Deployment and Its Relationship to Equal Opportunity and Organizational Effectiveness

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Psychometric Properties of the DEOMI Organizational Climate Survey

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ABSTRACT

The DEOMI Organizational Climate Survey (DEOCS) has been employed by the United States military to measure equal opportunity (EO) and its relationship to organizational effectiveness (OE; i.e., military readiness). It consists of eight scales measuring EO and five scales measuring OE. The purpose of the current study was to determine whether the EO scales and OE scales can be viewed as distinct dimensions. Using responses of more than 500,000 military personnel who completed the DEOCS between 2005 and 2007 the dimensionality of the two scales were examined using classical test theory (correlations and reliability analyses) and item response theory. Results indicated that most of the items could be grouped into the EO and OE scales (Cronbach's alphas = .931 and .950 respectively). However positive EO items did not fit well with the other EO items and seemed to be part of a different scale. Two items dealing with overall EO climate correlated well with the EO and OE scale items but did little to improve their psychometric properties. Implications for future work regarding EO and diversity in the military will be discussed.

INTRODUCTION

Researchers at the Defense Equal Opportunity Management Institute (DEOMI) successfully developed in the Military Equal Opportunity Climate Survey (MEOCS; Landis,

Dansby, & Faley, 1993) in the early 1990s. This project has included revising the MEOCS and keeping it up to date. Suggested revisions to the MEOCS have included shortening it and making its items more neutral (i.e., replacing references to "majority," "minority," "men," and "women" with more general terms "race" and "gender" and then using demographic information to determine the respondent's specific race and gender). The resulting revision of the MEOCS called the DEOCS (DEOMI Organizational Climate Survey) met and in many cases surpassed its predecessor in psychometric qualities (Truhon, 2003).

The DEOCS consists of 13 scales. Eight of these scales deal with equal opportunity (EO), two of which are presented to civilian personnel only (Age Discrimination, Disability Discrimination) and were not used in the present analyses. The remaining five scales deal with organizational effectiveness (OE). The DEOCS has undergone a number of changes since Truhon's (2003) report. This entails new analyses of its psychometric properties.

The traditional approach to examine the psychometric properties of a measure is to employ classical test theory (CTT). CTT is based upon the idea that a person's score on a test (X) is the result of his or her true test score (τ) and some error (ε).

$$X = \tau + \varepsilon$$

In CTT the aim is to reduce the amount of error so that the test score is closely related to the true score. This relationship or the reliability of the test is an important statistic, often calculated in terms of internal consistency (e.g., Cronbach's [1951] alpha).

There are other statistics of interest such as difficulty and discrimination. Difficulty refers to the proportion of test takers who answered an item incorrectly. Discrimination involves comparing the performance of better test takers with worse test takers, ideally the upper and lower 29% (Kelley, 1939). CTT is limited by the circularity in the logic of these calculations

and by its applications to ability tests only.

In contrast, item response theory (IRT) is based on a more complex mathematical probabilistic formula which includes a latent trait or ability(θ), the discrimination of items (*a*), the difficulty of items(*b*), guessing factors (*c*), and a transcendental number (*e*, which is approximately equal to 2.718). This formula can be applied to ability tests and adjusted (letting *c* = 0).

$$P(X) = c + (1 - c)\left(\frac{e^{[a(\theta - b)]}}{1 + e^{[a(\vartheta - b)]}}\right)$$

Despite the differences between CTT and IRT, use of both approaches can provide complementary information about the psychometric properties of a test (Zickar & Broadfoot, 2009). It seems appropriate to apply both CTT and IRT to the DEOCS. For the purposes of this study, six EO subscales were treated as one scale and the five OE subscales were treated as a separate scale.

METHOD

Participants

The entire sample consisted of 569,034 military personnel who completed the DEOCS between June 2005 and September 2007. These personnel were mostly male, White, and non-Hispanic. They were more likely to be military personnel (rather than civilians) with the most frequent status that of junior enlisted. The median age was approximately 28 years. There were 5,776 units with from 1 to 2,554 individuals in each unit (median size 56). Of these 5,776 units there 153 Air Force units, 880 Army units, 192 Coast Guard units, 628 Department of Defense or Joint units, 1,159 Marine units, 2,561 Navy units, and 59 Other units. The military branch of 144 units could not be determined.

