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Psychometric Evaluation of the Navy-Wide Personnel Survey: Development and Validation of Short Forms

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Foreword

The Navy-wide Personnel Survey (NPS) is the major product of the Navy-wide Survey Program (NWSP). Administered regularly since 1990 by the Navy Personnel Research, Studies, and Technology (NPRST) Division of the Bureau of Naval Personnel (BUPERS), the NPS focuses on such topics as: Sailor demographics, leadership satisfaction, organizational commitment, performance evaluations, morale, detailing, assignments, job characteristics, job satisfaction, career development, availability of resources, gender integration, and overall satisfaction with Navy life. This information provides valuable current Navy personnel policies and programs. The NPS is conducted under the sponsorship of the Chief of Naval Personnel (N1) within the NWSP funding line. That funding line is managed by the N1 Modeling and Analysis Branch (N104) of BUPERS. Because of the critical role NPS has in other Navy surveys and polls, the data were analyzed in detail using advanced statistical techniques to develop reliable and valid scales and indexes. The current report describes the development and validation of short forms of the longer NPS scales. Any questions regarding this report should be directed to the NPS Project Director, Dr. Kimberly Whittam, kimberly.whittam@navy.mil, (901) 874-2321 or DSN 882-2321.

DAVID L. ALDERTON, Ph.D.
Director

Executive Summary

The Navy-wide Personnel Survey (NPS) is one of the most comprehensive sources of data concerning Navy Sailors' perceptions of the quality of Navy work life and how it impacts them, their families, and the Navy organization as a whole. With rich data sources, such as the NPS, a common challenge is developing methods for combining and presenting the data, so that the results can be easily disseminated and effectively used. An earlier report described how items on the NPS may be combined into 19 psychometric scales, representing the following constructs: (1) availability of resources, (2) morale, (3) gender integration, (4) workplace climate, (5) tempo, (6) impact on personal life, (7) immediate supervisor, (8) command leadership, (9) communication, (10) job security, (11) fairness, (12) Navy image, (13) organizational commitment, (14) advancement/promotion, (15) performance evaluations/fitness reports, (16) recognition, (17) career progression, (18) career counseling/guidance, and (19) detailing (Bann, Whittam, & Barnett-Walker, 2006). Each of these scales demonstrated good psychometric properties.

In addition to developing a set of reliable and valid individual scales, an overall measure of Navy Climate was developed. The Navy Climate Index (NCI) is designed to be a single metric that captures the Navy's overall "temperature" or "climate" both currently and with a view towards the future. The NCI combined the following seven scales which represented indicators influencing Navy Climate: (1) workplace climate, (2) organizational commitment, (3) morale, (4) job security, (5) communication, (6) fairness, and (7) Navy image. Scores on the NCI were significantly, positively related to several outcomes, including perceptions of Navy tone, job satisfaction, and retention intentions.

Earlier results suggested that the individual construct scales and the Navy Climate Index provide useful, reliable, and valid measures for assessing Sailors' perceptions of the Navy experience. However, the 19 individual scales are comprised of 95 items. Administering a large number of items can reduce potential measurement error of the scales, resulting in greater reliability and validity. However, in some cases, shorter scales may provide important practical benefits that may outweigh a loss in reliability or validity, including reduced time and costs for survey administration, lower respondent burden, and improved response rates.

This report briefly outlines our exploration of potential short forms for the 19 scales on the 2005 Navy-wide Personnel Survey. Our primary goal was to develop 1-item measures for each of the scales which could be administered when time and/or respondent burden is of particular concern. Using both statistical and content-based criteria, we successfully developed 14 1-item short forms. Short forms for four of the remaining scales contained two items each and the short form for the final scale contained five items, primarily due to concerns about ensuring content coverage. Each of the short forms accounted for at least 70 percent of the variance in the long form scores and contained items with high levels of discrimination, no floor or ceiling effects, and appropriate content.

In addition to developing short forms for each of the individual scales, a short form for the Navy Climate Index was also developed, referred to as the NCI-SF. Confirmatory factor analyses supported combining the short forms of seven scales (Workplace Climate, Organizational Commitment, Morale, Job Security, Communication, Fairness, and Navy Image) into a single NCI-SF score. The NCI-SF demonstrated similar relationships with other variables (i.e., demographics, tone, job satisfaction, and retention intentions) as the NCI long form, supporting its validity. Furthermore, the NCI-SF was strongly, positively correlated with the NCI ($r = 0.97$) and accounted for 94 percent of the variance in the NCI scores.

In conclusion, the results suggest that several of the scales on the NPS may be substantially shortened, in some cases, with minimal loss of reliability. In particular, the findings suggest that reducing the length of the Navy Climate Index by 73 percent (i.e., removing 35 of the 48 items on the NCI) produces nearly identical scores, given the high correlation between the long and short forms of the NCI. The new 13-item NCI-SF that was developed could be administered as a part of a Navy Quick Poll to provide Navy leadership with rapid feedback concerning Navy climate. Future studies should explore the development of appropriate cut-points or benchmarks for the NCI-SF in relation to important outcomes, such as retention intentions.

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Background

The Navy-wide Personnel Survey (NPS) is one of the most comprehensive sources of data concerning Navy Sailors' perceptions of the quality of Navy work life and how it impacts them, their families, and the Navy organization as a whole. With rich data sources, such as the NPS, a common challenge is developing methods for combining and presenting the data, so that the results can be easily disseminated and effectively used. An earlier report described how items on the NPS may be combined into 19 psychometric scales, representing the following constructs: (1) availability of resources, (2) morale, (3) gender integration, (4) workplace climate, (5) tempo, (6) impact on personal life, (7) immediate supervisor, (8) command leadership, (9) communication, (10) job security, (11) fairness, (12) Navy image, (13) organizational commitment, (14) advancement/promotion, (15) performance evaluations/fitness reports, (16) recognition, (17) career progression, (18) career counseling/guidance, and (19) detailing (Bann, Whittam, & Barnett-Walker, 2006). Each of these scales demonstrated good psychometric properties.

In addition to developing a set of reliable and valid individual scales, an overall measure of Navy Climate was developed. The Navy Climate Index (NCI) is designed to be a single metric that captures the Navy's overall "temperature" or "climate" both currently and with a view towards the future. The NCI combined the following seven scales which represented indicators influencing Navy Climate: (1) workplace climate, (2) organizational commitment, (3) morale, (4) job security, (5) communication, (6) fairness, and (7) Navy image. Scores on the NCI were significantly, positively related to several outcomes, including perceptions of Navy tone, job satisfaction, and retention intentions.

The results suggested that the individual construct scales and the Navy Climate Index provide useful, reliable, and valid measures for assessing Sailors' perceptions of the Navy experience. However, these scales require the administration of a large number of items. The 19 individual scales are comprised of 95 items. Reducing the survey to only the scales comprising the Navy Climate Index would still require the administration of 48 items. Administering a large number of items can reduce potential measurement error of the scales, resulting in greater reliability and validity. However, in some cases, shorter scales may provide important practical benefits that may outweigh a loss in reliability or validity. Shorter scales reduce the time and costs of survey administration. They also lower respondent burden and can be particularly useful in situations, such as in times of high operational activity, when the time for completing a survey may be limited. Furthermore, several studies have found an inverse relationship between survey length and response rates with shorter surveys having higher response rates (e.g., Kalantar & Talley, 1999; McCarty, House, Harman, & Richards, 1999; Steele, Schwendig, & Kilpatrick, 1992; Tomaskovic-Devey, Leiter, & Thompson, 1994). Finally, even if the length of a survey were to remain the same, the use of shorter scales would allow other scales to be added to the survey, enabling the assessment of more constructs within the same time period.

This study explored reducing the length of the 19 NPS scales with the goals of lowering respondent burden, reducing survey administration time and costs, and increasing response rates.. The primary focus was on assessing the feasibility of using single-item scales. Both statistical and content criteria were considered when developing the short forms of the scales. After reducing the size of the individual scales, a short form of the Navy Climate Index was developed which may be used for a rapid assessment of the current Navy climate.

Scale Short Forms

This provides an overview of the development and psychometric evaluation of short forms for the 19 scales included on the 2005 Navy-wide Personnel Survey. The 2005 NPS was administered on the Internet between March 20 and June 20, 2005 to a stratified random sample of 16,372 active duty Sailors. There were a total of 3,610 usable surveys which, after adjusting for incomplete surveys and non-contacts, resulted in an overall response rate of 26 percent (unweighted) and 37 percent (weighted to the population).

To develop the short forms, researchers examined several psychometric properties of the individual items, including their means, standard deviations, and item response theory (IRT) parameters, and assessed the relationship between the short and long forms of the scales, using ordinary least squares regression. Before beginning the short form development and evaluation process, the following criteria was established for a short form scale to be considered an acceptable substitute for the long form scale:

Ceiling and/or Floor Effects. To avoid potential ceiling or floor effects, the items selected for the short forms should not have means that are near the minimum or maximum possible scores.

Variability in Item Responses. The standard deviations for each item as a measure of the variability in item responses were examined. Items for which all respondents respond similarly are not informative and should not be included on the short form.

Item Response Theory Parameters. In an earlier report, IRT parameters were computed for each item using the graded response model (Samejima, 1969). Items comprising each short form must have an IRT slope of one or greater, indicating good discrimination, and a spread of IRT threshold parameters.

Variability in Long Form Scores. Each short form was regressed on the long form scores to determine the percentage of variability in the long form scores accounted for by the short form scores. Scores on the short form were required to account for at least 70 percent of the variance in the long form scores to be an acceptable short form.

Content Considerations. In addition to the statistical properties of the items, the content of the items was evaluated when developing the short forms. Overall, researchers sought to select items that had general, rather than specific, content. General items capture participants' broader perspectives of a construct rather than

restricting them to specific elements of the construct. For example, all else being equal, item 23F (satisfied with immediate supervisor), a general item on the Immediate Supervisor scale, should more effectively capture participants' overall perceptions of their immediate supervisor than a more specific item, such as item 23A (adequate training/expertise), which would assess only the participant's perceptions of his/her supervisor's training and could miss other important aspects of the supervisor's performance, such as his/her responsiveness to concerns and interactions with others.

Ideally, the scales could be reduced to the shortest scale possible, namely a 1-item scale. Research began by testing individual items to determine their suitability as 1-item scales. However, if none of the items were considered adequate as a one-item scale, based on the criteria outlined above, a scale with two or more items was then developed. The following sections described the short form development and evaluation for each of the 19 scales.

Availability of Resources

To develop a short form for the Availability of Resources scale, researchers began by examining the item descriptive statistics shown in Table 1. Overall, the four items on the scale demonstrate good psychometric properties (i.e., no ceiling or floor effects, high IRT slopes, and spread of IRT threshold parameters). However, none of the items individually accounted for at least 70 percent of the variance in the long form scores and therefore, would not be suitable as 1-item scales.

When reviewing the content of the items, it appears that they split into two general content areas: (1) people-oriented resources (item 8A [adequate qualified personnel] and item 8D [adequate Navy support services]), and (2) equipment-related resources (item 8B [adequate tools] and item 8C [adequate spare parts and/or supplies]). To ensure that both content areas were covered, a 2-item short form was developed, containing one item from each content area. Item 8A (adequate qualified personnel) was selected to represent people-oriented resources because it has a higher threshold parameter and accounts for a greater percentage of variance in long form scores than item 8D (adequate Navy support services). While item 8B (adequate tools) has a higher threshold parameter and accounts for slightly more variance than item 8C (adequate spare parts and/or supplies), item 8C also performs well and was selected for inclusion in the short form, given prior results from the NPS and anecdotal evidence which suggests spare parts are a particularly salient concern among Sailors.

Scores for the resulting 2-item short form were computed, using the mean of responses to items 8A and 8C. The short form accounts for 84 percent of the variance in the Availability of Resources long form scores. To graphically represent the relationship between the short and long forms, the mean long form scores were plotted according to five categories based on mean responses to the short form. The mean short forms were placed into categories as follows: (1) strongly disagree (mean of 0.0–0.9), (2) disagree (mean of 1.0–1.9), (3) neither agree nor disagree (mean of 2.0–2.9), (4) agree (mean of 3.0–3.9), and (5) strongly agree (mean of 4.0–5.0). As shown in Figure 1, there is a strong, positive relationship between the two forms with mean long form scores increasing as mean scores on the short form increase.

