	Resident Educator
Pre-Service	1	0.93658 <.0001
Resident Educator	0.93658 <.0001	1

Other statistics supported the validation of this linear regression model. If we square the correlation coefficient to get r-squared, we arrive at a number equal to 0.8772 (see **Figure 2**). This is significant because it tells us that the teacher pre-service instrument accounts for 87.7% of the variation in the resident educator survey. The F-test evaluates the model overall and indicates if the observed r-squared is statistically reliable. Figure 2 shows that the Pr>F value of the total model is less than .0001

meaning we can reject the null hypothesis that all of the regression coefficients are equal to zero.

Whereas r-squared is a relative measure of fit, the root MSE is an absolute measure of fit. The RMSE is essentially the standard deviation of the unexplained variance. In the case of this linear model, the low RMSE value of 0.074 indicates the model is a good fit for accurately predicting a response. Furthermore, the Type III Sum of Squares p-value is <.0001 indicating the model explains a statistically significant proportion of the variance or that the two surveys are linearly related.

Figure 2 – Pre-Service and Resident Educator Predictive Validity

The GLM Procedure					
Dependent Variable: Resident Educator					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	1.80308662	1.80308662	328.53	<.0001
Error	46	0.25246686	0.00548841		
Corrected Total	47	2.05555348			
R-Square	Coeff Var	Root MSE	Resident Educator Mean		
0.877178	2.237238	0.074084	3.311396		
Source	DF	Type I SS	Mean Square	F Value	Pr > F
preservice	1	1.80308662	1.80308662	328.53	<.0001
Source	DF	Type III SS	Mean Square	F Value	Pr > F
preservice	1	1.80308662	1.80308662	328.53	<.0001
Parameter	Estimate	Standard Error	t Value	Pr > t	
Intercept	-0.54481893	0.2130218	-2.56	0.0139	
preservice	1.130944593	0.06239594	18.13	<.0001	

While the model has been supported, residuals and potential outliers have to be investigated. In doing so, a fit diagnostics test (seen in **Figure 3** on the next page) was run to examine observations that exerted a greater than normal influence on the overall outcome of the model or the prediction limits.

Nearly all of the observations' residuals hovered around the zero line. Only four variables demonstrated outlier characteristics. Further testing shows (in **Figure 4**) Questions 9_1, 12_3, 12_6, and

12_7 each exert an influence on the model greater than Cook's D threshold of $(4/N = 0.08)$. Interestingly enough, of the four influential questions, the two questions (12_3 and 12_7) that ask about Ohio-Specific Requirements impact the model the most. The reason for this is because they stray farther from the mean than the two variables that ask about Academic Content Standards (9_1 and 12_6). Thus, an observation will have more influence with more discrepancy and leverage.