This sample was reduced further for the purposes in performing CTT analyses only responses with complete data for each scale were considered. From the remaining participants 10% were randomly selected. That resulted in 50,393 participants for the EO scale and 50,955 participants for the OE scale.

Materials

The current revised version of the DEOCS consists of 68 items, 13 of which provide demographic information. The EO section of the DEOCS consists of 30 items comprising eight scales (two to four items per scales). These scales (Sexual Harassment and Discrimination [SHD], Differential Command Behavior toward Women and Minorities [DCB], Positive EO Behavior [PEO], Racist Behavior [RB], Age Discrimination [AD], Religious Discrimination [REL], Disability Discrimination [DD], and Overall EO Climate [OEOC]) were developed from earlier versions of the MEOCS. The 25 items in five scales (Organizational Climate [OC], Trust in the Organization [TR], Work Group Effectiveness [WGE], Work Group Cohesion [WGC], Leadership Cohesion [LC], and Job Satisfaction [JS]) of the OE section were similarly developed.

All scales use a Likert-type rating scale (1= "very high chance that the action occurred," 2= "reasonably high chance that the action occurred," 3= "moderate chance that the action occurred," 4= "small chance that the action occurred", and 5= "almost no chance that the action occurred"). All responses to items were coded so that higher scores indicated better equal opportunity environment.

Procedure

Commanders or managers of Department of Defense organizations can request an EO evaluation from DEOMI. Copies of the DEOCS and optical scan forms are then sent to the EO

officer for that unit. EO officers administer the DEOCS to personnel within the unit and return the forms for analysis to DEOMI. EO officers can also request that an online version of the DEOCS be administered.

Analyses

Because items dealing with AD and DD are designed for civilian members of the Department of Defense, these data were not included in the following analyses. CTT analyses were performed using SPSS (2008), especially its Reliability Analysis. IRT analyses were performed using Multilog (Thissen, Chen, & Bock, 2003) using the graded response model (Samejima, 1974).

RESULTS

Classical Test Theory

The correlations between the EO items are presented in Table 1. Treating all these items as belonging to the same scale produced a Cronbach's alpha of .910. Please note that in the diagonals are the scale's Cronbach's alpha if that item were removed.

As can be seen the items that deal with Positive EO correlate poorly with the other EO items. In addition Cronbach's alpha would increase if these items were removed. Rerunning the reliability analysis without these items produced a Cronbach's alpha of .931. In the case of dropping an item from the scale Cronbach's alpha was reduced. However, there was minimal loss in reliability when the two items dealing with OEOC were removed. A third reliability analysis was run without these items. In this case the Cronbach's alpha appeared unchanged (.931).

Because these two items did not appear to affect the reliability of the EO scale, they were included with the OE items. The correlations between OE, including the OEOC items are

presented in Table 2. Treating all these items as belonging to the same scale produced a Cronbach's alpha of .950. As in Table 1, the values in the diagonals are the scale's Cronbach's alpha if that item were removed.

As can be seen the items correlate positively with each other. Items in the same subscale correlate especially well. Removing any single item from the scale did not reduce the overall reliability.

Item Response Theory

The item characteristics curves (ICCs) for the EO items are presented in Figure 1. Most ICCs follow the usual pattern (either S-shaped or normal curves). However, curves 15to 18 do not follow that pattern; these are the PEO items. When those items were removed, OEOC items also did not fit the pattern. The ICCs for the reduced set of EO items are presented in Figure 2.

The remaining EO items have good discrimination (all as ≥ 2.00) and varied difficulty indices (b_1s range from -2.15 to -1.10; b_4s range from -0.37 to 1.12; see Table 3).

The ICCs for the extended set OE items (including the OEOC items) are presented in Figure 3. Although many ICCs are either S-shaped or normal curves, the heights of these curves are not as great as those for the EO. This can be seen in Table 4. Some items have relatively low discrimination (i.e., nine of the items have as ≤ 1.79). However the difficulty indices are even more varied than those for the EO items (b_1s range from -2.88 to -1.05; b_4s range from 0.29 to 1.71).

DISCUSSION

There are several lessons to be taken from these analyses. Except for the PEO items, most of EO items correlate well with each other and can be considered as one scale. This coincides

with the experience of military EO advisors that units with problems in aspect of EO generally have problems in other areas.