Table 1
Availability of Resources scale

Item #	Description	% Scale Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q8A	Adequate qualified personnel	57.1	2.15	1.02	1.96	-2.45	-1.45	-0.94	0.84
Q8B	Adequate tools	69.4	2.29	1.02	4.58	-1.89	-1.05	-0.59	0.90
Q8C	Adequate spare parts and/or supplies	64.2	2.63	1.11	2.28	-1.87	-0.90	-0.18	1.43
Q8D	Adequate Navy support services	46.6	2.29	1.03	1.25	-2.91	-1.76	-0.91	1.43

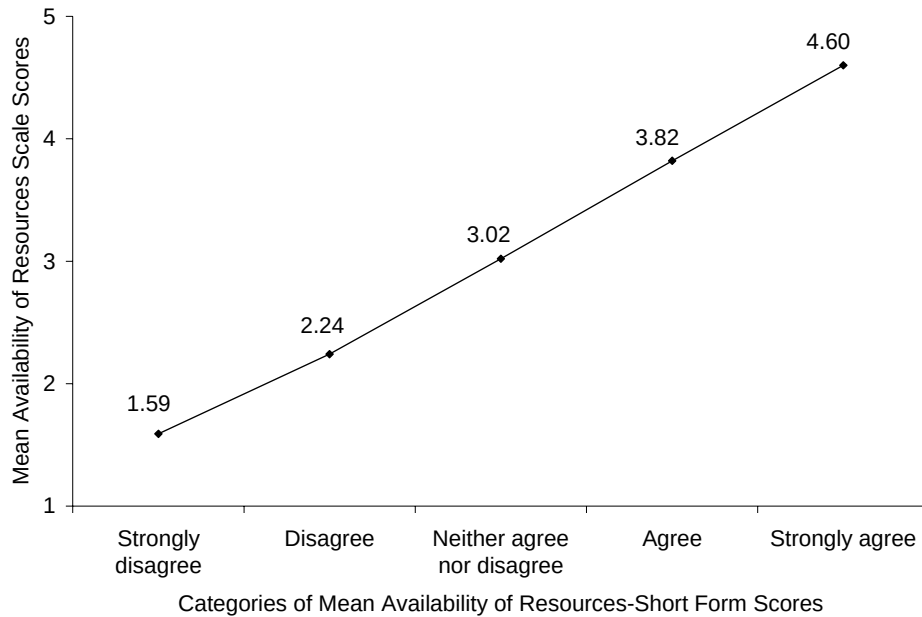


Figure 1. Mean Availability of Resources scale scores by mean short form scores.

Morale

The descriptive statistics for the 16 items comprising the Morale scale are displayed in Table 2. As shown in the table, none of the items accounts for at least 70 percent of the variance in the Morale scale scores. In addition, reviewing the content of the items suggests that they may be measuring multiple aspects of Morale, including performance evaluations (items 10A, 10B, and 10P), supplies (10C), training (items 10D and 10E), co-workers and leaders (items 10F-H, 10K, and 10N), and workload and compensation (items 10I, 10J, 10L, 10M, and 10O). Using a 1-item scale may not capture all of these diverse factors. Therefore, one item from each of the five constructs was included to form a short form. Based on content, percentage of variance accounted for, and the item parameters, the following five items were chosen for inclusion in the Morale short form:

- Item 10B (Performance evaluation system),
- Item 10C (Supply of spare parts/supplies),
- Item 10D (Quality of Navy training programs),
- Item 10H (Command leadership), and
- Item 10J (Workload).

Similar to the Availability of Resources scale, scores for the Morale short form were computed as the mean of the items comprising the scale. The Morale short form accounted for 84 percent of the variance in the long form scores. As shown in Figure 2, there is a strong, positive, linear relationship between the short and long forms.

Table 2
Morale scale

Item #	Description	% Scale Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q10A	Advancement/promotion opportunities	31.8	2.61	1.06	1.20	-2.90	-1.22	-0.25	2.16
Q10B	Performance evaluation system	39.8	2.66	0.99	1.50	-2.59	-1.11	-0.06	2.24
Q10C	Supply of spare parts/supplies	32.3	2.98	0.93	1.27	-2.69	-0.93	0.82	3.14
Q10D	Quality of Navy training programs	41.5	2.57	0.90	1.64	-2.65	-1.41	-0.12	2.21
Q10E	Quality of education programs	36.6	2.33	0.90	1.48	-2.97	-1.84	-0.54	1.72
Q10F	Co-workers/shipmates	37.7	2.26	1.00	1.47	-2.88	-1.51	-0.79	1.35
Q10G	Immediate supervisor	39.9	2.33	1.08	1.57	-2.36	-1.34	-0.62	1.26
Q10H	Command leadership	48.9	2.51	1.19	1.89	-1.83	-0.91	-0.32	1.21
Q10I	Pace of work	50.6	2.82	1.08	2.34	-1.68	-0.65	0.08	1.87
Q10J	Workload	51.0	2.96	1.12	2.27	-1.50	-0.50	0.26	1.92
Q10K	Unit/workgroup manning	44.9	2.98	1.10	1.87	-1.66	-0.53	0.33	2.21
Q10L	Pay/bonuses/other compensation	30.8	2.63	1.01	1.16	-2.74	-1.59	0.04	2.29
Q10M	Amount of time off	46.5	2.66	1.20	1.77	-1.69	-0.81	-0.17	1.50
Q10N	Navy support services	26.9	2.56	0.97	1.17	-2.95	-1.72	-0.16	2.36
Q10O	TEMPO	33.3	3.10	1.07	1.30	-1.87	-0.72	0.97	2.57
Q10P	Performance of crew, work team on exercises	34.9	2.36	0.85	1.43	-3.22	-2.04	-0.42	1.88

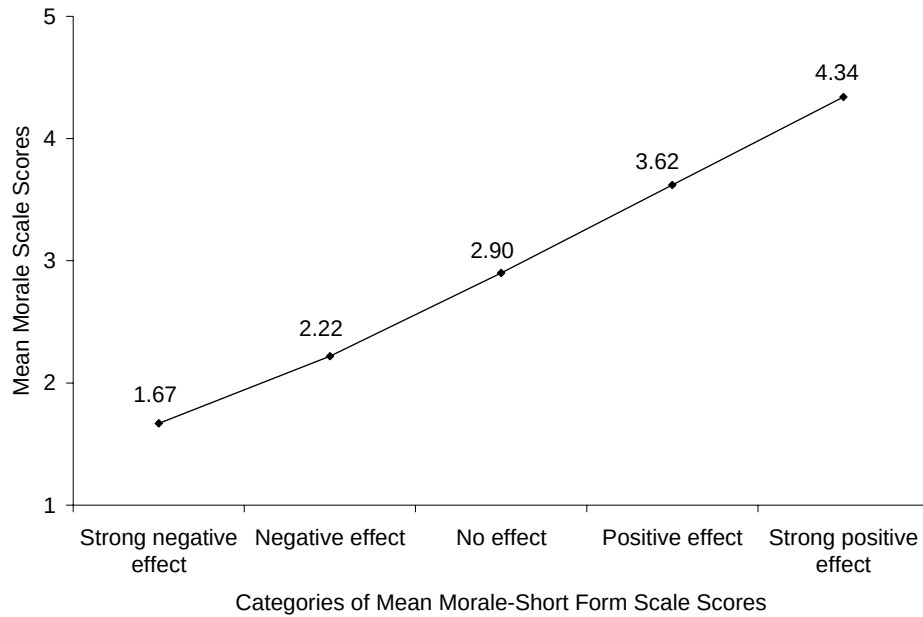


Figure 2. Mean Morale scale scores by mean short form scores.

Gender Integration

As shown in Table 3, items 12B (women have ability to carry out combatant roles) and 12C (women are being successfully integrated) each individually account for approximately 72 percent of the variance in the Gender Integration scale. Both have high slope parameters, mid-range mean values, and variability in item responses. Item 12C was selected for use as the 1-item Gender Integration scale due to focus on gender integration in general rather than specifically in combat roles. Figure 3 plots the mean Gender Integration scale scores by responses to item 12C. The strong, linear relationship in the graph supports the equivalence of the 1-item short form and the Gender Integration scale long form.

Table 3
Gender Integration scale

Item #	Description	% Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q12A	Supportive leadership	63.3	1.90	0.90	1.78	-2.91	-2.20	-1.19	0.46
Q12B	Women have ability to carry out combatant roles	72.5	2.05	0.98	3.38	-2.03	-1.51	-0.76	0.52
Q12C	Women are being successfully integrated	72.4	2.21	0.96	2.82	-2.13	-1.54	-0.58	0.84

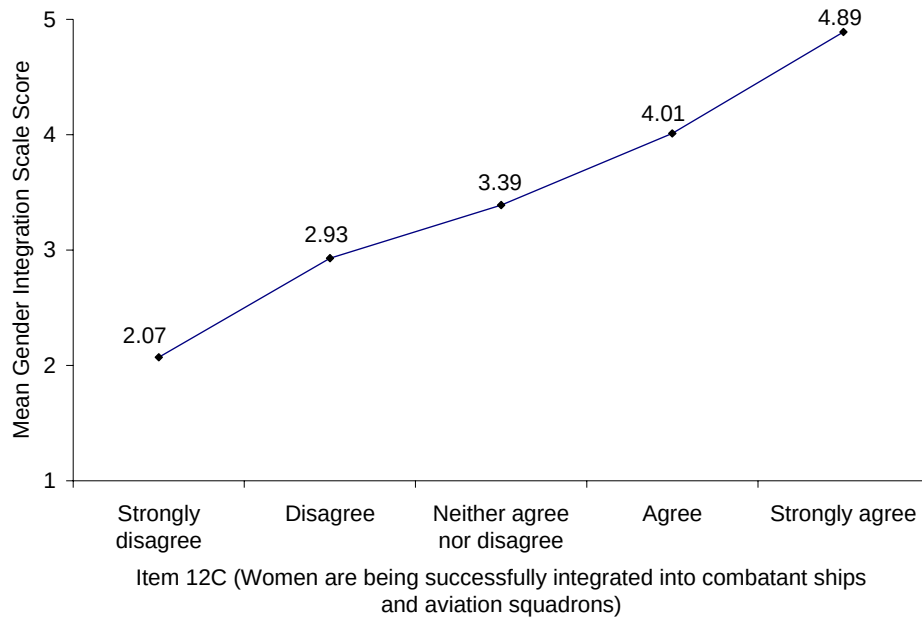


Figure 3. Mean Gender Integration scale scores by 1-item gender integration measure.

Workplace Climate

The item-level descriptive statistics for the Workplace Climate scale are presented in Table 4. None of the items on the scale accounts for at least 70 percent of the variance in the long form scores by itself; however, item 13D (opportunity for personal growth and development on the job) accounts for 66 percent of the scale variance. To construct a 2-item short form, item 13D was selected first based on the large percentage of variance for which it accounts and its large IRT slope (α) parameter. The remaining items were then examined with large slope parameters and selected item 13B (amount of responsibility I have in my job) for the second item on the scale. This 2-item short form demonstrated a strong relationship with the long form scores (see Figure 4) and accounted for 80 percent of the variance in the long form scores.

Table 4
Workplace Climate scale

Item #	Description	% Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q13A	Amount of freedom I am given to do my job	55.9	2.11	1.03	2.19	-2.36	-1.29	-0.77	0.70
Q13B	Amount of responsibility I have in my job	61.4	2.02	0.96	3.28	-2.18	-1.30	-0.77	0.57
Q13C	Amount of challenge in my job	61.7	2.15	1.04	3.37	-1.91	-1.13	-0.59	0.66
Q13D	Opportunity for personal growth and development on the job	65.8	2.37	1.13	2.97	-1.76	-0.91	-0.38	0.87
Q13E	Feeling of accomplishment I get from doing my job	62.1	2.26	1.13	2.87	-1.76	-1.01	-0.47	0.74
Q13F	Job security	36.4	2.00	0.98	1.36	-3.07	-2.15	-1.09	0.68
Q13G	Physical working conditions of my work site	36.5	2.17	0.98	1.37	-3.12	-1.81	-0.94	1.16
Q13I	Flexibility in dealing with family/personal issues	40.8	2.14	1.10	1.26	-2.70	-1.81	-0.83	0.82

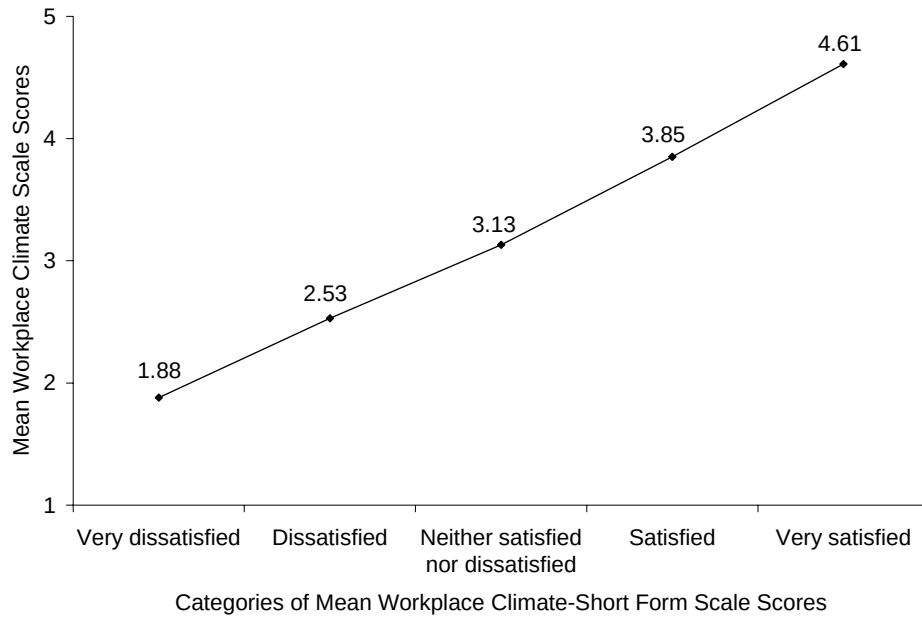


Figure 4. Mean Workplace Climate scale scores by mean short form scores.

