# DEVELOPMENT OF A GRADUATION PREDICTION SCALE FOR U.S ARMY CANDIDATES ATTENDING EOD SCHOOL

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# TABLE OF CONTENTS

# LIST OF TABLES

# DEVELOPMENT OF A GRADUATION PREDICTION SCALE FOR U.S ARMY CANDIDATES ATTENDING EOD SCHOOL

## EXECUTIVE SUMMARY

This paper describes the results of a series of studies in the development and validation of a scale to predict successful graduation of Army candidates from the U.S. Navy Explosive Ordnance Disposal (EOD) training program. Previous research found that EOD practitioners have a unique profile of abilities not assessed by standard cognitive and aptitude tests. Use of these tests alone results in a substantial number of EOD candidates in training who fail to graduate (20% – 45%). The *Multiple Intelligences Developmental Assessment Scales* (MIDAS™) is a unique self-report that describes a person's skills and abilities in eight distinct intelligences that have a direct relationship to the EOD profession. The MIDAS was administered to 983 EOD candidates and the scales were correlated with graduation status. Five scales were found to have significant correlation to graduation status. These scales were combined into a Graduation Prediction Scale (GPS) that was able to predict within an acceptable level of accuracy the graduation status of nearly 42% - 80% (m=66%) of training candidates. The next step is to conduct field studies of the MIDAS-GPS to determine how well admissions personnel are able to integrate the GPS score into their admissions decision-making procedures.

The need for qualified EOD technicians has risen dramatically since the use of improvised explosive devices (IEDs) has become the favored weapon of terrorists and insurgents. In turn, this has increased the number of candidates being admitted to EOD training programs across the Services. Even though attrition rates from the EOD training program has historically been high due to the nature of the training, the need to increase the throughput of students in the training pipeline has also resulted in an increase in percentage of EOD candidates who fail to graduate. This results in several undesirable consequences, to include 1) a less than efficient use of the sponsoring organizations financial resources; 2) a loss of training seats that could be filled by successful candidates; and 3) disappointment and a misuse of the EOD candidate's time and talents that could be devoted to a career path better matched with his or her skills and abilities.

All applicants to EOD training programs are administered the ASVAB as a screening instrument of cognitive ability and skills, but recent data shows that despite its use, there is between a 20% to 45% attrition rate in EOD programs. Previous research (Bundy and Sims, 2007) demonstrated that practicing EOD technicians possess a unique profile of abilities not assessed by standard cognitive and skills tests, specifically, intrapersonal intelligence, visual-spatial intelligence, leadership skills and general logic. The research described here has investigated whether or not these unique abilities can be successfully measured to predict within an acceptable margin of error an applicant's likelihood of graduation from EOD training.

To investigate this question with the goal of improving the number of EOD candidates who successfully graduate, two self-report assessments were administered to 983 candidates admitted to the Army EOD training programs at two sites from a wide variety of states, including Puerto Rico. At the end of the training, program administrators reported back to the researchers which

candidates successfully graduated, and which did not. Graduation status data was reported by the various sites over the course of a year.

## EOD CANDIDATES DESCRIPTION

Of the 983 total Candidates, 5% (N=44) are female and the remaining 95% (N=937) are male. The mean age of the sample is 24.3 years with a minimum of 18 and a maximum of 47. The mean age for males was 23.6 and 24.6 for females. Sixty-four percent (634) are initial MOS and 28% (272) are current service personnel requesting Reclassification and 7% (N=67) have prior military service. Sixty-five percent (N=629) have a high school degree or GED and 10% (N=95) a Technical Certification, 9% (N=92) have an Associates degree and 16% (N=161) have a BS or other advanced degree.

## ASSESSMENTS

Two instruments were administered to all EOD Candidates at the onset of their training, The Multiple Intelligences Developmental Assessment Scales (MIDAS™) and the Canfield Learning Style Inventory (LSI). The MIDAS consists of eight main scales, three intellectual style scales and 29 subscales. The LSI consists of 17 scales that describe a person's learning preferences and attitude such as Expectation for Success, Working with Peers/ Independently, Reading and Working Logically. See Appendix 1 for details.

## DATA ANALYSIS

Training sites provided data on Candidates' graduation status during the course of the year and these results were consolidated into three data-sets of graduates and non-graduates. Non-graduate groups were comprised of candidates who were terminated from training due to academic deficiencies, and the final sample of 671 students consisted of 422 Graduates and 249 Non-Graduates. Three-hundred and twelve candidates were dismissed for other reasons or the program failed to report their final status during the timeframe for this study.