The distinction between the PEO items and to the other EO items can be determined by examining their wording. The PEO items involve taking positive steps toward EO, or prescriptive values, and the other EO items involve avoiding taking negative steps against EO, or proscriptive values (McKinney, 1971).

The OE items correlate well and appear to be part of a single scale, especially seen by the high Cronbach's alpha. However the IRT analyses reveal that there are too many items for a single scale. It is likely that a high Cronbach's alpha can be retained if this scale is reduced to two or more scales.

The OEOC items are correlated with both of these scales as they currently stand. It is possible that these items can provide a link between the two aspects of this test (Truhon & Banks, 2007).

Finally the results demonstrate that CTT and IRT should not be viewed as competitors in test development. Instead they can provide complementary analyses (Zickar & Broadfoot, 2009).

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TABLE 1
Correlations between EO Items

	RB 1	DCB 4	DCB 5	DCB 6	DCB 7	SHD 10	RB 11	RB 12	DCB 13	SHD 14	SHD 15	REL 16	REL 17	REL 18	PEO 2	PEO 3	PEO 8	PEO 9	OEOC 53	OEOC 54
RB1	.906																			
DCB4	.339	.904																		
DCB5	.352	.722	.903																	
DCB6	.318	.590	.692	.904																
DCB7	.329	.574	.660	.654	.904															
SHD10	.362	.467	.516	.484	.498	.904														
RB11	.641	.422	.463	.432	.448	.508	.902													
RB12	.736	.385	.414	.383	.398	.451	.812	.903												
DCB13	.397	.482	.523	.490	.515	.537	.516	.489	.903											
SHD14	.626	.358	.386	.354	.372	.487	.678	.735	.516	.903										
SHD15	.571	.361	.388	.358	.380	.490	.637	.653	.516	.754	.904									
REL 16	.304	.531	.598	.571	.563	.555	.465	.410	.541	.415	.430	.904								
REL 17	.478	.365	.408	.378	.407	.461	.575	.566	.455	.586	.594	.550	.904							
REL 18	.330	.506	.560	.528	.545	.538	.466	.421	.546	.434	.453	.726	.572	.904						
PEO2	-.085	.113	.132	.098	.107	.052	-.003	-.040	.052	-.041	-.045	.109	-.015	.076	.915					
PEO3	-.042	.155	.188	.160	.174	.102	.041	-.001	.105	-.005	-.011	.169	.022	.124	.719	.912				
PEO8	-.017	.182	.210	.185	.191	.137	.055	.007	.135	.006	.006	.201	.047	.157	.561	.653	.911			
PEO9	.014	.195	.220	.200	.217	.146	.083	.042	.153	.036	.031	.210	.065	.169	.543	.638	.757	.911		
OEOC53	.310	.383	.378	.325	.341	.337	.362	.341	.369	.332	.333	.315	.262	.318	.202	.219	.235	.261	.905	
OEOC54	.323	.392	.387	.332	.345	.340	.372	.352	.376	.342	.345	.323	.270	.326	.205	.222	.236	.263	.882	.905