TEMPO

All three items on the TEMPO Scale appeared to have good psychometric properties although two of the items (item 19A and 19B) had higher slope parameters ($a = 3.12$ and 3.13 , respectively) than item 19C (see Table 5). These two items also accounted for approximately 72 percent of the variance in the long form parameters. Item 19A (time spent at permanent duty station) was selected for use as the 1-item Tempo short form because the term “permanent duty station” is more general than the term “shore duty” used in item 19B (time spent on shore duty) and could potentially be applied to a variety of personnel, including both Sailors and civilian personnel. As expected, mean Tempo scale scores increase as agreement with this 1-item measure increases (see Figure 5).

Table 5
TEMPO scale

Item #	Description	% Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q19A	Time spent at permanent duty station	72.2	2.22	1.08	3.12	-1.93	-1.21	-0.57	0.66
Q19B	Time spent on shore duty	72.6	2.35	1.10	3.13	-1.79	-1.19	-0.36	0.80
Q19C	Time spent on sea duty	57.4	2.42	1.02	1.52	-2.63	-1.62	-0.30	1.32

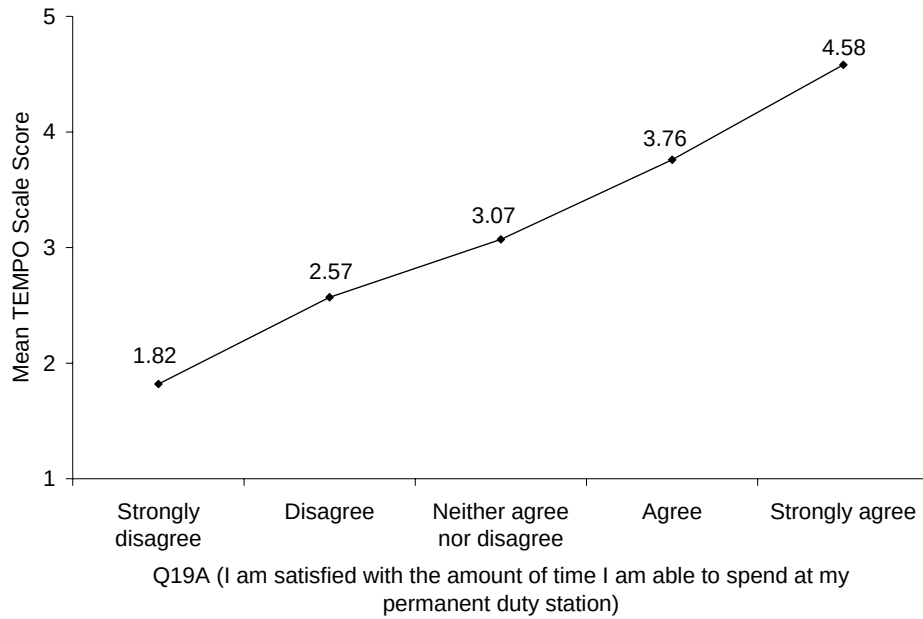


Figure 5. Mean TEMPO scale scores by 1-item TEMPO measure.

Impact on Personal Life

Based on the item characteristics presented in Table 6, item 21A (career gets in way of personal life) was selected for use as a 1-item Impact on Personal Life scale. This item had the highest percentage of variance (79%), standard deviation (1.17), and IRT slope parameter (4.21). It also has general content and demonstrated a strong relationship with the Impact on Personal Life long form scores (see Figure 6).

Table 6
Impact on Personal Life scale

Item #	Description	% Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q21A	Career gets in way of personal life	78.5	2.89	1.17	4.21	-1.55	-0.41	0.26	1.17
Q21B	Career causes significant separation from family	67.9	2.39	1.13	2.00	-2.31	-1.04	-0.31	0.92
Q21C	Difficulty juggling career and personal life	71.5	3.18	1.14	2.37	-1.48	-0.21	0.65	1.68

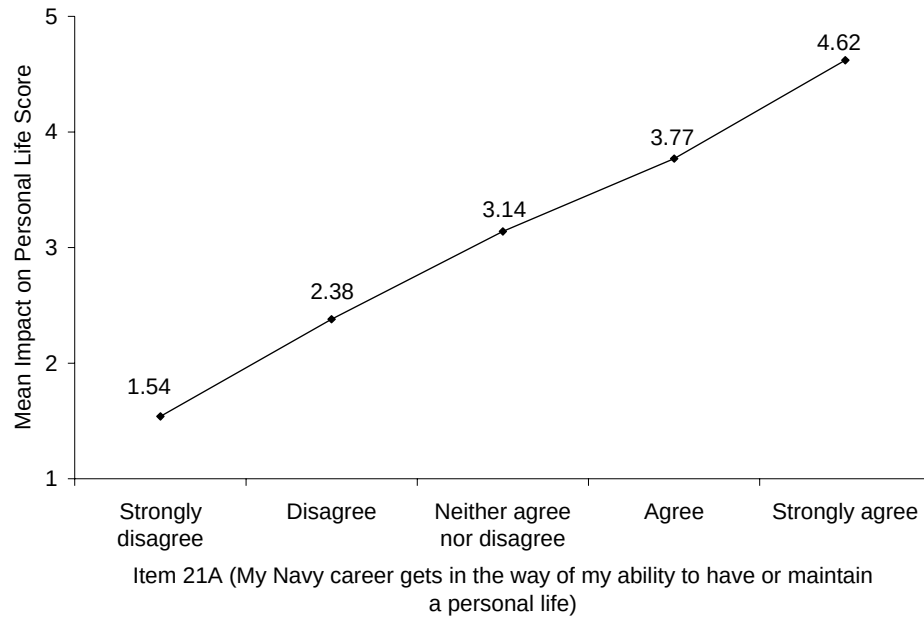


Figure 6. Mean Impact on Personal Life scale scores by 1-item impact on personal life measure.

Immediate Supervisor

After reviewing the item-level descriptive statistics shown in Table 7, item 23F (satisfied with immediate supervisor) was selected for use as a 1-item Immediate Supervisor measure. This single item accounted for 90 percent of the variance in the long form scores. It also had the largest slope parameter (9.14); standard deviation (1.14), a spread of threshold parameters, and a strong, linear relationship with the long form scores (see Table 7 and Figure 7).

Table 7
Immediate Supervisor scale

Item #	Description	% Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q23A	Adequate training/expertise	66.8	1.93	0.99	3.07	-1.87	-1.13	-0.74	0.54
Q23B	Deals well with subordinates	84.6	2.17	1.14	5.60	-1.36	-0.76	-0.36	0.65
Q23C	Deals well with superiors	70.5	2.05	0.99	3.36	-1.79	-1.11	-0.52	0.71
Q23D	Provides adequate support and guidance	85.3	2.23	1.14	5.59	-1.34	-0.74	-0.27	0.73
Q23E	Responsive to Sailor needs and concerns	79.9	2.15	1.09	4.89	-1.41	-0.86	-0.38	0.69
Q23F	Satisfied with immediate supervisor	89.8	2.14	1.14	9.14	-1.24	-0.75	-0.38	0.59

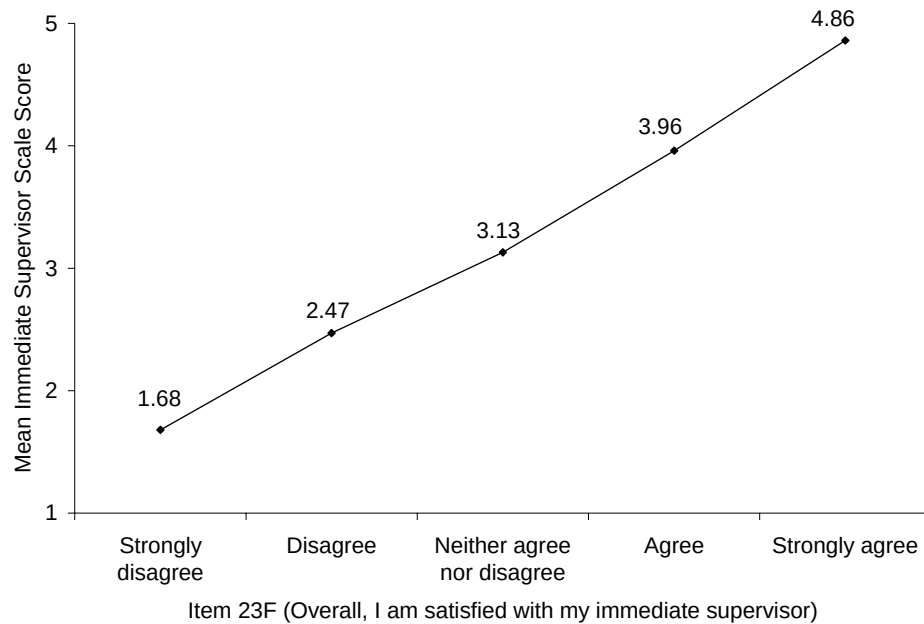


Figure 7. Mean Immediate Supervisor scale scores by 1-item immediate supervisor measure.

Command Leadership

Similar to the Immediate Supervisor scale, a general satisfaction item, item 24F (satisfied with command leadership) was chosen as a 1-item Command Leadership measure. This item had the highest standard deviation and discrimination, accounted for 89 percent of the variance in the long form and was strongly related to the long form scores (see Table 8 and Figure 8).

Table 8
Command Leadership scale

Item #	Description	% Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q24A	Adequate training/expertise	66.1	1.96	0.90	2.95	-0.71	0.75	1.35	2.05
Q24B	Deals well with subordinates	84.5	2.27	1.07	5.39	-0.89	0.32	0.80	1.47
Q24C	Deals well with superiors	70.7	2.08	0.90	3.38	-0.90	0.49	1.26	1.94
Q24D	Provides adequate support and guidance	84.1	2.31	1.08	5.63	-0.94	0.27	0.80	1.36
Q24E	Responsive to Sailor needs and concerns	81.3	2.27	1.09	5.13	-0.88	0.32	0.83	1.33
Q24F	Satisfied with command leadership	88.7	2.29	1.10	7.93	-0.84	0.30	0.78	1.28

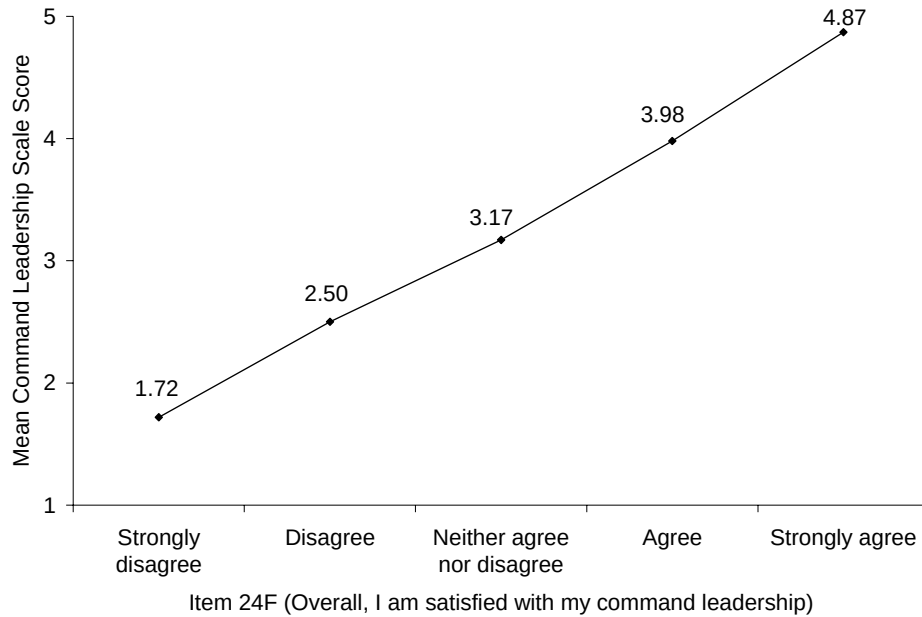


Figure 8. Mean Command Leadership scale scores by 1-item command leadership measure.

