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WORKER-ORIENTED AND JOB-ORIENTED INSTRUMENTS FOR EVALUATING JOB--ETC(U)
JAN 78 R VINEBERG, E N TAYLOR

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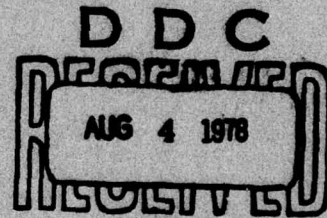
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Worker-Oriented and Job-Oriented Instruments for Evaluating Job Performance

Robert Vineberg
Elaine N. Taylor

Presentation at the
19th Conference of the
Military Testing Association
San Antonio, Texas October 1977



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PREFATORY NOTE

This paper is based on a presentation given at the 19th Conference of the Military Testing Association, October 17-21, 1977, at San Antonio, Texas. The Conference was hosted by the Air Force Human Resources Laboratory and the Air Force Occupational Measurement Center.

Dr. Robert Vineberg and Dr. Elaine N. Taylor are Senior Staff Scientists in the Carmel Research Office of HumRRO's Western Division. The information presented in this paper was developed during the course of research in Project SINBAD, "A Proposed Study of the Job Proficiency of Men in Different Mental Categories: I. Development of an Instrument for Generating Proficiency Profiles."

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WORKER-ORIENTED AND JOB-ORIENTED INSTRUMENTS FOR EVALUATING JOB PERFORMANCE^{1,2}

Robert Vineberg and Elaine N. Taylor

I am going to describe two instruments for obtaining performance ratings. These two instruments have been developed at the task and element level of jobs. These instruments, the Performance Analysis Inventory (PAI) and the Task Proficiency Inventory (TPI) were developed as part of an ONR study concerned with the performance capabilities of men at different aptitude levels. The part of the study concerning aptitude levels has not yet been undertaken.

In developing these instruments, we collected data on men in ten Navy ratings and three pay grades aboard the aircraft carriers *Enterprise* and *Constellation*.

Depending on the job being performed and the type of instrument, the forms contain between 34 and 93 rating items. A particular feature of this study then, is the development of information about performance in many elements of a job, rather than with regard to a few global measures.

The rating instruments are based upon two different models of job analysis. Ernest McCormick (1972) has referred to these approaches as worker-oriented and job-oriented models. A worker-oriented approach focuses on elements of behavior that generalize across tasks and jobs. For example, observing visual displays, obtaining information from written materials, using non-precision tools, activating variable setting controls, following fixed procedures, estimating quantity, analyzing information, or negotiating with people.

A job-oriented approach to job analysis focuses on specific technological elements of job content. For example, repairing carburetors, drafting business letters, annealing copper tubing, organizing stock control functions, or translating Russian newspaper articles.

Forms of our worker-oriented instrument, the PAI, are based upon elements of jobs taken from McCormick's job analysis questionnaire, the Position Analysis Questionnaire or PAQ. The jobs in the study were first analyzed with a modified form of the PAQ that we developed for use in the Navy. Each job was analyzed by rating the relevance or importance of each of 139 possible worker-oriented elements. Then performance rating scales were developed for each element of importance that emerged. (See Table 1, page 4)

This slide shows the jobs in the study and the number of worker-oriented items included in the various forms of the Performance Analysis Inventory for obtaining performance evaluations.

Forms of our job-oriented rating instrument, the Task Proficiency Inventory, were based on task inventory data furnished by the Navy Occupational Task Analysis Program (NOTAP). Here, we used existing task analysis data to identify elements of performance to be evaluated. (See Overlay to Table 1, page 4)

¹ Paper presented at 1977 Military Testing Association Conference, San Antonio, Texas, 17-21 October 1977.

² Sponsored by the Naval Education and Training Command and the Personnel and Training Research Program, Office of Naval Research, Contract N00014-75-C-0938 (NR 156-047). The project monitor was Dr. Marshall Farr, Director, Personnel and Training Research Program.

This overlay adds the number of job-oriented items included in the various forms of the Task Proficiency Inventory for obtaining performance evaluations. Here, separate instruments were developed by pay grade where such job analysis data was available. At the time we constructed the scales, NOTAP job analysis data were not available for Electrician's Mate, Hull Maintenance Technician, and Interior Communications. The essential feature of both methodologies is that performance is defined and evaluated in terms of very specific behavioral or technological referents. (See Table 2, page 5)

This slide shows some sample items from the worker-oriented PAI for Aviation Boatswain's Mate — Equipment. (See Table 3, page 6)

This slide shows some sample items from the job-oriented TPI for the same job.