TABLE 2
Correlations between OE Items

	OC 27	OC 28	OC 29	OC 25	OC 26	TR 30	TR 31	TR 32	WGE 33	WGE 34	WGE 35	WGE 36	WGC 37	WGC 38	WGC 39	WGC 40	LC 41	LC 42	LC 43	LC 44	JS 45	JS 46	JS 47	JS 48	JS 49	OEOC 53	OEOC 54
OC27	.951																									
OC28	.502	.950																								
OC29	.532	.522	.949																							
OC25	.349	.436	.449	.948																						
OC26	.409	.410	.584	.638	.948																					
TR30	.304	.390	.366	.527	.497	.949																				
TR31	.388	.503	.471	.552	.572	.586	.948																			
TR32	.371	.443	.486	.532	.607	.542	.755	.948																		
WGE33	.164	.165	.237	.283	.318	.254	.275	.333	.950																	
WGE34	.175	.183	.258	.303	.346	.274	.294	.355	.758	.949																
WGE35	.184	.198	.274	.310	.350	.273	.306	.359	.560	.621	.949															
WGE36	.167	.173	.253	.299	.338	.262	.282	.338	.608	.647	.669	.949														
WGC37	.212	.236	.299	.343	.383	.309	.355	.393	.528	.584	.610	.623	.948													
WGC38	.204	.219	.296	.334	.382	.302	.342	.395	.541	.593	.630	.623	.804	.949												
WGC39	.243	.290	.325	.384	.399	.346	.416	.426	.437	.481	.504	.494	.687	.661	.948											
WGC40	.258	.315	.341	.407	.417	.364	.444	.447	.439	.487	.506	.495	.684	.650	.796	.948										
LC41	.330	.424	.408	.476	.505	.456	.578	.567	.335	.364	.381	.363	.448	.436	.486	.525	.947									
LC42	.326	.405	.410	.466	.507	.445	.561	.574	.344	.373	.397	.374	.432	.451	.447	.475	.820	.948								
LC43	.319	.414	.390	.467	.485	.452	.578	.564	.311	.337	.349	.335	.408	.400	.490	.507	.779	.779	.948							
LC44	.317	.416	.390	.468	.487	.452	.578	.567	.311	.340	.347	.335	.405	.397	.461	.516	.768	.765	.855	.948						
JS45	.293	.312	.377	.412	.449	.371	.418	.439	.376	.390	.380	.384	.405	.408	.417	.417	.438	.449	.441	.440	.949					
JS46	.214	.238	.278	.317	.338	.297	.327	.339	.343	.373	.360	.371	.398	.401	.383	.389	.361	.366	.359	.361	.502	.950				
JS47	.228	.210	.319	.324	.402	.292	.320	.368	.322	.346	.326	.341	.340	.356	.323	.326	.335	.354	.337	.343	.458	.417	.950			
JS48	.333	.313	.404	.388	.444	.357	.420	.432	.313	.330	.316	.317	.354	.356	.370	.378	.420	.422	.414	.414	.508	.406	.488	.949		
JS49	.394	.396	.507	.470	.545	.419	.495	.496	.355	.379	.368	.364	.425	.415	.448	.458	.487	.482	.475	.470	.575	.461	.478	.644	.948	
OEOC53	.319	.399	.415	.472	.490	.422	.525	.531	.301	.329	.345	.328	.387	.382	.425	.457	.500	.494	.498	.510	.391	.323	.321	.381	.433	.948
OEOC54	.338	.421	.437	.490	.507	.430	.542	.544	.303	.331	.348	.330	.395	.389	.436	.469	.510	.504	.507	.516	.404	.333	.326	.395	.455	.880	.948