Communication

While the items on the Communication scale met the criteria for the means, standard deviations, and IRT parameters, none of the items alone accounted for at least 70 percent of the variance in the long form scores (Table 9). To develop a 2-item short form, researchers first selected item 25D (command leadership keeps me informed of Navy policies) which accounts for the largest percentage of variance (66%) and has the highest discrimination (i.e., IRT slope parameter). Item 25A (Navy clearly communicates goals and strategies) was then selected as the second item for inclusion in the scale. While items 25B (senior leadership keeps Sailors informed) and 25C (command leadership communicates positive attitude about Navy) have higher slope parameters and account for more variance, item 25A was selected because item 25B has very similar content to item 25D and item 25C is too specific given its focus on positive attitude. Combined items 25A and 25D account for 82 percent of the variance in the scores on the Communication long form and as shown in Figure 9, mean scores on the Communication long form increase with increasing mean scores on the short form.

Table 9
Communication scale

Item #	Description	% Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q25A	Navy clearly communicates goals and strategies	50.6	2.55	1.00	1.77	-2.57	-1.10	-0.33	1.82
Q25B	Senior leadership keeps Sailors informed	64.2	2.55	1.01	2.58	-2.11	-0.95	-0.32	1.58
Q25C	Command leadership communicates positive attitude about Navy	50.1	2.20	0.95	1.87	-2.57	-1.64	-0.77	1.08
Q25D	Command leadership keeps me informed of Navy policies	65.8	2.35	0.97	3.16	-2.14	-1.16	-0.49	1.14
Q25E	Someone in chain of command talked about new career initiatives	57.3	2.82	1.25	1.74	-1.67	-0.58	-0.03	1.53

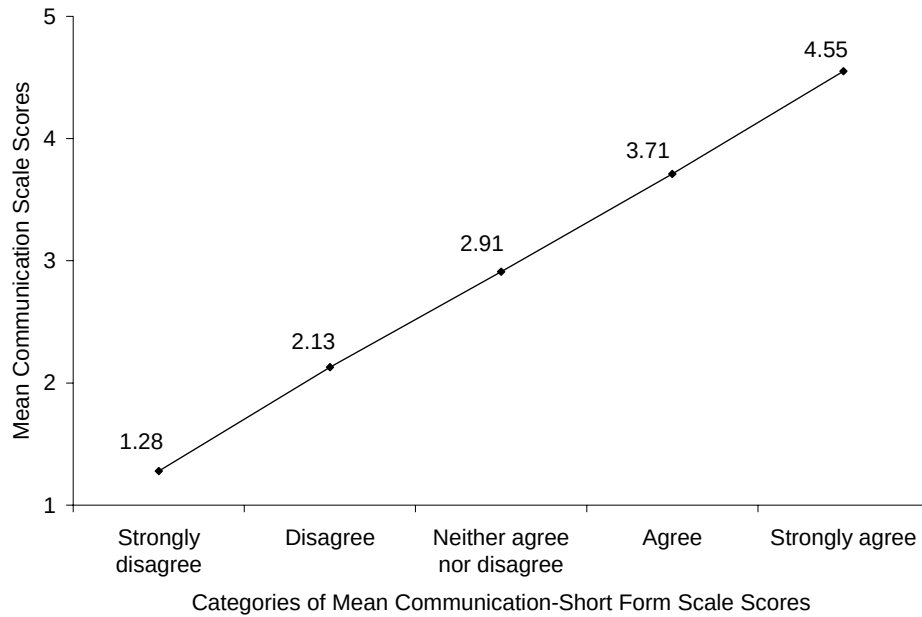


Figure 9. Mean Communication scale scores by mean short form scores.

Job Security

After reviewing the item psychometric properties and content shown in Table 10, item 26C (future in Navy appears secure) was selected as a 1-item short form for the Job Security scale. The item has content related to general job security, has the highest slope parameter ($a = 4.14$), accounts for the largest percentage of variance in Job Security scale scores (78%), and shows a strong, linear relationship with the Job Security scale (see Figure 10).

Table 10
Job Security scale

Item #	Description	% Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q26A	Feel positive about future Navy career	72.3	2.58	1.20	2.24	-1.74	-0.84	-0.21	1.11
Q26B	Navy is doing all it can to protect my job security	73.9	2.76	1.09	2.84	-1.67	-0.77	0.12	1.42
Q26C	Future in Navy appears secure	78.3	2.39	1.12	4.14	-1.62	-0.96	-0.41	0.87

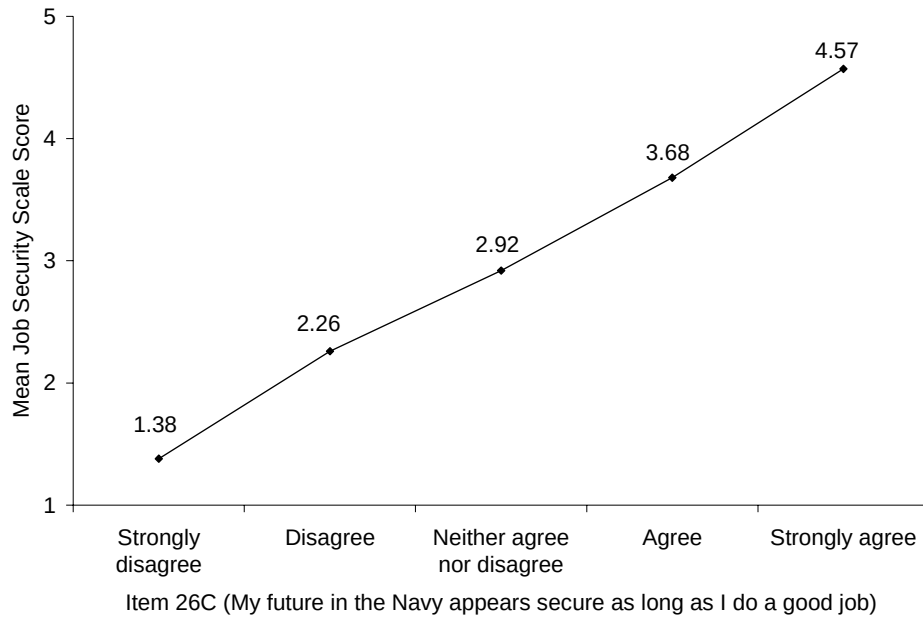


Figure 10. Mean Job Security scale scores by 1-item job security measure.

Fairness

Item 27D (confident policies affecting size of Navy will be administered fairly and consistently) was selected as a 1-item short form for the Fairness scale. Although this item accounted for slightly less than 70 percent of the variance in long form scores, it demonstrated the highest level of discrimination ($\alpha = 2.85$), was strongly, positively related to long form scores, and conceptually appeared to be most related to fairness (see Table 11 and Figure 11).

Table 11
Fairness scale

Item #	Description	% Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q27A	Navy personnel policies seem fair	64.0	2.59	1.03	2.27	-1.99	-1.01	-0.21	1.62
Q27B	Navy policies retain best quality Sailors	71.6	2.99	1.17	2.70	-1.37	-0.44	0.24	1.68
Q27C	Trust Navy to look out for my best interests	70.8	3.20	1.13	2.73	-1.20	-0.28	0.55	1.95
Q27D	Confident policies affecting size of Navy will be administered fairly and consistently	69.5	2.92	1.06	2.85	-1.50	-0.65	0.27	1.87

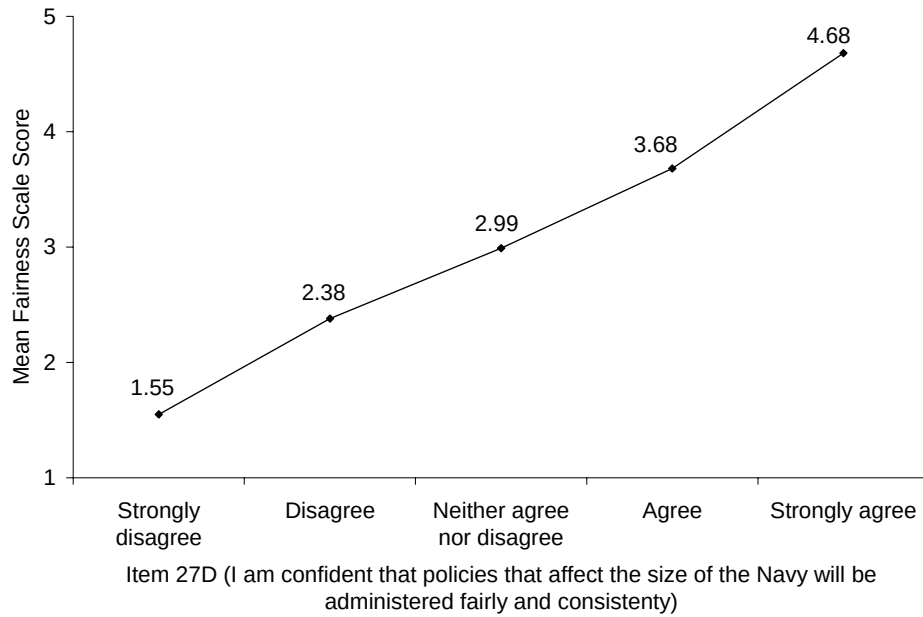


Figure 11. Mean Fairness scale scores by 1-item fairness measure.

Navy Image

Item 28C (I would recommend the Navy as a good place to work) was chosen as a 1-item measure of Navy Image. This item met all of the criteria specified for the selection of a short form; it accounted for 76 percent of the variance in Navy Image scale scores, had mid-range mean values, variability in item responses, the highest IRT slope parameter, a strong, linear relationship with the long form scores, and general item content (see Table 12 and Figure 12).

Table 12
Navy Image scale

Item #	Description	% Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q28A	I would encourage others to join the Navy	74.0	2.47	1.15	5.69	-1.29	-0.72	-0.22	0.84
Q28B	I talk about Navy to friends as a good organization	72.5	2.25	1.03	5.37	-1.57	-0.99	-0.42	0.77
Q28C	I would recommend the Navy as a good place to work	76.3	2.40	1.08	7.39	-1.40	-0.83	-0.26	0.84
Q28D	I would wear civilian clothing with Navy logos	42.4	2.63	1.25	1.39	-1.83	-0.89	-0.24	1.43
Q28E	Information I hear about Navy from non-Navy sources is usually positive	42.1	2.57	0.94	1.42	-2.72	-1.38	-0.15	2.20
Q28F	Comments I hear about Navy from fellow Sailors are usually positive	55.9	3.07	1.06	1.88	-1.63	-0.40	0.48	2.46
Q28G	Navy of tomorrow will be better than today	43.3	2.86	1.05	1.35	-2.09	-1.06	0.56	2.19

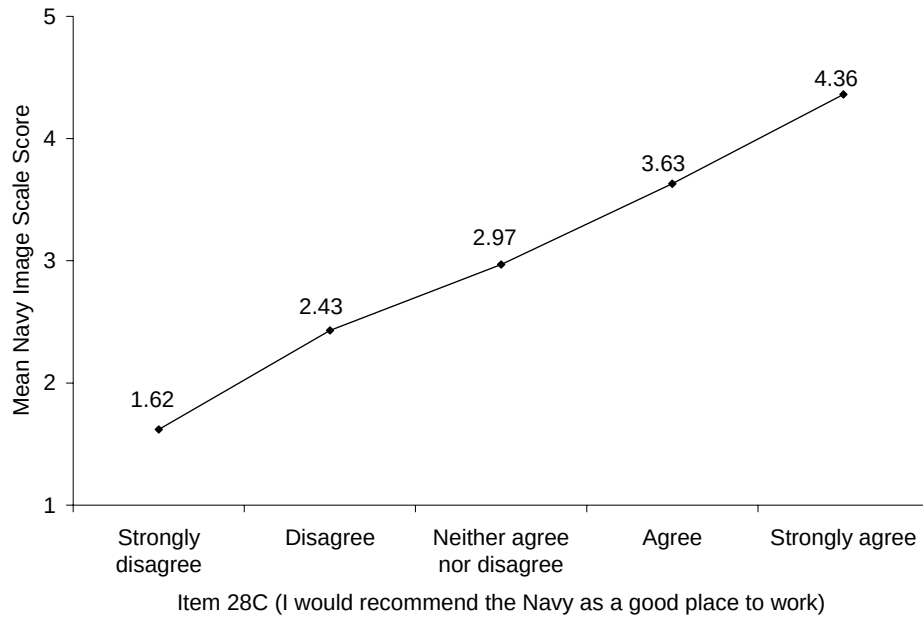


Figure 12. Mean Navy Image scale scores by 1-item Navy image measure.