To provide a basis for item analysis, performance data were obtained for 569 incumbents in the ten jobs. For comparative purposes, we also obtained Performance Evaluation Report scores. This is the instrument that is used operationally in the Navy for evaluating a man's performance. (See Figure 1a, page 7)

This slide shows frequency distributions of scale value usage for E-3 and E-4 on the different instruments. The worker-oriented PAI and the job-oriented TPI have 7-point scales, while the Performance Evaluation Report has ten-point scales. The distributions are displayed with the mid-points of the scales coinciding in order to avoid the distortion that occurs if data from one type of scale are expressed in terms of the other.

The PAI and TPI show less skew than the operational instrument, but it must be pointed out that here we are comparing experimental and operational data. Obviously, we do not know what characteristics our instruments would demonstrate if they were administered on a continuing basis by military personnel. (See Figure 1b, page 8)

This slide shows the distributions for E-5 and all pay grades combined. As always, skewness increases with grade. The job element or task level approach has not overcome this problem. Frequency data in the handout shows respectable distributions for our instruments at the E-3 level, but deterioration setting in at the E-4 level.

The handout also contains tables of means, standard deviations of subject means, subject standard deviations, and item standard deviation. These analyses were undertaken to look for relative leniency, halo, and discrimination between the two experimental rating instruments. Comparisons among these statistics show less leniency and halo and better discrimination for the worker-oriented scales than the job-oriented scales. (See Tables 4-14, pages 9-16)

This completes my presentation. We presently are awaiting permission to use these instruments in the second phase of our study to collect data on the performance of men at different aptitude levels.

Reference

Ernest J. McCormick, Paul R. Jeanneret, and Robert C. Mecham, "A study of job characteristics and job dimensions as based on the position analysis questionnaire (PAQ), monograph, *Journal of Applied Psychology*, Vol. 56, No. 4, August 1972.

**WORKER-ORIENTED AND JOB-ORIENTED INSTRUMENTS
FOR EVALUATING JOB PERFORMANCE^{1,2}**

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TABLES AND FIGURES

¹Paper presented at 1977 Military Testing Association Conference, San Antonio, Texas, 17-21 October 1977.

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Table 1

**Number of Items in the Performance Analysis Inventory (PAI)
And the Task Proficiency Inventory (TPI) by Navy Job and Pay Grade**

(Overlay to Table 1)

NAVY JOB	PAI	TPI		
		E3	E4	E5
Aviation Boatswain's Mate				
Equipment (ABE)	56	40	40	63
Fuel (ABF)	49	40	40	50
Handling (ABH)	56	40	40	50
Aviation Ordnance (AO)	45	54	40	51
Electrician's Mate (EM)	50	--	--	--
Hull Maintenance Technician (HT)	47	--	--	--
Interior Communication (IC)	49	--	--	--
Mess Management Specialist				
(MS S2 Division)	39	54	40	56
(MS S5 Division)	38	93	68	86
Storekeeper (SK)	34	56	40	61

Table 2

**Sample Items From Worker-Oriented PAI for
Aviation Boatswain's Mate – Equipment**

2. **Work produced using energy-powered tools to perform operations not requiring great accuracy or precision. (Electric grinders and drills, welding equipment, brazing gear, skill saw, etc.)**

Exceptionally Good			Satisfactory			Exceptionally Poor	Never Has to
7	6	5	4	3	2	1	X

3. **Work accomplished using handling devices. (Pouring zinc from ladles, using mechanical fingers, etc.)**

Exceptionally Efficient			Satisfactory			Exceptionally Inefficient	Never Has to
7	6	5	4	3	2	1	X

37. **Remembering information for a brief period of time. (Console recorder, launch valve strobe timer readings, steam pressures, etc.)**

Very Reliable			Satisfactory			Very Unreliable
7	6	5	4	3	2	1

41. **Being aware of and alert to the condition/quality of equipment material, or weapon systems. (For example, condition of components in catapult and recovery gear, etc.)**

Exceptionally Aware			Satisfactory			Exceptionally Unaware
7	6	5	4	3	2	1

42. **Being accurate in transcribing. (Copying or posting data or information for later use; water brake readings, fluid history reports, etc.)**