FIGURE 1
Plots of Item Characteristic Curves for EO Items

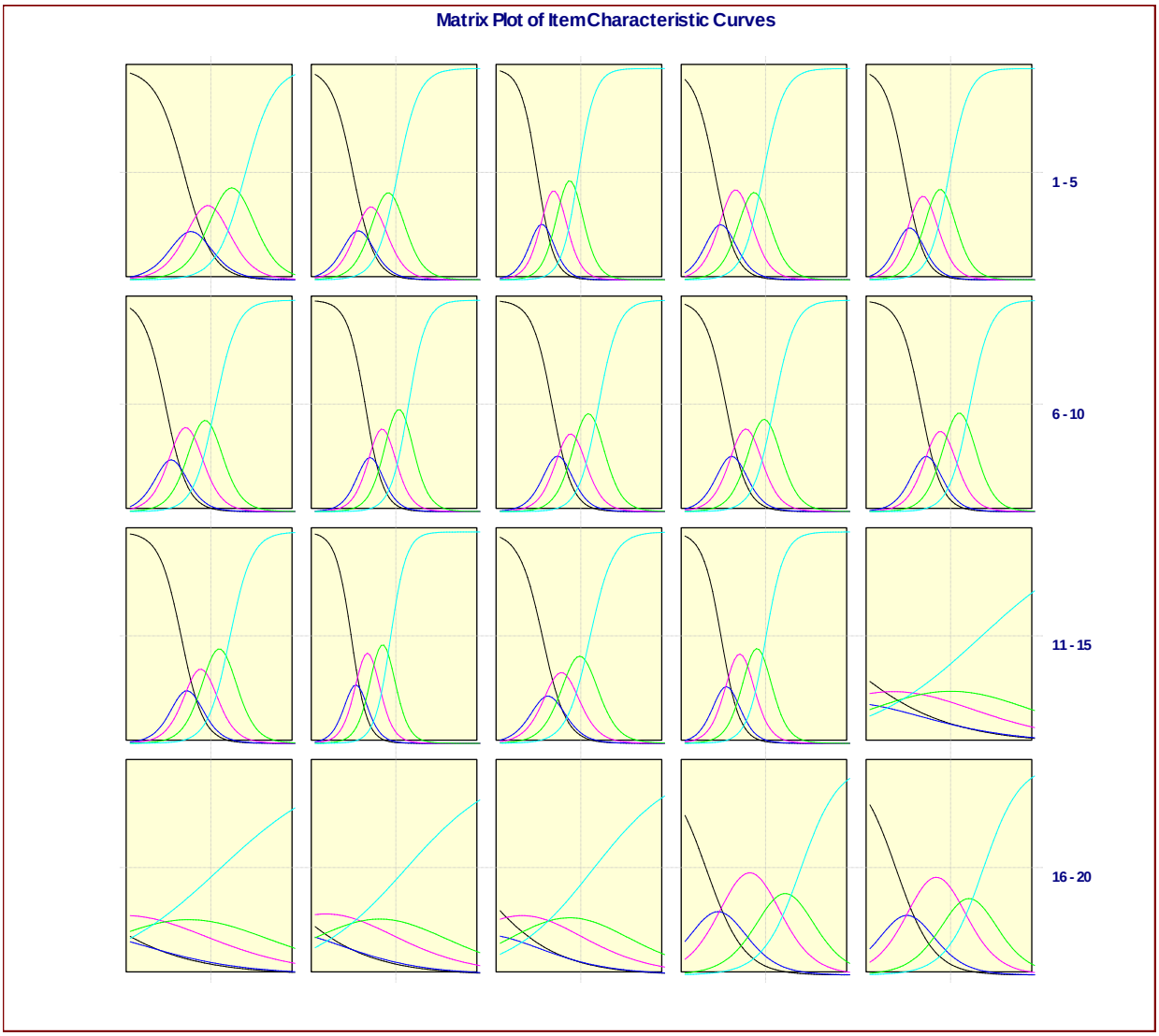

FIGURE 2
Item Characteristic Curves for the Reduced Set of EO Items

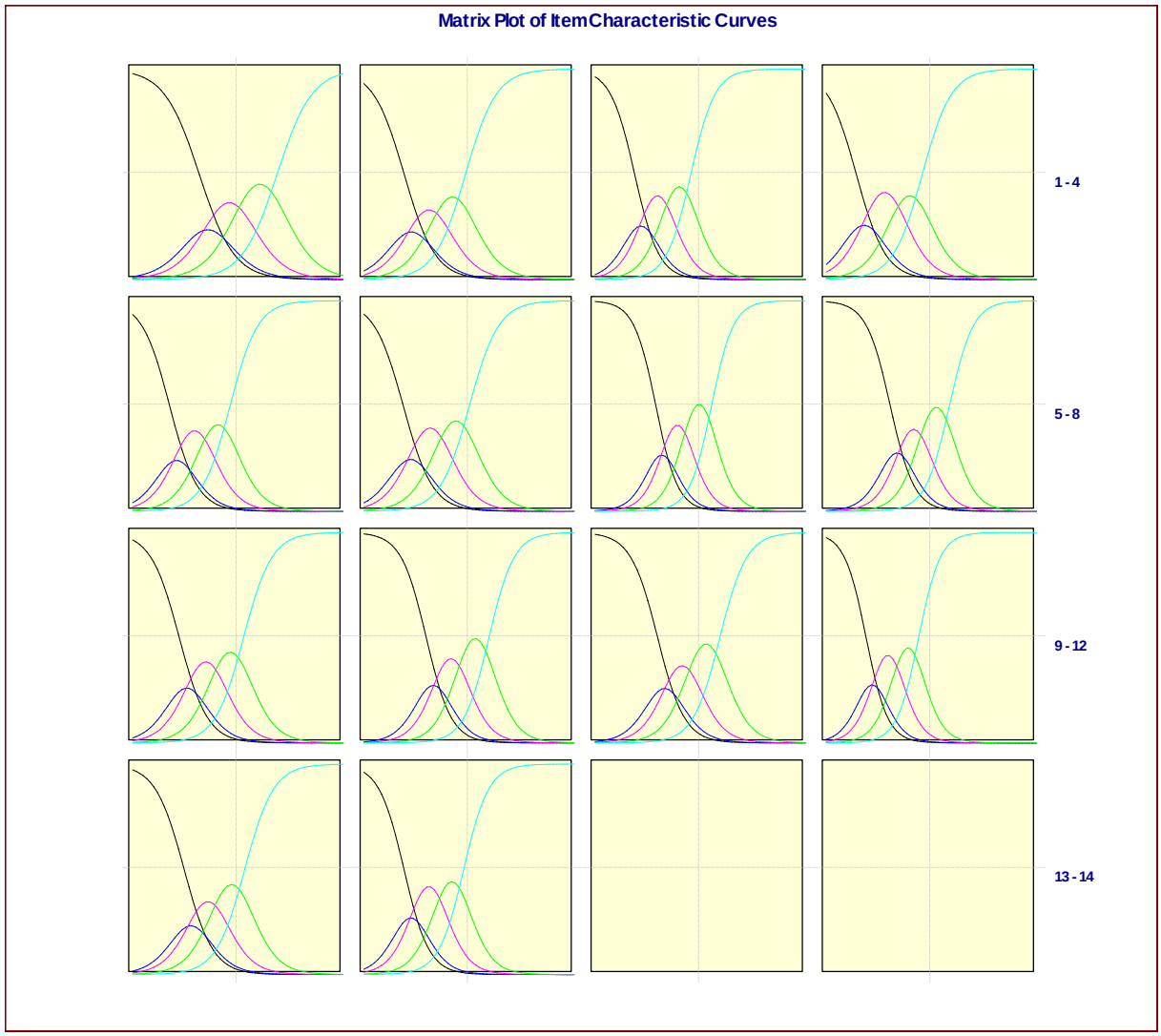

TABLE 3
Discrimination (*a*) and Difficulty (*b*) Indices for IRT Analysis of Reduced Set of EO Items

Item	*a*	b_1	b_2	b_3	b_4
RB1	2.00	-1.10	-0.62	0.14	1.12
DCB4	2.26	-1.85	-1.45	-0.84	-0.10
DCB5	2.88	-1.87	-1.51	-0.93	-0.27
DCB6	2.39	-2.15	-1.71	-0.97	-0.26
DCB7	2.52	-1.95	-1.56	-0.92	-0.23
SHD10	2.39	-1.88	-1.46	-0.76	0.01
RB11	3.20	-1.27	-0.93	-0.38	0.32
RB12	2.93	-1.18	-0.79	-0.23	0.51
DCB13	2.47	-1.68	-1.24	-0.59	0.16
SHD14	2.79	-1.22	-0.82	-0.21	0.57
SHD15	2.61	-1.22	-0.81	-0.22	0.56
REL 16	3.23	-1.87	-1.57	-0.97	-0.37
REL 17	2.43	-1.54	-1.15	-0.56	0.20
REL 18	2.80	-1.86	-1.47	-0.83	-0.15