Organizational Commitment

Similar to the Navy Image scale, there was a single item that appeared to stand out as a potential 1-item short form. Item 37E (I feel a strong sense of belonging in the Navy) accounted for 84 percent of the variance in the Organizational Commitment scale scores and met the other criteria for selection as a short form (see Table 13 and Figure 13).

Table 13
Organizational Commitment scale

Item #	Description	% Scale Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q37A	Navy has personal meaning for me	72.7	2.08	1.05	3.41	-1.96	-1.27	-0.59	0.51
Q37B	I feel like I'm "part of the family" in the Navy	78.7	2.41	1.16	4.11	-1.57	-0.86	-0.24	0.78
Q37C	I feel "emotionally attached" to the Navy	83.7	2.60	1.23	4.86	-1.29	-0.66	-0.02	0.87
Q37D	I could not easily become attached to another organization	68.4	2.85	1.24	2.52	-1.38	-0.55	0.26	1.18
Q37E	I feel a strong sense of belonging in the Navy	84.3	2.46	1.17	5.33	-1.40	-0.81	-0.17	0.81

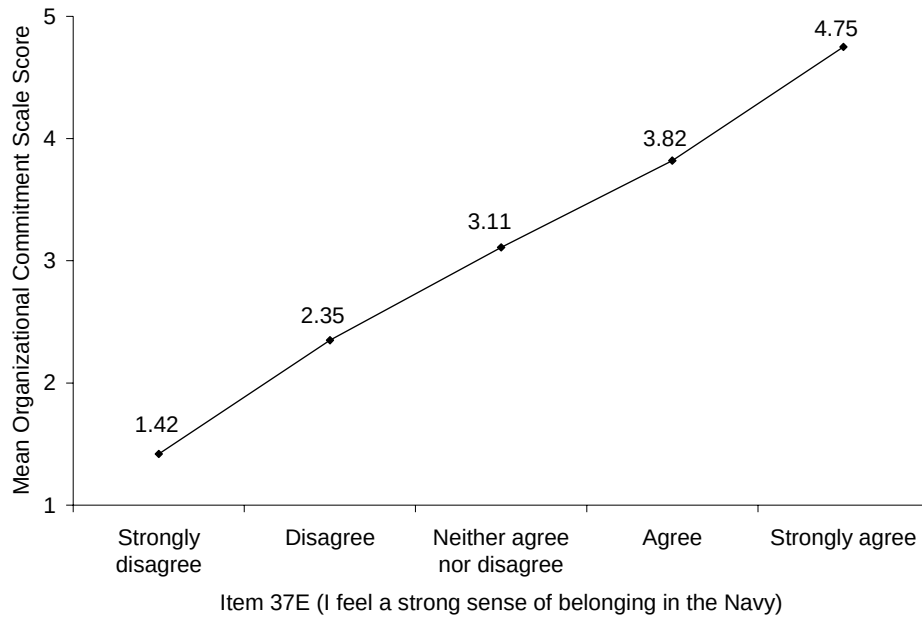


Figure 13. Mean Organizational Commitment scale scores by 1-item organizational commitment measure.

Advancement/Promotion

Consistent with other scales, such as Immediate Supervisor and Command Leadership, which contained an overall satisfaction item, item 38B (satisfied with advancement/promotion system) was selected as the 1-item measure for the Advancement/Promotion scale. This item performed best of the three items on the scale, accounted for 77 percent of the variance in long form scores, and demonstrated the pattern of scores expected of a suitable short form scale (see Table 14 and Figure 14).

Table 14
Advancement/Promotion scale

Item #	Description	% Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q38A	Clear understanding of advancement/promotion system	41.6	1.98	0.96	0.95	-4.29	-2.62	-1.74	0.94
Q38B	Satisfied with advancement/promotion system	76.7	2.98	1.26	4.89	-1.12	-0.32	0.16	1.27
Q38C	The most qualified Sailors get promoted	70.1	3.23	1.25	2.13	-1.15	-0.09	0.52	1.78

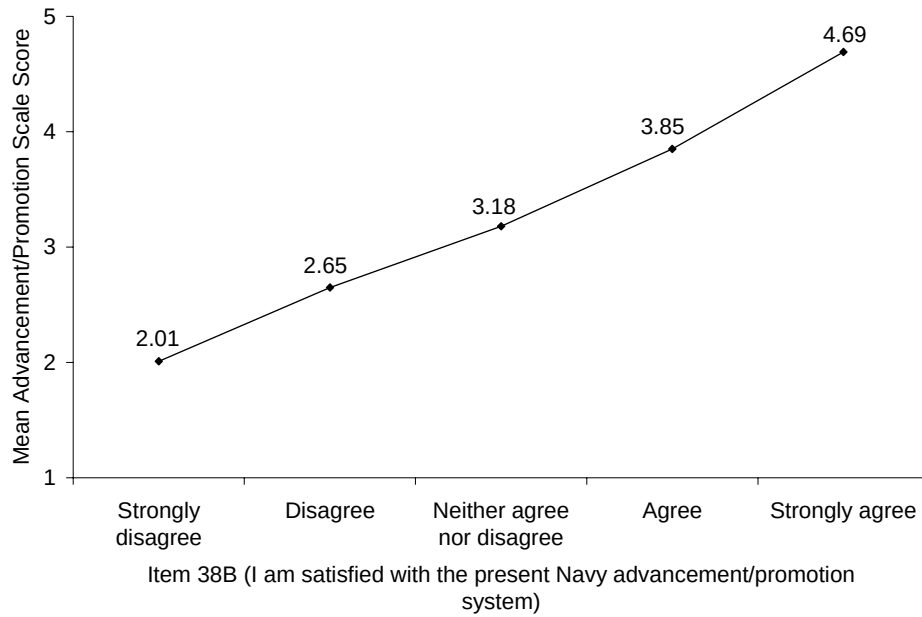


Figure 14. Mean Advancement/Promotion scale scores by 1-item advancement/promotion measure.

Performance Evaluations/Fitness Reports

The Performance Evaluation/Fitness Reports scale includes an overall satisfaction item, item 39F (satisfied with present EVAL/FITREP system), however, this item only accounts for 56 percent of the variance in the scale scores (see Table 15). Therefore, we developed a 2-item short form which includes item 39F along with an additional item from the scale, item 39B (Last EVAL/FITREP was fair/accurate). Item 39B was selected due to its high IRT slope parameter and percentage of variance. Together these two items accounted for 81 percent of the variance in long forms and increases in mean scores on the 2-item short form are associated with increases in mean scores on the long form (see Figure 15).

Table 15
Performance Evaluations/Fitness Reports scale

Item #	Description	% Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q39A	Clear understanding of present system	35.2	1.91	0.91	1.45	-3.25	-2.05	-1.40	0.66
Q39B	Last EVAL/FITREP was fair/accurate	66.7	2.22	1.12	4.20	-1.53	-1.00	-0.58	0.63
Q39C	Last EVAL/FITREP was conducted in a timely manner	53.3	2.12	1.03	2.73	-1.90	-1.27	-0.79	0.69
Q39D	Able to submit input at my last EVAL/FITREP	45.7	2.03	1.02	2.18	-2.12	-1.45	-0.91	0.55
Q39E	Last promotion recommendation was fair	64.9	2.14	1.08	3.86	-1.64	-1.15	-0.59	0.54
Q39F	Satisfied with present EVAL/FITREP system	56.3	2.66	1.18	1.79	-1.75	-0.90	-0.15	1.45
Q39G	Most qualified and deserving Sailors score highest on the EVALs/FITREPs	45.5	3.11	1.25	1.21	-1.58	-0.39	0.54	2.29

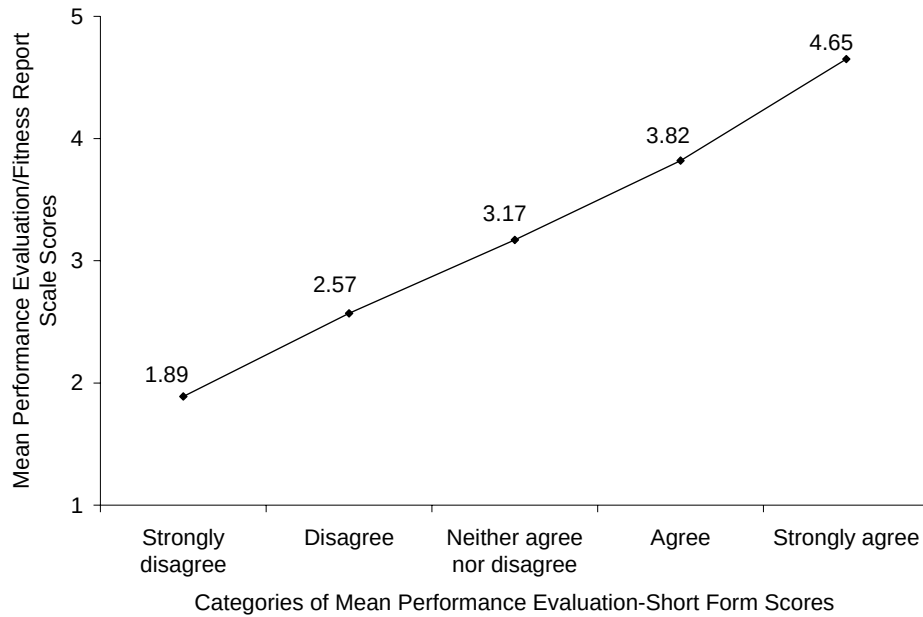


Figure 15. Mean Performance Evaluation/Fitness Report scale scores by mean short form scores.

Recognition

The Recognition scale contains only two items: item 40A (adequately recognized for accomplishments on EVALs/FITREPs) and item 40B (Adequately recognized for accomplishments with awards). Both items have similar psychometric properties (see Table 16). Item 40A was selected as a 1-item short form because it focuses on general recognition rather than specifically on awards. As shown in Figure 16, mean Recognition scale scores increase steadily with increasing levels of agreement on item 40A.

Table 16
Recognition scale

Item #	Description	% Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q40A	Adequately recognized for accomplishments on EVALs/ FITREPs	81.6	2.44	1.17	3.31	-1.66	-0.89	-0.35	0.89
Q40B	Adequately recognized for accomplishments with awards	83.7	2.76	1.24	3.08	-1.36	-0.64	-0.04	1.16

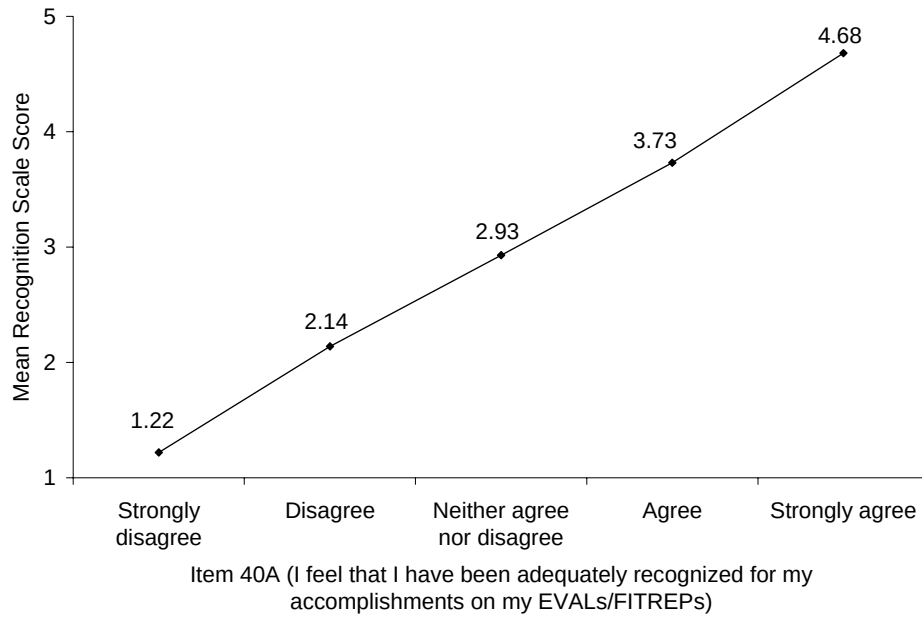


Figure 16. Mean Recognition scale scores by 1-item recognition measure.

Career Progression

Earlier analyses of the 2005 NPS data suggested that the NPS scale on Career Development should be split into two scales, measuring Career Progression and Career Counseling/Guidance. The psychometric properties of the two items on the Career Progression scale are presented in Table 17. Both items have similar properties and could be suitable one-item measures of Career Progression. Item 41A (clearly defined path for my designator, rating, or community) was selected because it accounts for a higher percentage of variance (78%) in the long form scores. This relationship is presented graphically in Figure 17.