Exceptionally Accurate			Satisfactory			Very Inaccurate	Never Has to
7	6	5	4	3	2	1	X

53. **Obtaining job information by seeing differences using far vision. (Deck edge operator, aircraft identification to determine correct settings for arresting gear, etc.)**

Exceptionally Good			Satisfactory			Exceptionally Poor	Never Has to
7	6	5	4	3	2	1	X

Table 3

Sample Items From Job-Oriented TPI for
Aviation Boatswain's Mate – Equipment

Very Effective	Average					Very Ineffective	Never Has to
7	6	5	4	3	2	1	X

- 17. Applying preservatives to cables (CDPS, purchase cables, bridles, etc.).
- 18. Cleaning hydraulic filters.
- 19. Stowing/breaking out parts/equipment.
- 20. Rigging the barricade.
- 21. Changing bridle arrestor straps.
- 22. Replacing "O" rings in volves/cylinders.
- 23. Painting safety markings on flight deck.
- 24. Repacking the retract valve.
- 25. Maintaining logs/records (catapult, flight deck, fuels, etc.).
- 26. Participating in working parties.
- 27. Functionally checking catapults by firing no-loads.
- 28. Ensuring safety lines are in place during no-load firings.
- 29. Changing purchase cable on "AG" engines (re-reeve).
- 30. Safety wiring equipment/gear/switches.
- 31. Measuring slipper wear.