Figure 3 – Pre-Service and Resident Educator Predictive Validity

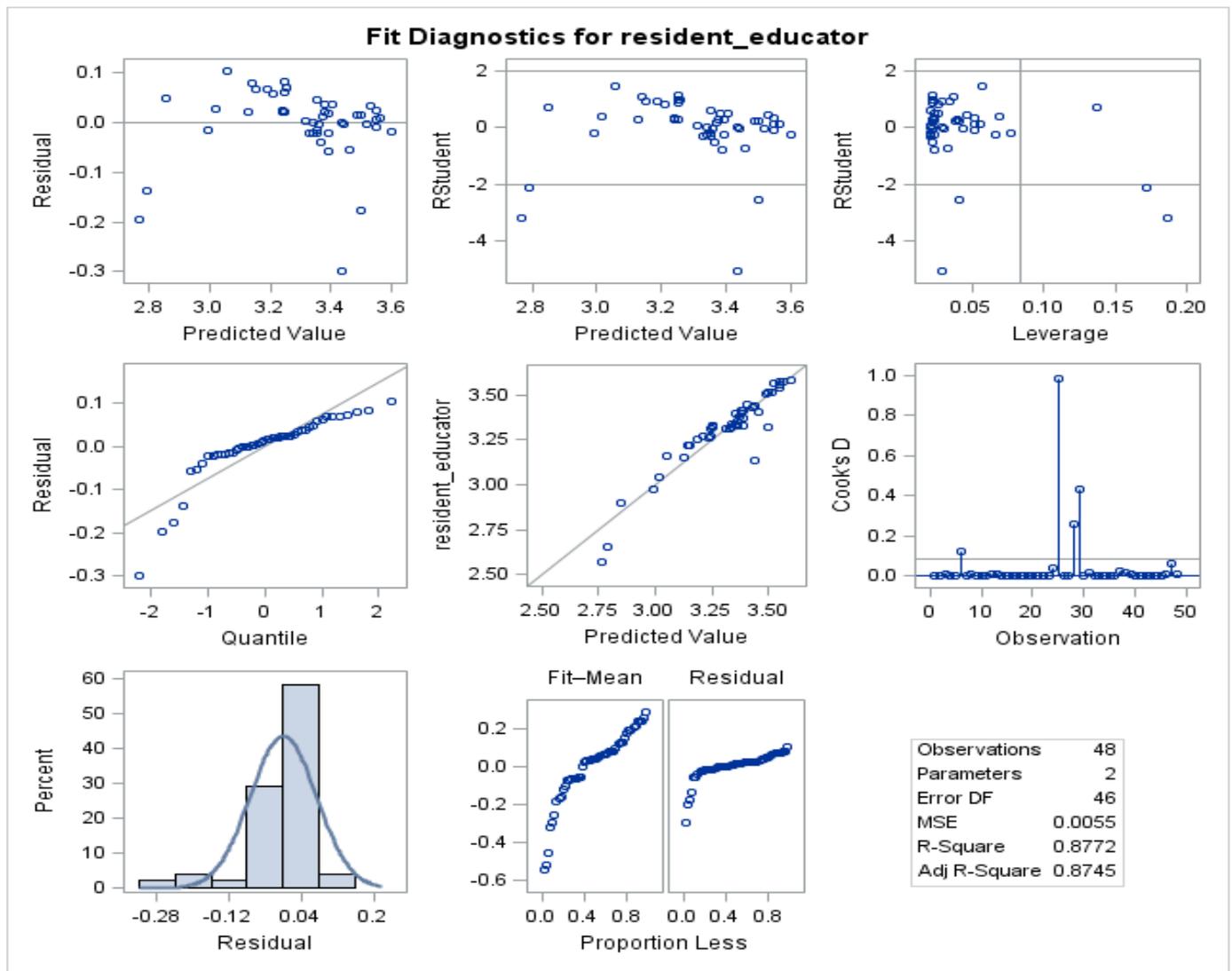


Figure 4 – Pre-Service and Resident Educator Predictive Validity

OBS	Var	Pre-Service	RE	Cook's D Influence	Leverage	Standard Influence	Residual	Student Residual	-2 -1 0 1 2	RStudent*
25	Q12_3	2.927	2.569	0.98803	0.18613	-1.54279	-0.1965	-2.939	*****	-3.226
29	Q12_7	2.949	2.652	0.43527	0.17141	-0.96817	-0.1383	-2.051	****	-2.1287
28	Q12_6	3.521	3.138	0.25656	0.02962	-0.88945	-0.2992	-4.1	*****	-5.0913
6	Q9_1	3.577	3.324	0.12555	0.04068	-0.53098	-0.1766	-2.433	****	-2.5785
12	Q10_2	3.54	3.404	0.00959	0.03287	-0.13781	-0.0547	-0.751	*	-0.7475
8	Q9_3	3.478	3.331	0.00766	0.02414	-0.12328	-0.0576	-0.787	*	-0.7838
35	Q14_1	3.458	3.327	0.00326	0.02249	-0.0801	-0.039	-0.532	*	-0.5281
19	Q11_2	3.664	3.58	0.00251	0.0667	-0.0701	-0.019	-0.265		-0.2622
27	Q12_5	3.127	2.977	0.00178	0.07754	-0.05905	-0.0146	-0.206		-0.2037
7	Q9_2	3.447	3.332	0.00096	0.02182	-0.04348	-0.0215	-0.294		-0.2911

*An absolute studentized deleted residual (RStudent) value of 2 indicates the observation should be investigated.

Face and Content Validity

The Pre-Service Survey, Resident Educator Survey, Principal Intern Survey, Principal Mentor Survey, and Employer Survey were found to have strong content validity [as demonstrated through crosswalks detailing the alignment of the items on each instrument to the related standards and requirements](#). The Pre-Service Survey, Resident Educator Survey, and Employer Survey are aligned to the Ohio Standards for the Teaching Profession (InTASC-aligned), Ohio School Operating Standards, and the Ohio Professional Development Standards. The Principal Intern Survey and Principal Mentor Survey are aligned to the Ohio Standards for Principals and the Educational Leadership Constituent Council (ELCC) Standards.

The face validity of each instrument was affirmed through evaluation of each instrument to subject matter experts. Feedback from the experts resulted in modifications to each instrument.

Conclusion

Validating survey instruments is important to ensure accurate results when assessing teacher candidate and educator perceptions. Using Cronbach's Alpha to measure internal consistency provided substantial evidence for the support in proving the reliability of the surveys.

To gain a better explanation of the data elements within each survey, factor analyses were conducted to categorize the data into broader explanations. This basic approach allowed us to discover the unique dimensions within each data set and also between like surveys, such as the pre-service and resident educator instruments. Ultimately, we can use the factor analyses results to provide a first assessment of the key issues in the data, which can be used for further analysis.

The linear regression model is a good fit overall. Testing reveals there is a strong linear relationship between the teacher pre-service candidate survey and the resident educator survey; thus, indicating that the prior is a good predictor of the latter's response outcomes. That being said, questions

focused on Ohio's specific requirements and academic content standards fell outside the 95% confidence limits, suggesting a resident educator's opinions about those topics might not necessarily be a reflection of how they responded during their teacher candidate learning experience.