Four questions were investigated in sequence:

1) Does the population sampled have characteristics associated with successful EOD practitioners?
2) Do successful EOD School graduates have significantly different intellectual profiles from non-graduates?
3) Can a Graduation Prediction Scale (GPS) score be derived from the identified scales that differentiate successful graduates from non-graduates?
4) Can GPS values be calibrated so as to differentiate between several types of EOD applicants within acceptable margins of error, e.g., High-Potential, Good-Potential, At-Risk, and Low-Potential.

## INITIAL FINDINGS

Initial data determined that the highest MIDAS scales for both experienced EOD practitioners and EOD training candidates were very well aligned with the skills and abilities most associated with successful EOD technicians (Appendix 2). Their four highest main scales are all in the high range: Intrapersonal (64%), Spatial (62%), Interpersonal (60%) and Logical-mathematical (60%). Five of the top ten subscales are the same for both EOD practitioners and candidates: spatial awareness, self-knowledge, problem-solving, athletics, working with objects and management.

The LSI results indicate that a large number of the EOD candidates have a learning-style personality type of Conceptual (N= 399), Neutral (N= 266) or Independent (N= 117). Their top learning preferences are Reading, Qualitative, Competitive, Listening, Independence, People and Authority.

During Phase One data analysis, the first batch of Graduates and Non-Graduates were compared to determine if their MI scales differ in any significant way that might be useful to identify applicants to EOD training with a high potential for success. Phase Two repeated these analyses with the final total sample provided by training program managers.

## PHASE ONE: COMPARING GRADUATES AND NON-GRADUATES

Phase One sample is comprised of 190 Graduates and 134 Non-Graduates. There are 11 females (3%) and 313 males (97%). The mean age for Graduates was 25.3 and 23.7 years for Non-Graduates ($p$<.00). Sixty-six percent (N=214) have a high school degree, while 20% (N=65) have an Associates, Certificate or Technical degree and 13% (N=41) have a BS degree or higher.

### LSI SCALES

Only two of the LSI scales differentiated between Graduates and Non-Graduates at levels approaching significance, Qualitative (18 vs. 19, $p$<.00) and Reading (17 vs. 18, $p$< .09). Because these differences are so small and not directly pertinent to the tasks of EOD professionals, it was decided to focus research attention on the MIDAS scales as potentially viable indicators for predicting graduation success.

### MIDAS SCALES

The MIDAS main, style and subscales were examined in sequence. Mean main scale differences between Graduates and Non-Graduates were small, ranging from 1 – 2% points for six of the eight scales. The only two scales that are significantly different are Musical which has the largest difference of 6% ($p$< .01) and Intrapersonal 3% ($p$<.01). These small differences indicate that the two groups are closely matched, except that Graduates have higher overall self-understanding (64% vs. 61%) and Non-Graduates have more highly developed Musical abilities (49% vs. 43%).

Given these small main scale differences, it is necessary to examine the intellectual style scales and subscales. Graduates score significantly higher at 65% versus 62% for Non-Graduates ($p$<.058) on the General Logic intellectual style scale. The General Logic scale is a equated with common sense problem solving for mechanical-type and social problems in everyday life (Shearer, 2007)

MIDAS subscales are indicators of specific skills within each of the main eight areas. For example, Calculations and Everyday Problem Solving are subscales for the Logical-mathematical main scale. There are eight subscales with differences between Graduates and Non-Graduates that are theoretically meaningful and statistically significant or approaching significance. Graduates are higher on six scales (Personal Knowledge, Persuasion, Writing, Spatial Awareness and Problem-Solving and Science). Non-Graduates are higher on the Musical Appreciation and Composing subscales. See Table 1 below.

TABLE 1. MIDAS SCALES: GRADUATES VS. NON-GRADUATES, T-TESTS

| Scale | Graduates | Non-Grads | sig. |
|---|---|---|---|
| Musical | 43% | 49% | .01 |
| Musical Appreciation | 57% | 64% | .00 |
| Composing Music | 29% | 36% | .02 |
| Intrapersonal | 64% | 61% | .01 |
| General Logic | 65% | 62% | .05 |
| Personal Knowledge | 70% | 64% | .00 |
| Persuasion | 66% | 61% | .02 |
| Spatial Problem Solving | 70% | 66% | .02 |
| Spatial Awareness | 69% | 65% | .10 |
| Writing/Reading | 57% | 54% | .13 |
| Science | 60% | 56% | .13 |

*Note:* Graduates, *n*= 190; Non-Graduates, *n*= 134

It was also found that the Education level of the candidate was significantly correlated with graduation status ($p < .03$) as determined by Pearson Chi-Square , Phi and Cramer's V tests. There is an increased graduation rate for candidates with higher levels of education. See Table 2.