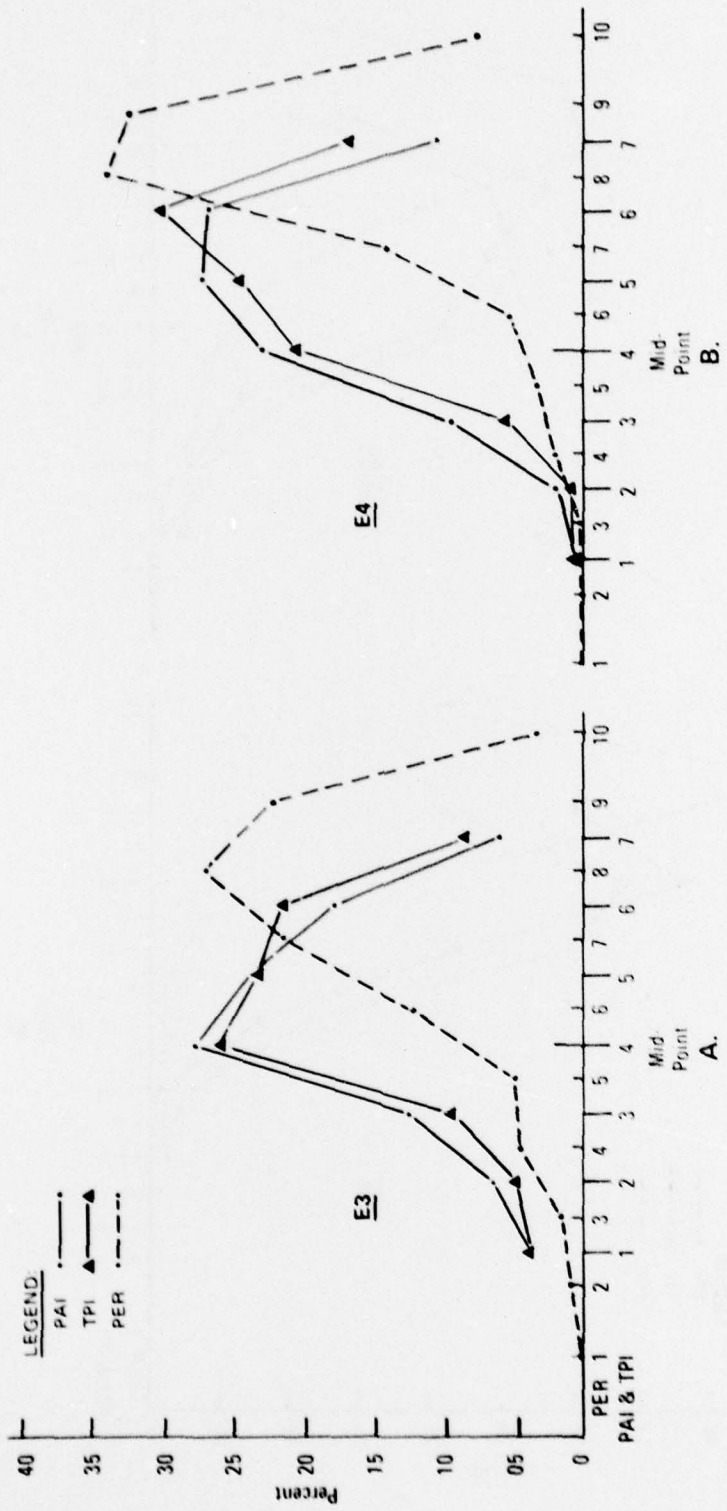


Figure 1a. Frequency Distributions (in %) of Scale Value Usage for Three Rating Instruments Drawn With the Mid-Points of Scales Coinciding

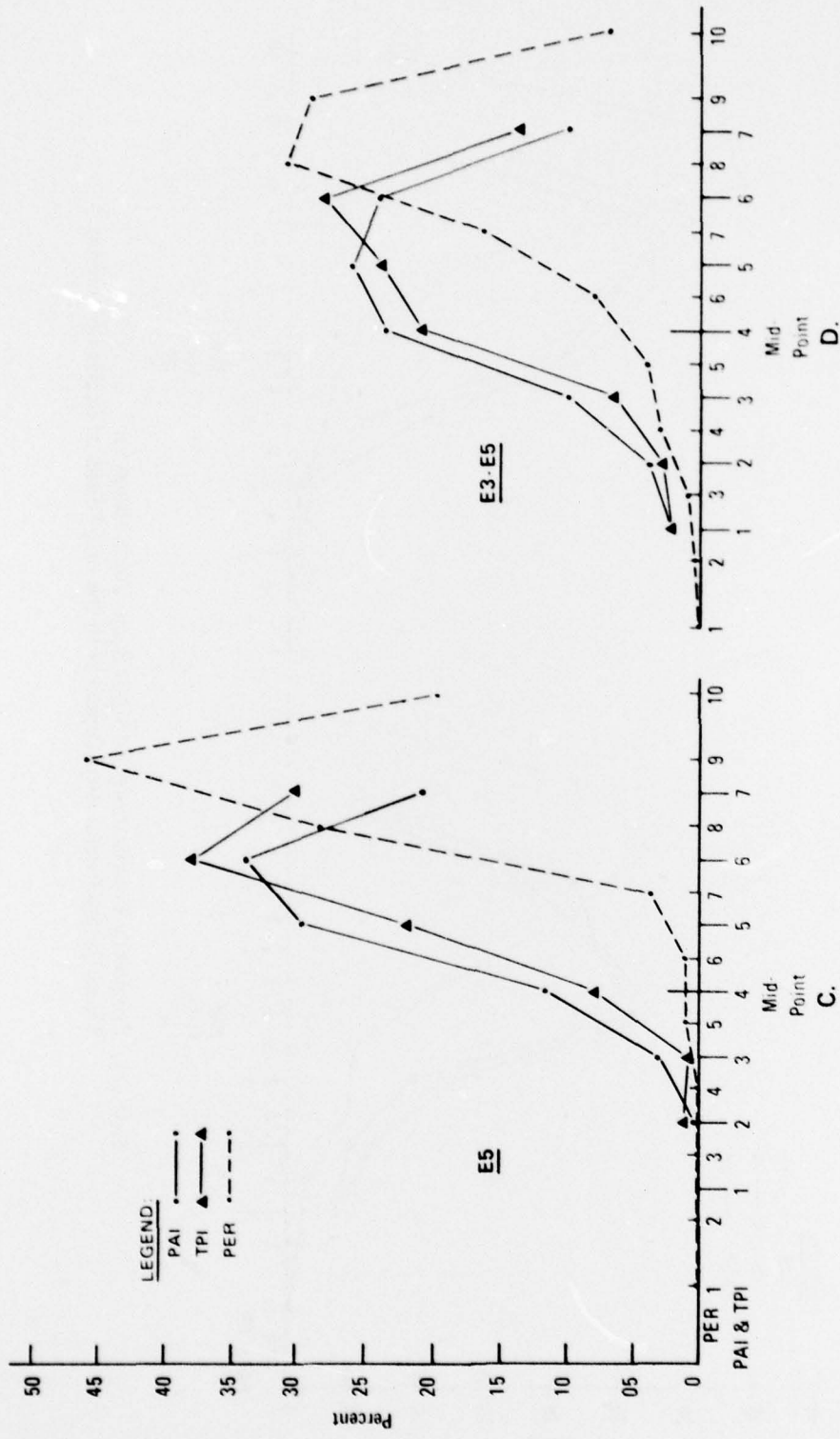


Figure 1b. Frequency Distributions (in %) of Scale Value Usage for Three Rating Instruments Drawn With the Mid-Points of Scales Coinciding.