FIGURE 4
Item Characteristic Curves for the OE Items

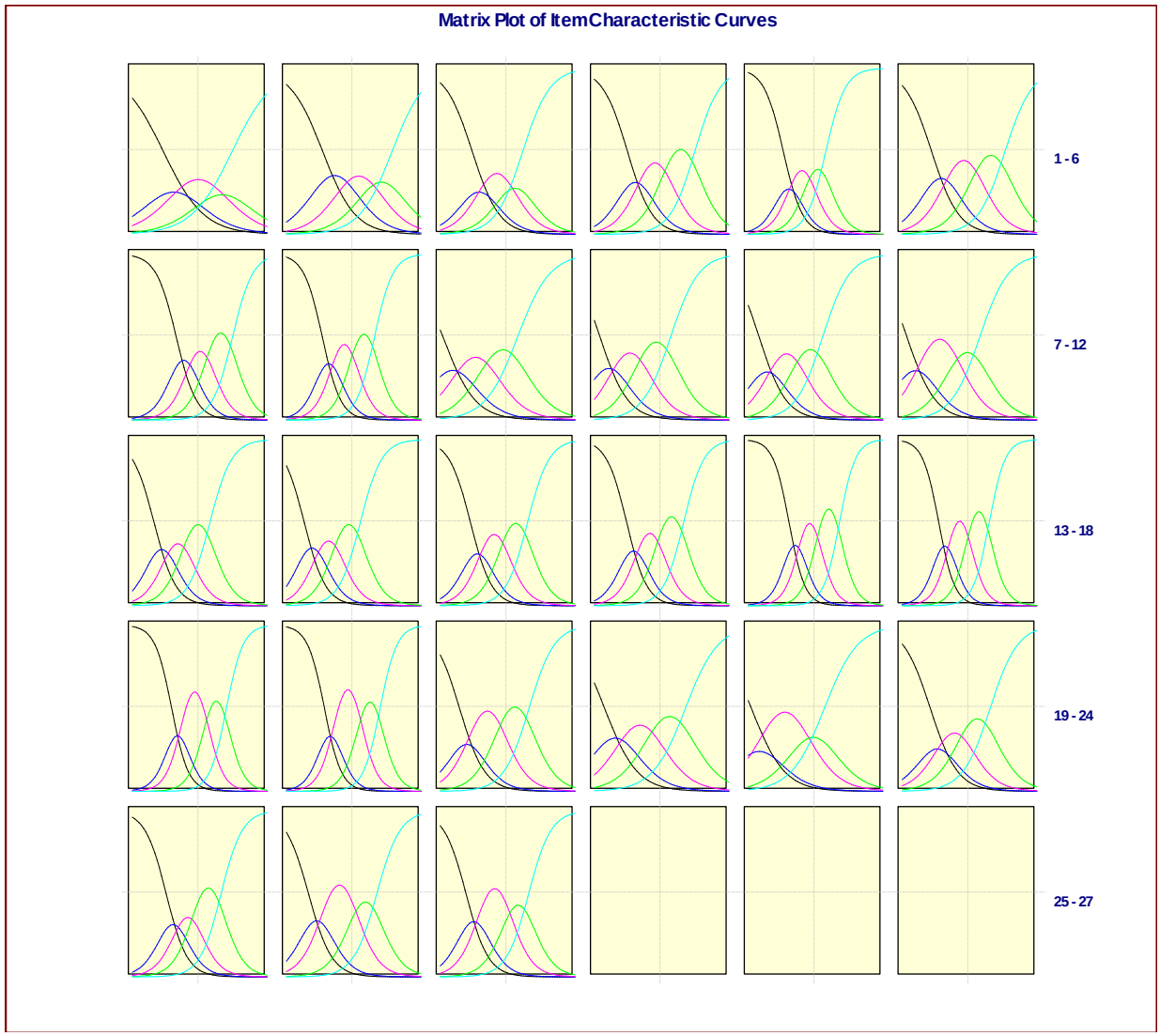

TABLE 4
Discrimination (*a*) and Difficulty (*b*) Indices for IRT Analysis of OE Items

Item	*a*	b_1	b_2	b_3	b_4
OC27	1.10	-1.63	-0.68	0.56	1.44
OC28	1.37	-1.39	-0.31	0.76	1.71
OC29	1.65	-1.58	-0.95	-0.02	0.67
OC25	1.79	-1.53	-0.81	0.22	1.48
OC26	2.32	-1.44	-0.96	-0.26	0.46
TR30	1.64	-1.70	-0.84	0.32	1.58
TR31	2.23	-1.05	-0.37	0.42	1.46
TR32	2.43	-1.40	-0.82	-0.01	0.93
WGE33	1.39	-2.88	-2.00	-0.86	0.44
WGE34	1.60	-2.75	-1.95	-0.88	0.40
WGE35	1.65	-2.52	-1.80	-0.78	0.31
WGE36	1.56	-2.80	-2.01	-0.65	0.45
WGC37	2.05	-2.04	-1.35	-0.59	0.45
WGC38	2.10	-2.20	-1.51	-0.73	0.29
WGC39	2.08	-1.66	-1.04	-0.16	0.88
WGC40	2.22	-1.56	-0.94	-0.10	0.98
LC41	2.83	-1.18	-0.65	0.12	1.06
LC42	2.81	-1.37	-0.84	-0.04	0.87
LC43	2.70	-1.25	-0.74	0.29	1.19
LC44	2.67	-1.31	-0.79	0.28	1.18
JS45	1.78	-2.15	-1.49	-0.31	0.95
JS46	1.37	-2.54	-1.58	-0.35	1.06
JS47	1.35	-2.86	-2.14	-0.61	0.39
JS48	1.64	-1.75	-1.12	-0.22	0.92
JS49	2.12	-1.50	-0.88	-0.18	0.95
OEOC53	1.92	-2.01	-1.28	0.01	1.03
OEOC54	2.01	-1.86	-1.17	0.01	0.93