Table 17
Career Progression scale

Item #	Description	% Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q41A	Clearly defined path for my designator, rating, or community	78.3	2.40	1.10	2.14	-2.02	-1.21	-0.49	1.09
Q41B	Sufficient progress in my advancement	73.9	2.29	1.01	2.94	-2.09	-1.34	-0.62	0.85

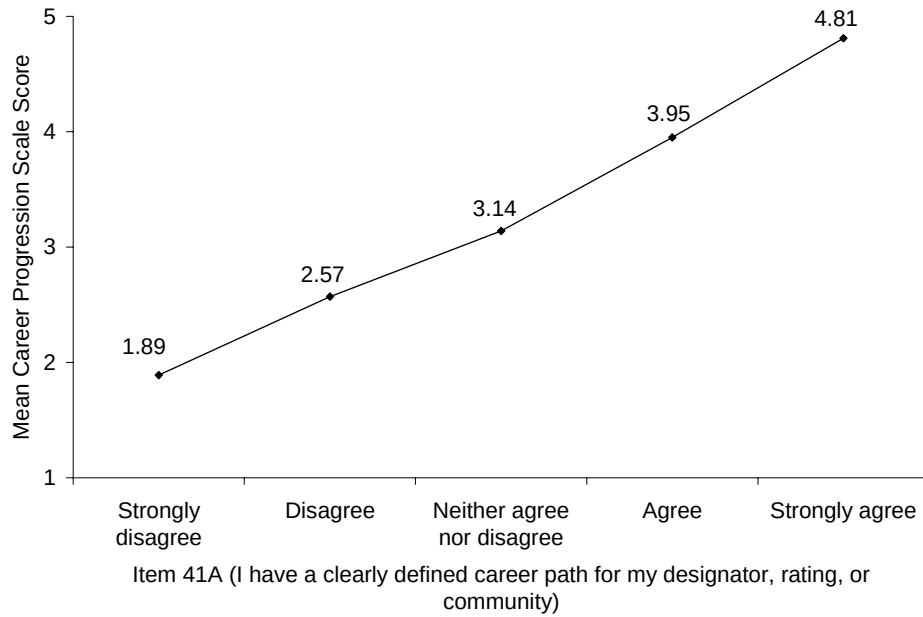


Figure 17. Mean Career Progression scale scores by 1-item career progression measure.

Career Counseling/Guidance

The means, standard deviations, percentage of scale variance, and IRT parameters for the two Career Counseling/Guidance items are displayed in Table 18. The items generally have similar values for each of these measures. Item 41D was selected as the 1-item Career Counseling/Guidance short form given its higher IRT slope parameter ($a = 5.56$). The strong, positive relationship between item 41D and the long form is presented graphically in Figure 18.

Table 18
Career Counseling / Guidance

Item #	Description	% Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q41C	Given adequate counseling/ guidance by my immediate supervisor	89.7	2.76	1.16	3.80	-1.44	-0.66	0.04	1.28
Q41D	Given adequate counseling/ guidance by my career counselor	89.2	2.84	1.18	5.56	-1.24	-0.59	0.14	1.26

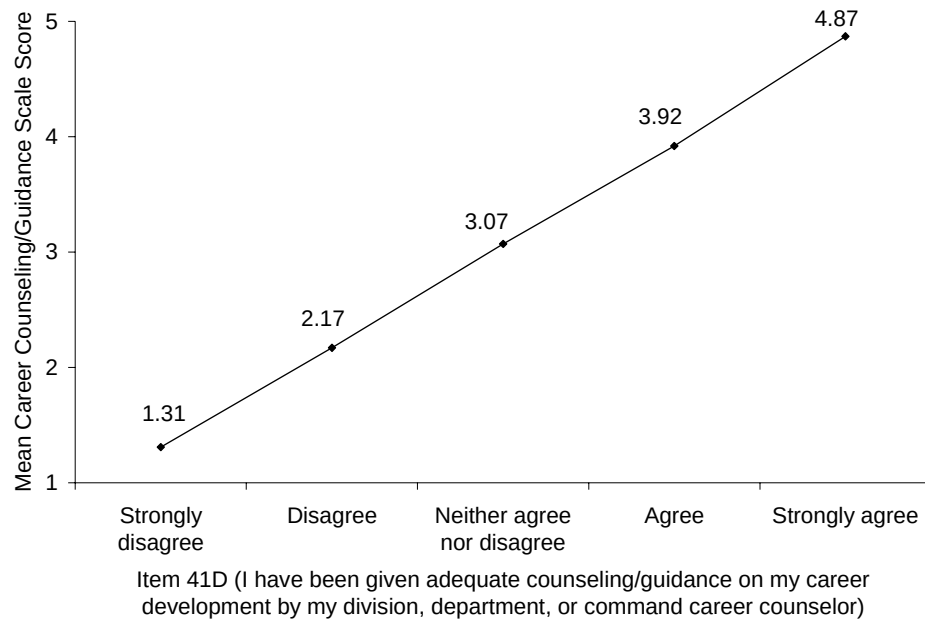


Figure 18. Mean Career Counseling/Guidance scale scores by 1-item career counseling/guidance measure.

Detailing

Item-level descriptive statistics for the six items on the Detailing scale are presented in Table 18. The overall satisfaction item, item 24F (satisfied with my detailer), was chosen as the 1-item Detailing short form because it accounts for the greatest variance and shows a strong relationship with Detailing long form scores and has the largest slope parameter (see Table 19 and Figure 19).

Table 19
Detailing scale

Item #	Description	% Variance	Mean	SD	IRT Parameters				
					a	b1	b2	b3	b4
Q42A	Satisfied with detailing process	68.9	2.83	1.10	2.67	-1.48	-0.70	0.13	1.75
Q42B	Clear understanding of detailing process	44.6	2.60	1.09	1.47	-2.33	-1.04	-0.15	1.75
Q42C	Detailer responds in a timely manner	73.4	2.62	1.07	3.33	-1.54	-0.93	0.05	1.23
Q42D	Detailer is an advocate for my needs/desires	81.3	2.90	1.09	5.34	-1.23	-0.65	0.35	1.42
Q42E	Detailer is receptive to resolving conflicts	81.6	2.80	1.03	5.71	-1.33	-0.79	0.28	1.44
Q42F	Satisfied with my detailer	85.1	2.71	1.06	7.39	-1.30	-0.86	0.13	1.24

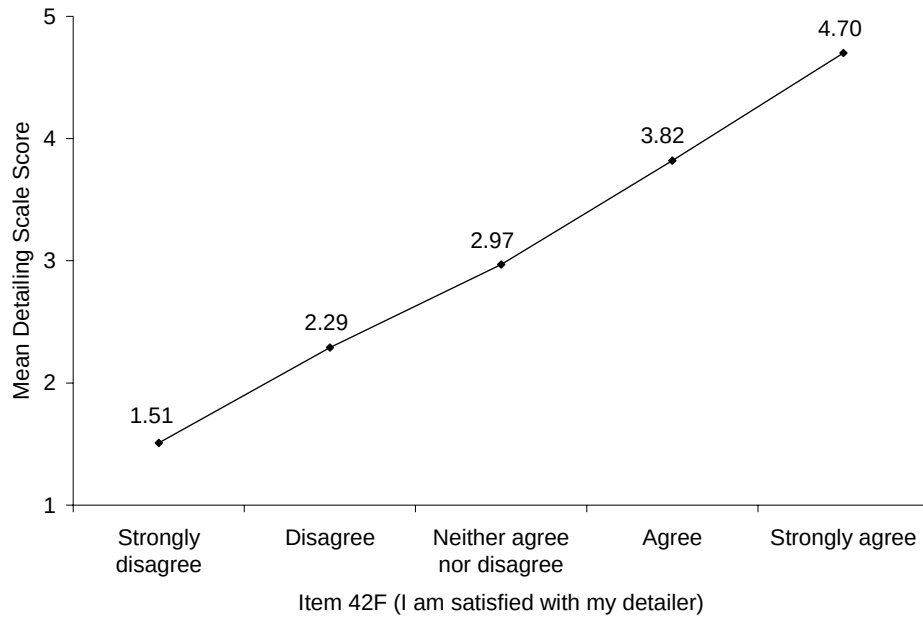


Figure 19. Mean Detailing scale scores by 1-item detailing measure.

Final Short Forms

Table 20 presents the final short forms of the 19 individual scales. The percentage of variance in long form scores accounted for by the short forms ranges from 70 percent for the Fairness scale to 90 percent for the Immediate Supervisor scale.

Table 20
Short Forms of scales on the Navy-wide Personnel Survey

Item #	Description	% of Variance in Long Form	Mean	SD
Availability of Resources		84%	3.62	0.90
8A	Adequate qualified personnel			
8C	Adequate spare parts and/or supplies			
Morale		84%	3.26	0.74
10B	Performance evaluation system			
10C	Supply of spare parts/supplies			
10D	Quality of Navy training programs			
10H	Command leadership			
10J	Workload			
Gender Integration		72%	2.21	0.96
12C	Women are being successfully integrated			
Workplace Climate		80%	3.81	0.93
13B	Amount of responsibility I have in my job			
13D	Opportunity for personal growth and development on the job			
TEMPO		72%	2.22	1.08
19A	Time spent at permanent duty station			
Impact on Personal Life		79%	2.89	1.17
21A	Career gets in the way of personal life			
Immediate Supervisor		90%	2.14	1.14
23F	Satisfied with immediate supervisor			
Command Leadership		89%	2.29	1.10
24F	Satisfied with command leadership			
Communication		82%	3.55	0.83
25A	Navy clearly communicates goals and strategies			
25D	Command leadership keeps me informed of Navy policies			
Job Security		78%	2.39	1.12
26C	Future in Navy appears secure			
Fairness		70%	2.92	1.06
27D	Confident policies affecting size of Navy will be administered fairly and consistently			

Table 20
Short Forms of scales on the Navy-wide Personnel Survey

Item #	Description	% of Variance in Long Form	Mean	SD
Navy Image				
28C	I would recommend the Navy as a good place to work	76%	2.40	1.08
Organizational Commitment				
37E	I feel a strong sense of belonging in the Navy	84%	2.46	1.17
Advancement/Promotion				
38B	Satisfied with advancement/promotion system	77%	2.98	1.26
Performance Evaluations/Fitness Reports				
39B	Last EVAL/FITREP was fair/accurate	81%	3.56	1.00
39F	Satisfied with present EVAL/FITREP system			
Recognition				
40A	Adequately recognized for accomplishments on EVALs/FITREPs	82%	2.44	1.17
Career Progression				
41A	Clearly defined path for my designator, rating, or community	78%	2.40	1.10
Career Counseling/Guidance				
41D	Given adequate counseling/guidance by my career counselor	89%	2.84	1.18
Detailing				
42F	Satisfied with my detailer	85%	2.71	1.06

Note: Scores for short forms containing more than one item are computed as the mean of items comprising the scale.

Navy Climate Index-Short Form (NCI-SF)

As described in an earlier report (Bann et al., 2006) and shown in Figure 20, overall Navy Climate was conceptualized as including seven underlying constructs measured by the NPS: (1) workplace climate, (2) organizational commitment, (3) morale, (4) job security, (5) communication, (6) fairness, and (7) Navy image. The long form of the Navy Climate Index was developed by combining the NPS scales measuring each of these constructs to capture both the current view of climate and perceptions of the future that may impact it. In this chapter development of a short form of the NCI (i.e., NCI-SF) is described using the newly developed short forms of the scales.