Table 4

**Frequency of Usage of Scale Values From E3 Data on
Three Rating Instruments (All Navy Jobs, All Items)**

Scale Values	PAI		TPI		PER		
	f	%	f	%	Navy Scale Value	f	%
1	420	4.14	144	4.02	1.0	1	.16
2	686	6.77	180	5.03	2.0	7	1.10
3	1306	12.88	355	9.92	2.6	12	1.88
4	2856	28.18	943	26.35	2.8	31	4.85
5	2394	23.62	851	23.78	3.0	34	5.32
6	1841	18.17	786	21.96	3.2	80	12.52
7	631	6.23	320	8.94	3.4	135	21.13
Never					3.6	174	27.23
Has To	1675		1585		3.8	142	22.22
					4.0	23	3.60
TOTAL *	10134	99.99	3579	100.00		639	100.01

*Totals do not include "Never Has To" perform.

Table 5

**Frequency of Usage of Scale Values From E4 Data on
Three Rating Instruments (All Navy Jobs, All Items)**

Scale Values	PAI		TPI		PER		
	f	%	f	%	Navy Scale Value	f	%
1	95	0.92	37	1.00	1.0	--	--
2	241	2.32	50	1.35	2.0	--	--
3	999	9.63	209	5.63	2.6	4	.46
4	2349	22.65	762	20.53	2.8	18	2.09
5	2821	27.20	909	24.50	3.0	30	3.48
6	2758	26.60	1122	30.23	3.2	47	5.45
7	1107	10.68	622	16.76	3.4	123	14.27
Never					3.6	292	33.88
Has To	683		1444		3.8	279	32.37
					4.0	69	8.01
TOTAL *	10370	100.00	3711	100.00		862	100.01

*Totals do not include "Never Has To" perform.

Table 6

**Frequency of Usage of Scale Values From E5 Data on
Three Rating Instruments (All Navy Jobs, All Items)**

Scale Values	PAI		TPI		PER		
	f	%	f	%	Navy Scale Value	f	%
1	4	0.13	2	0.13	1.0	--	--
2	14	0.46	16	1.07	2.0	--	--
3	98	3.18	13	0.87	2.6	--	--
4	355	11.53	119	7.96	2.8	--	--
5	915	29.71	326	21.79	3.0	1	.98
6	1052	34.16	571	38.17	3.2	1	.98
7	642	20.84	449	30.01	3.4	4	3.92
Never					3.6	29	28.43
Has To	118		459		3.8	47	46.08
					4.0	20	19.61
TOTAL*	3080	100.01	1496	99.99		102	100.00

*Totals do not include "Never Has To" perform.

Table 7

**Frequency of Usage of Scale Values From E3-E5 Data on
Three Rating Instruments (All Navy Jobs, All Items)**

Scale Values	PAI		TPI		PER		
	f	%	f	%	Navy Scale Value	f	%
1	519	2.20	183	2.08	1.0	1	.06
2	941	3.99	246	2.80	2.0	7	.44
3	2403	10.19	577	6.57	2.6	16	1.00
4	5560	23.58	1824	20.76	2.8	49	3.06
5	6130	25.99	2086	23.74	3.0	65	4.06
6	5651	23.96	2479	28.22	3.2	128	7.99
7	2380	10.09	1391	15.83	3.4	262	16.34
Never					3.6	495	30.88
Has To	2416		3488		3.8	468	29.20
					4.0	112	6.99
TOTAL*	23584	100.00	8786	100.00		1603	100.02

*Totals do not include "Never Has To" perform.