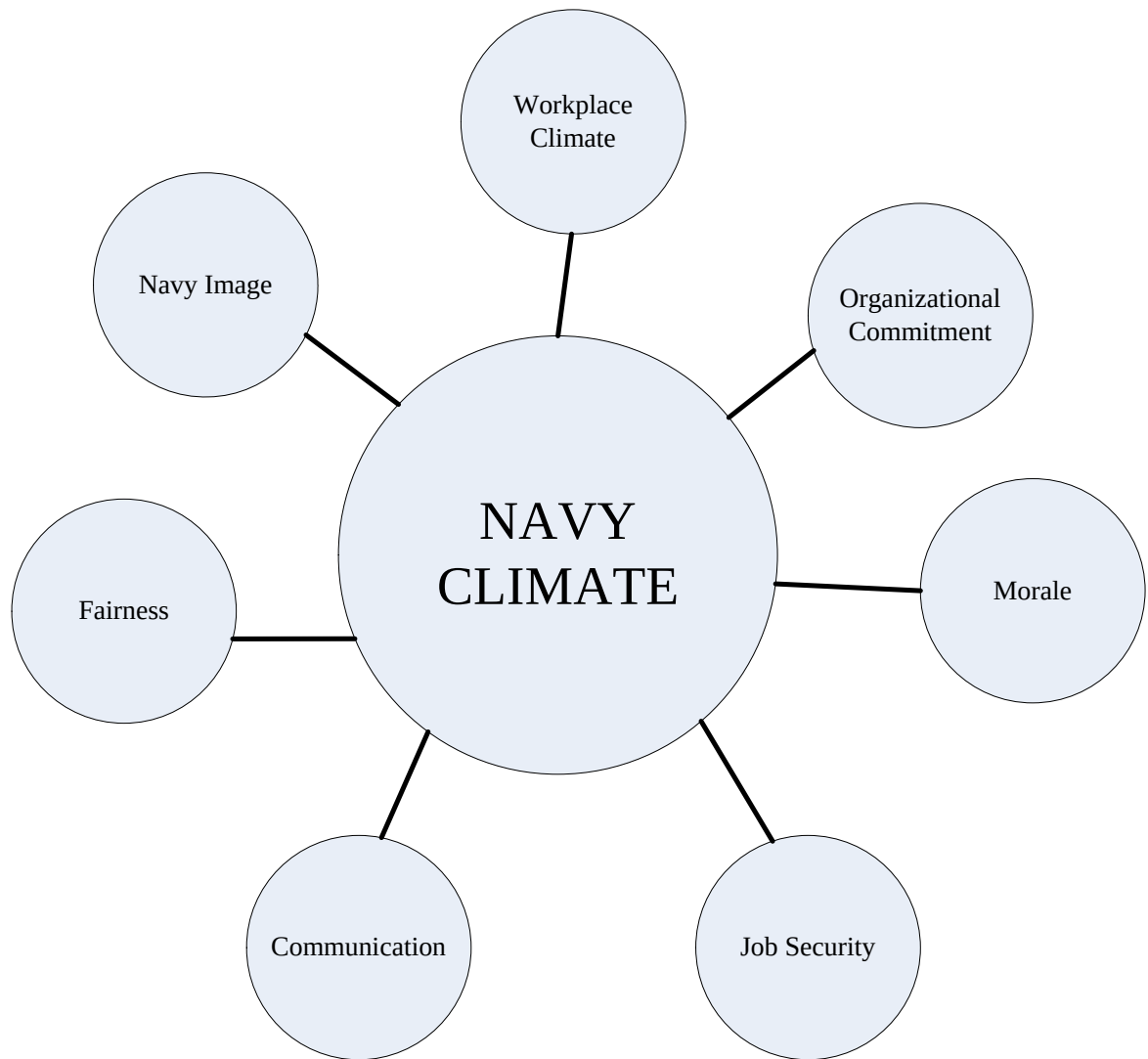


Figure 20. Constructs comprising Navy Climate Index.

Development of the Navy Climate Index-Short Form

To develop the NCI-SF, a confirmatory factor model was conducted using the short forms of the scales corresponding to each of the constructs underlying Navy Climate. Figure 21 presents a path diagram for the second-order confirmatory factor model. In this model, researchers tested whether the seven short form scales (Workplace Climate, Organizational Commitment, Morale, Job Security, Communication, Fairness, and Navy Image) form a single construct representing overall Navy Climate. As with the development of the long form of the NCI, correlated errors were permitted between two pairs of scales: (a) Workplace Climate and Fairness, and (b) Navy Image and Organizational Commitment.

The fit indices suggest that the model had a good fit, indicating that the seven scales may be combined into an overall Navy Climate Index (CFI = 0.98, TLI = 0.96, SRMR = 0.03). Table 21 presents the factor loadings. The scales had similar factor loadings with values ranging from 0.56 for Organizational Commitment to 0.69 for Workplace Climate.

The factor loadings for the scales were then used to compute scores for the NCI-SF. Weights for each scale were computed based on the scale's factor loading divided by the sum of the factor loadings. Specifically, scores for the Climate index short form were computed using the formula outlined in the following worksheet (see Table 22). Index scores may range from 0 to 100 with higher values indicating a more positive Navy climate.

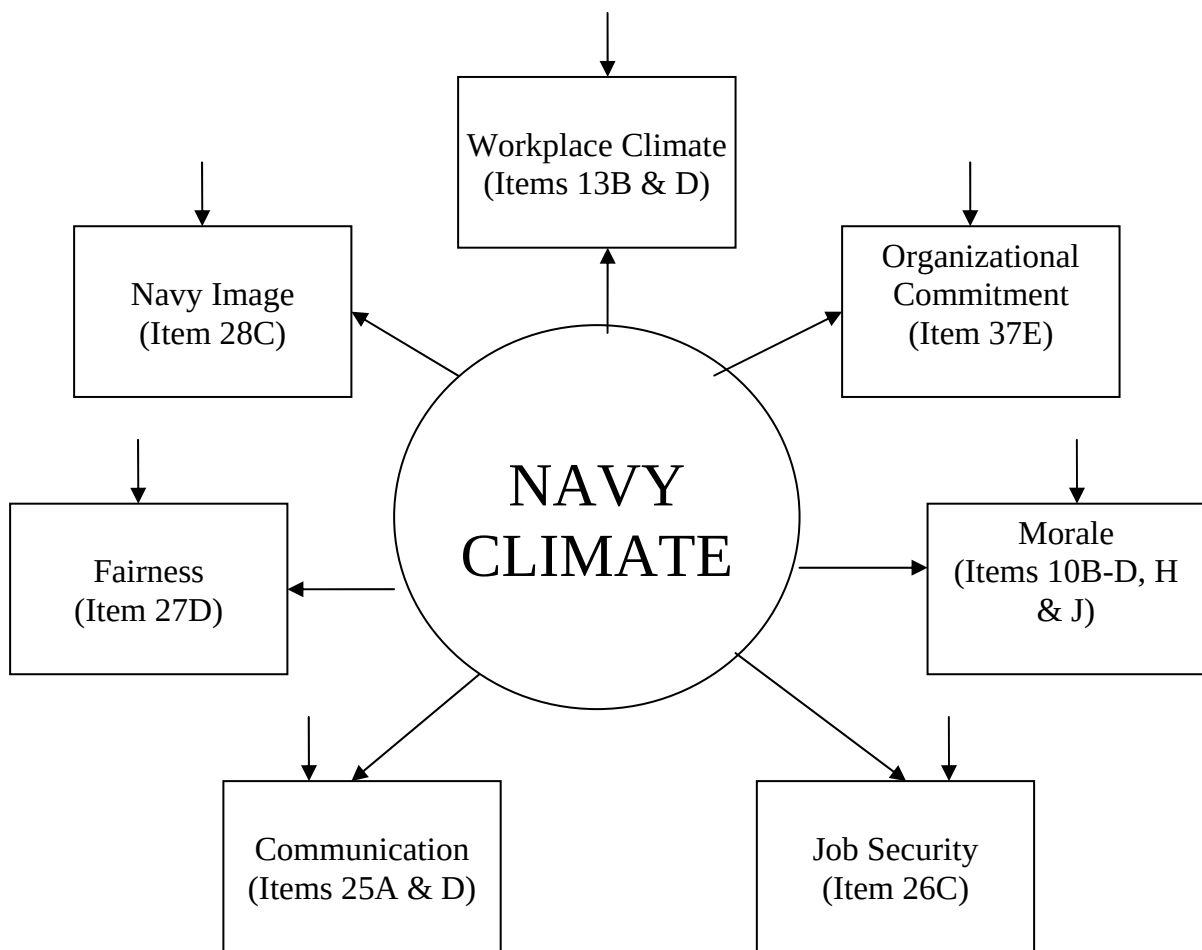


Figure 21. Path diagram for confirmatory factor model of Navy Climate Index-Short Form.

Table 21
Results of second-order confirmatory factor model for Navy Climate Index

Path	Standardized Coefficient
Navy Climate Index	
Morale	0.67
Workplace Climate	0.69
Communication	0.65
Job Security	0.58
Fairness	0.62
Navy Image	0.67
Organizational Commitment	0.56
Model Fit Indices	
Comparative Fit Index	0.98
Tucker-Lewis Index	0.96
Standardized Root Mean Square Residual	0.03

Note: Similar to the long form of the Navy Climate Index, correlated errors are permitted between the following two pairs of scales: (1) Workplace Climate and Fairness, and (2) Navy Image and Organizational Commitment.

Table 22
Worksheet for calculating Navy Climate Index-Short Form scores

Scale	Short Form Score		Scoring Coefficient		Scale score x scoring coefficient	Row
Workplace Climate	Mean of items 13B and 13D	x	0.15	=	_____	(1)
Organizational Commitment	Item 37E	x	0.12	=	_____	(2)
Morale	Mean of items 10B-D, 10H, and 10J	x	0.15	=	_____	(3)
Job Security	Item 26C	x	0.15	=	_____	(4)
Communication	Mean of items 25A and 25D	x	0.14	=	_____	(5)
Fairness	Item 27D	x	0.14	=	_____	(6)
Navy Image	Item 28C	x	0.15	=	_____	(7)
Sum of scale scores x scoring coefficients (rows 1-7)				=	_____	(8)
Subtract 1 from row 8				=	_____	(9)
Navy Climate Index-Short Form Score: Multiply row 9 by 25				=	_____	(10)

Validation of Navy Climate Index-Short Form

Next, the equivalence of the short and long forms of the NCI was evaluated. The correlation between the two forms was 0.97 and the short form accounted for 94 percent of the variance in the long form scores, suggesting that the two forms are highly related. To further explore the equivalence of the two forms, the NCI-SF scores among various demographic groups were compared to determine if the patterns of differences are similar to those found with the long form. As with the long form of the NCI, significantly higher scores on the NCI-SF were found for those who are male, have a higher education, are married, have children under age 21 in their household, are an officer or warrant officer, are not in their first term of service, and not currently deployed (Table 23).

In addition, we compared mean NCI-SF scores by responses to the following three items, measuring tone and job satisfaction:

Q29A: How would you rate Navy tone?

Q29B: How would you rate your current command's tone?

Q65: Considering everything, how satisfied are you with Navy life?

As shown in Figures 22 to 24, there is a significant, positive, linear relationship between the NCI-SF and Sailors' perceptions of tone and their job satisfaction ($p < .0001$). Sailors reporting high tone or job satisfaction had more positive climate scores, as measured by the NCI-SF.

Finally, the relationship between NCI-SF scores and the following three items measuring retention intentions was explored:

Q36A: I plan to serve out my current term of service or obligation.

Q36B: I plan to reenlist or continue with my career in the Navy at my next decision point.

Q36C: I plan to stay in the Navy for a full career if possible.

All three items were significantly, positively related to NCI-SF scores ($p < .0001$). However, as found with the long form of the NCI, this relationship appears to be stronger for re-enlistment plans (Q36B) and plans to remain in the Navy for a full career (Q36C) than plans to serve out the current term of service (Q36A).

Table 23
Mean Navy Climate Index scores by demographic characteristics

Characteristic	Mean	SD	p
Gender			
Male	63.15	16.96	< .0001
Female	59.28	18.18	
Education			
High school or less	60.73	18.14	< .0001
Some college or 2-year degree	61.64	17.68	
Bachelor's degree or more	64.37	16.05	
Marital Status			
Married	64.52	16.70	< .0001
Not married	59.18	17.61	
Children under 21 living in household			
Yes	64.01	16.85	< .0001
No	60.79	17.53	
Paygrade			
Enlisted	61.26	17.93	< .0001
Warrant Officer	66.99	13.96	
Officer	64.68	15.65	
First enlistment or term of service in Navy			
Yes	57.90	18.03	< .0001
No	65.44	16.01	
Currently on deployment			
Yes	59.23	19.16	.0016
No	62.69	17.06	

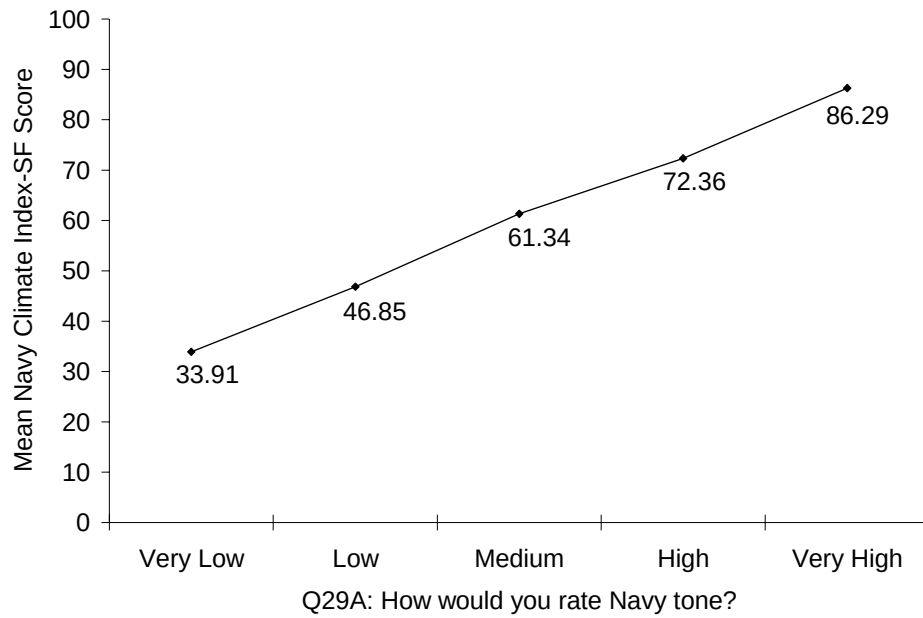


Figure 22. Mean Navy Climate Index-Short Form scores by respondent ratings of Navy tone.