Table 8

**Means and Standard Deviations of Subject Means on
Three Rating Instruments**

E3	Mean			Standard Deviation			N PAI & TPI	N PER	Raw PER Mean
	PAI	TPI	Converted PER	PAI	TPI	PER			
ABE	4.44	4.71	5.05	1.29	1.26	.94	46	29	3.42
ABF	4.13	4.35	5.35	1.23	1.13	.68	23	13	3.51
ABH	4.64	4.97	5.22	1.18	1.04	1.06	42	33	3.47
AO	4.30	4.77	5.28	1.52	1.37	.83	37	24	3.49
EM	4.36	--	4.94	1.00	--	1.19	17	13	3.35
HT	4.29	--	5.78	1.28	--	.66	19	9	3.63
IC	4.73	--	5.39	.75	--	.33	8	6	3.52
MS S2	3.47	3.82	4.86	1.22	1.29	1.20	20	12	3.36
MS S5	4.29	4.56	5.38	1.33	1.34	.90	33	17	3.52
SK	4.16	4.63	4.77	1.23	1.03	.88	10	5	3.30
<u>E4</u>									
ABE	5.19	5.25	5.51	.89	.92	.73	22	12	3.55
ABF	5.00	5.14	5.67	.87	.92	.64	28	18	3.60
ABH	5.31	5.31	6.01	1.12	1.12	.45	30	24	3.70
AO	4.87	5.02	5.69	1.29	1.27	.63	36	28	3.61
EM	4.40	--	5.26	1.10	--	.67	31	30	3.48
HT	4.76	--	5.63	.88	--	.94	24	22	3.60
IC	4.45	--	5.30	.99	--	.63	15	13	3.49
MS S2	5.01	5.12	5.73	1.09	1.03	.64	23	16	3.62
MS S5	5.51	5.90	6.49	.56	.64	.59	12	8	3.85
SK	5.12	5.66	5.97	.87	.72	.53	18	14	3.69
<u>E5</u>									
ABE	5.45	5.58	6.50	.99	.87	NC*	9	3	3.89
ABF	5.61	5.74	5.87	.63	.59	.17	8	4	3.66
ABH	5.78	5.86	**	NC	NC	**	3	**	**
AO	6.20	6.14	**	1.00	1.07	**	5	**	**
EM	5.03	--	6.07	.26	--	.58	10	4	3.72
HT	NC	--	NC	NC	--	NC	2	2	NC
IC	4.67	--	NC	NC	--	NC	3	2	NC
MS S2	5.35	5.54	NC	.85	.86	NC	11	1	NC
MS S5	6.00	6.26	**	.87	.60	**	17	**	**
SK	5.32	5.73	6.23	1.19	1.09	.61	7	4	3.77
<u>E3 E5</u>									
ABE	4.77	4.96	5.28	1.22	1.16	.98	77	45	3.49
ABF	4.74	4.91	5.57	1.12	1.08	.64	59	35	3.57
ABH	4.95	5.14	5.55	1.19	1.07	.94	75	57	3.57
AO	4.69	4.97	5.51	1.45	1.34	.75	78	52	3.55
EM	4.49	--	5.22	1.00	--	.87	58	48	3.47
HT	4.62	--	5.72	1.05	--	.86	45	34	3.62
IC	4.56	--	5.35	.87	--	.56	26	22	3.51
MS S2	4.51	4.72	5.36	1.35	1.30	.98	54	29	3.51
MS S5	5.00	5.28	5.74	1.34	1.32	.96	62	25	3.62
SK	4.89	5.38	5.78	1.12	.99	.81	35	23	3.63
OVERALL	4.73	5.04	5.49	1.23	1.20	.86	PAI 569	370	
							TPI 440		

*The number of cases was so low that the statistic was not computed where NC is shown.

**No data were available.

Table 9

**Number of Times Means on
One Rating Instrument Exceed Another**

	<u>PAI > TPI</u>	<u>PAI > PER</u>	<u>TPI > PER</u>
E3	0/7	0/10	0/7
E4	0/6*	0/10	0/7
E5	1/7	0/7**	0/4**

*A tie occurred in one comparison.

**PER data were not available for 3 Navy jobs, thus reducing the number of comparisons that could be made between PAI and PER to 7, and between TPI and PER to 4.

Table 10

**Number of Times Standard Deviations of
Means on One Rating Instrument Exceed Another**

	<u>PAI > TPI</u>	<u>PAI > PER</u>	<u>TPI > PER</u>
E3	5/7	9/10	6/7
E4	3/6	8/10	7/7
E5	4/6	2/3	2/2

Table 11

**Mean of Subject Standard Deviations for
Three Rating Instruments**

	<u>E3</u>	<u>E4</u>	<u>E5</u>	<u>E3-E5</u>
<u>PAI</u>				
ABE	0.84	0.94	0.59	0.84
ABF	0.72	0.67	0.69	0.69
ABH	0.86	0.74	0.63	0.80
AO	0.65	0.67	0.73	0.67
EM	0.75	0.79	0.68	0.76
HT	0.55	0.64	NC*	0.60
IC	0.71	0.71	0.75	0.71
MS-S2	0.70	0.71	0.62	0.69
MS-S5	0.69	0.68	0.60	0.66
SK	0.76	0.73	0.66	0.73
<u>TPI</u>				
ABE	0.80	0.83	0.77	0.81
ABF	0.76	0.66	0.65	0.70
ABH	0.74	0.78	0.69	0.75
AO	0.61	0.68	0.62	0.64
EM	**	**	**	**
HT	**	**	**	**
IC	**	**	**	**
MS-S2	0.62	0.71	0.56	0.65
MS-S5	0.57	0.61	0.56	0.57
SK	0.51	0.67	0.66	0.62
<u>PER</u>				
ABE	0.47	0.66	0.29	0.51
ABF	0.67	0.48	0.31	0.54
ABH	0.60	0.47	NC	NC
AO	0.50	0.54	NC	NC
EM	0.47	0.60	0.66	0.57
HT	0.36	0.44	NC	NC
IC	0.56	0.52	NC	NC
MS-S2	0.43	0.47	NC	NC
MS-S5	0.33	0.33	NC	NC
SK	0.47	0.35	0.46	0.40

*The number of cases was so low, that the statistic was not computed where NC is shown.

**No data were available.

Table 12

**Number of Times Average Subject Standard Deviations on
One Rating Instrument Exceed Another for a
Given Pay Grade**

	<u>PAI > TPI</u>	<u>PAI > PER</u>	<u>TPI > PER</u>
E3	6/7	10/10	7/7
E4	4/6	10/10	7/7
E5	5/7	4/4	3/3

Table 13

Mean of Item Standard Deviations for Three Rating Instruments

	<u>E3</u> \bar{x}_{SD}	<u>E4</u> \bar{x}_{SD}	<u>E5</u> \bar{x}_{SD}	<u>E3-E5</u> \bar{x}_{SD}
PAI				
ABE	1.52	1.18	1.14	1.42
ABF	1.38	1.09	0.88	1.26
ABH	1.40	1.27	0.62	1.36
AO	1.60	1.42	1.17	1.56
EM	1.26	1.35	0.74	1.21
HT	1.42	1.12	0.16	1.24
IC	1.03	1.15	0.86	1.10
MS S2	1.36	1.31	1.00	1.49
MS S5	1.39	0.85	0.98	1.31
SK	1.34	1.07	1.23	1.27
TPI				
ABE	1.45	1.19	1.07	1.28
ABF	1.26	1.15	0.81	1.24
ABH	1.26	1.27	0.49	1.09
AO	1.52	1.44	0.97	1.18
EM	**	**	**	**
HT	**	**	**	**
IC	**	**	**	**
MS S2	1.52	1.22	0.96	1.45
MS S5	1.52	0.80	0.84	1.21
SK	1.05	1.00	1.05	0.98
PER				
ABE	1.05	0.88	0.38	1.03
ABF	0.72	0.78	0.40	0.81
ABH	1.07	0.60	NC*	0.98
AO	1.05	0.82	NC	0.94
EM	1.36	0.88	0.75	1.05
HT	0.61	1.02	0.28	0.97
IC	0.55	0.81	0.56	0.75
MS S2	1.26	0.80	NC	1.03
MS S5	0.98	0.61	NC	0.92
SK	1.03	0.70	0.78	0.92

*The number of cases was so low, that the statistic was not computed where NC is shown.

**No data were available.

Table 14

**Number of Times Average Item Standard Deviations on
One Rating Instrument Exceed Another for a
Given Pay Grade**

	<u>PAI > TPI</u>	<u>PAI > PER</u>	<u>TPI > PER</u>
E3	7/9	9/10	7/7
E4	3/6	10/10	7/7
E5	7/7	5/7	4/4