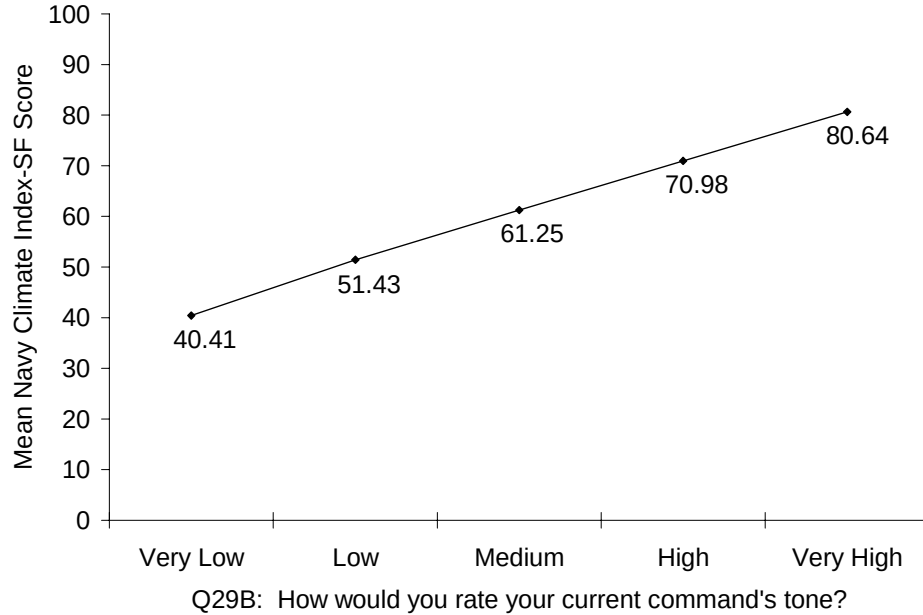


Figure 23. Mean Navy Climate Index-Short Form scores by respondent ratings of command's tone.

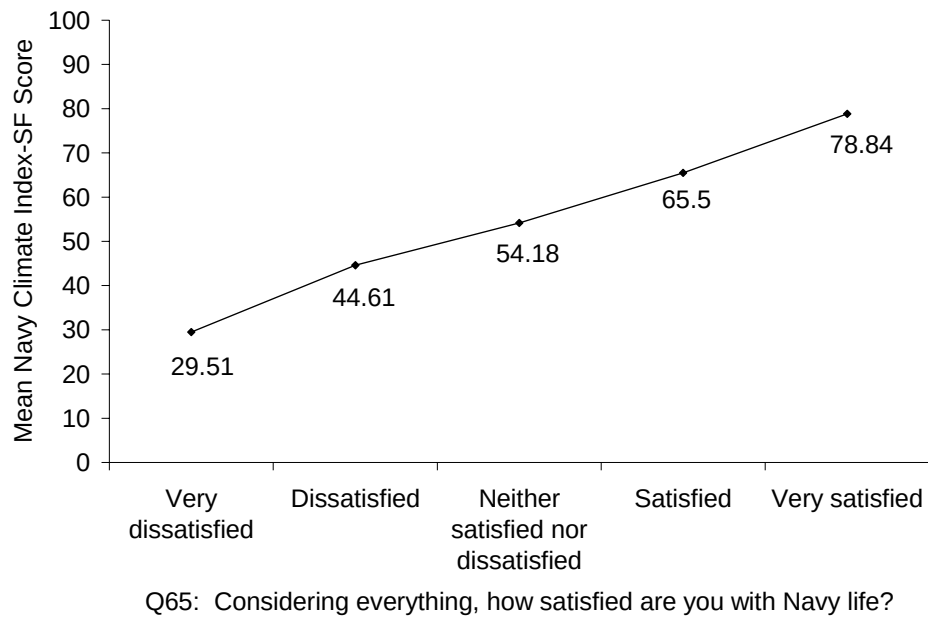


Figure 24. Mean Navy Climate Index-Short Form scores by respondent ratings of satisfaction with Navy life.

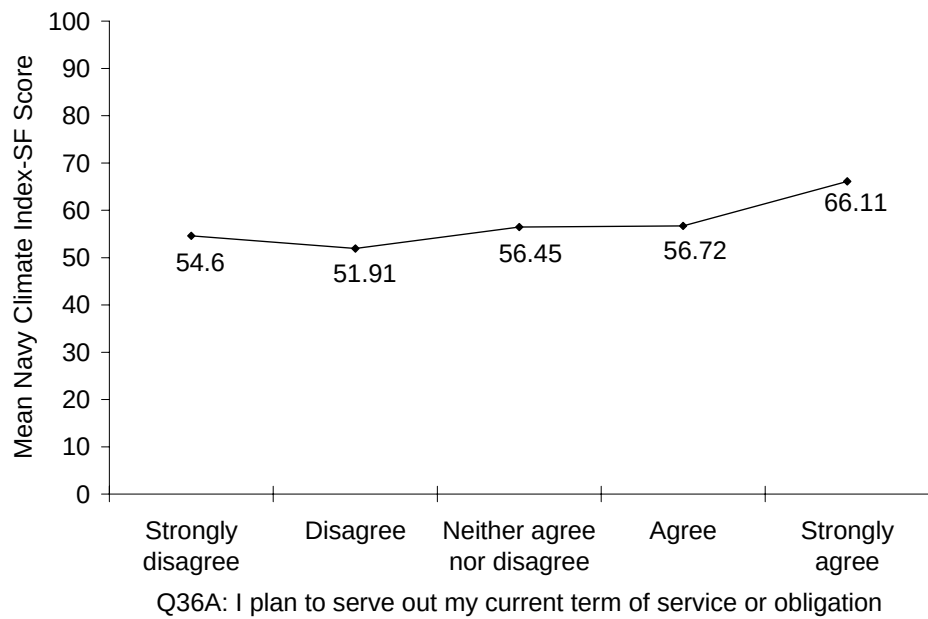


Figure 25. Mean Navy Climate Index-Short Form scores by retention intentions: Plans to serve out current term of service or obligation.

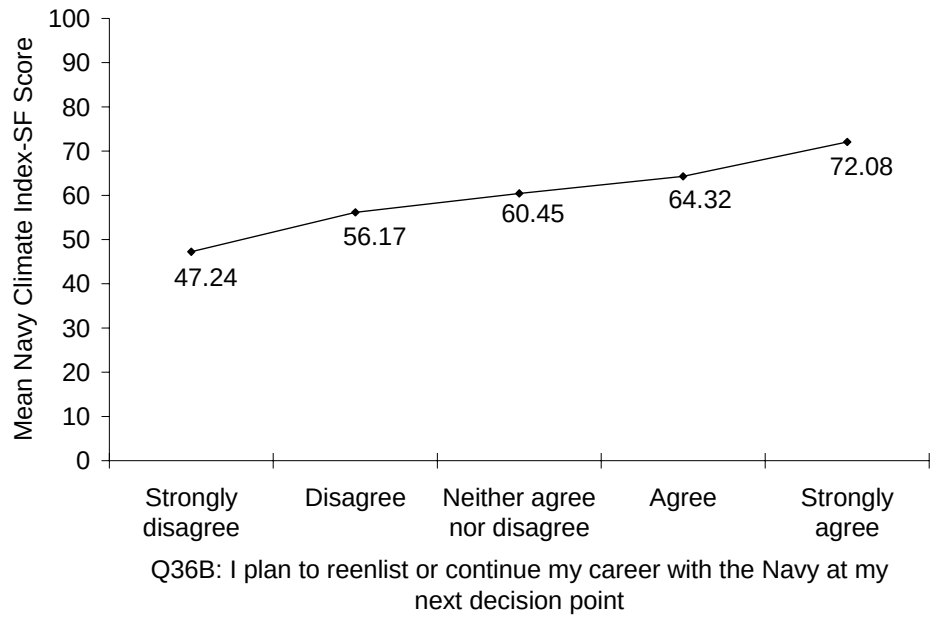


Figure 26. Mean Navy Climate Index-Short Form scores by retention intentions: Plans to reenlist or continue career with Navy at next decision point.

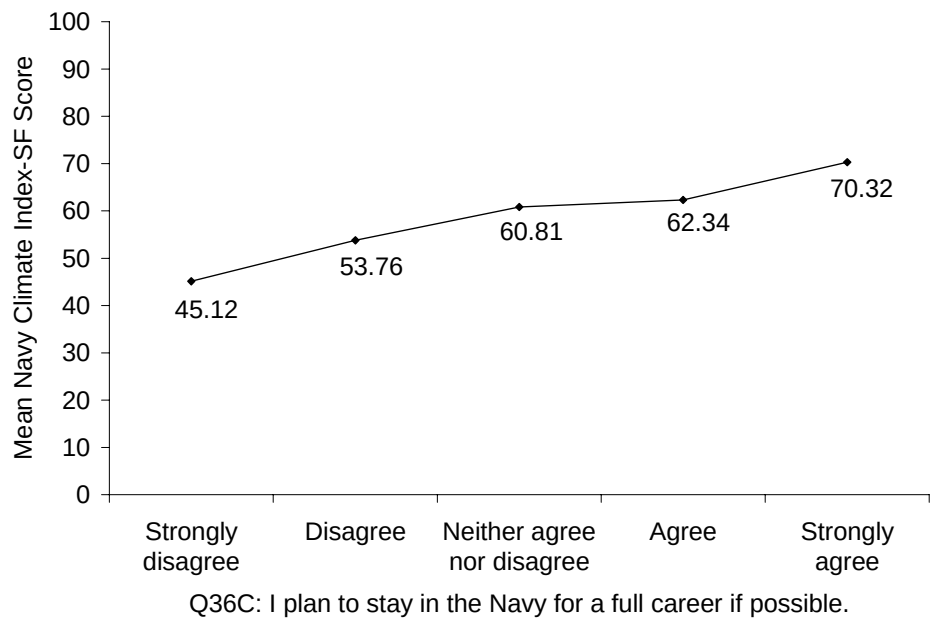


Figure 27. Mean Navy Climate Index-Short Form scores by retention intentions: Plans to stay in Navy for a full career.

Conclusion and Discussion

This report outlines the exploration of potential short forms for the 19 scales on the 2005 Navy-wide Personnel Survey. The primary goal was to develop 1-item measures for each of the scales which could be administered when time and/or respondent burden is of particular concern. Using both statistical and content-based criteria, 14 1-item short forms were successfully developed. Short forms for four of the remaining scales contained two items each and the short form for the final scale contained five items, primarily due to concerns about ensuring content coverage. Each of the short forms accounted for at least 70 percent of the variance in the long form scores and contained items with high levels of discrimination, no floor or ceiling effects, and appropriate content.

In addition to developing short forms for each of the individual scales, a short form for the Navy Climate Index was also developed, referred to as the NCI-SF. Confirmatory factor analyses supported combining the short forms of seven scales (Workplace Climate, Organizational Commitment, Morale, Job Security, Communication, Fairness, and Navy Image) into a single NCI-SF score. A worksheet was developed that can be used by future users to easily compute scores for the NCI-SF. The NCI-SF demonstrated similar relationships with other variables (i.e., demographics, tone, job satisfaction, and retention intentions) as the NCI long form, supporting its validity. Furthermore, the NCI-SF was strongly, positively correlated with the NCI ($r = 0.97$) and accounted for 94 percent of the variance in the NCI scores.

In conclusion, the results suggest that several of the scales on the NPS may be substantially shortened, in some cases, with minimal loss of reliability. In particular, the findings suggest that reducing the length of the Navy Climate Index by 73 percent (i.e., removing 35 of the 48 items on the NCI) produces nearly identical scores, given the high correlation between the long and short forms of the NCI. The new 13-item NCI-SF that was developed could be administered as a part of a Navy Quick Poll to provide Navy leadership with rapid feedback concerning Navy climate. Future studies could explore the development of appropriate cut-points or benchmarks for the NCI-SF in relation to important outcomes, such as retention intentions.

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