TABLE 2. EDUCATION LEVELS: GRADUATES VS. NON-GRADUATES

| Education Level | NonGrad | Graduated | Total | % Grad |
|---|---|---|---|---|
| HS/GED | 99 | 115 | 214 | 54% |
| Tech-Cert | 14 | 17 | 31 | 41% |
| Associates | 11 | 23 | 34 | 68% |
| BS or Adv | 10 | 31 | 41 | 76% |
| Total | 134 | 186 | 320 | 58% |

*Note:* Graduates, *n*= 190; Non-Graduates, *n*= 134; missing data, *n*= 4.

The next several steps in Phase One analyses involved the creation of a Graduation Prediction Scale (GPS) using the scales that best differentiated Graduates from Non-Graduates.

## GPS SCALE DEVELOPMENT

Based on the above results, two different versions of a GPS scale for MIDAS were created; a long and short version. The long version consisted of eight MIDAS scales, plus education level. The short version included only five scales, plus Education level. See Table 3.

Both versions were tested using Binary Logistic Regression. The long GPS correctly predicted 68% of graduates while the short GPS predicted 67%. Given these small differences in correct predictions and ease of use in practice, it was decided to proceed with development and validation of the short version of the GPS scale.

Using an equation derived from the regression analyses, the five subscales and education were weighted and calculated to produce a GPS scale score with a mean of 60%, with a Standard Deviation (SD) of 15%. Successful Graduates' mean score was 62%, SD 14, while Non-Graduates' mean was 52%, SD 14 ($p$<.00). See Table 4.

TABLE 3. FIVE MIDAS SCALES AND EDUCATION LEVEL COMPRISING GPS EQUATION

| Scale | B | S.E. | Wald | Df | Sig. | Exp(B) |
|---|---|---|---|---|---|---|
| Education Level | .206 | .114 | 3.251 | 1 | .071 | 1.229 |
| Music Appreciation | -.018 | .006 | 9.732 | 1 | .002 | .982 |
| Writing/Reading | .009 | .007 | 1.858 | 1 | .173 | 1.009 |
| Spatial Problem Solving | .019 | .009 | 4.726 | 1 | .030 | 1.019 |
| Personal Knowledge | .031 | .011 | 7.742 | 1 | .005 | 1.031 |
| General Logic | -.022 | .016 | 2.057 | 1 | .151 | .978 |
| Constant | -1.142 | .669 | 2.909 | 1 | .088 | .319 |

TABLE 4. GPS VALUES: GRADUATES VS. NON-GRADUATES

| Graduation Potential Score | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|
| NonGrad | 52.25 | 15.212 | 1.314 |
| Graduated | 62.04 | 14.428 | 1.058 |
| All | 60% | 14. | |

*Note:* Graduates, $n$= 186; Non-Graduates, $n$= 134

Using a cut value (or cutoff score) of .50, the GPS score correctly predicted graduation status of 67% of all Candidates. Eighty percent (80%) of successful graduates were correctly predicted, while 49% of Non-Graduates were correctly classified. In other words, of the 134 Non-Graduates there were 64 False Positives (51%) where the GPS incorrectly predicted that they would graduate. Of the 186 successful Graduates, there were 37 (20%) False Negatives where the GPS incorrectly predicted that they would not graduate. See Table 5.

TABLE 5. PHASE 1: BINARY LOGISTICAL REGRESSION CLASSIFICATION TABLE

| Observed | | Predicted | | |
|---|---|---|---|---|
| | | Graduation Status | | Percentage Correct |
| | | NonGrad | Graduated | |
| Graduation Status | Non-Grads | 64 | 70 | 49.0 |
| | Grads | 37 | 149 | 80.0 |
| Overall Percentage | | | | 67.2 |

*Note:* Cut value .50

Next, the GPS scale development was tested for accuracy in predicting successful graduation using the final total sample of successful Graduates and Non-Graduates.

## PHASE TWO: TESTING THE VALIDITY OF THE GPS SCORE

Army Phase II EOD School training staff provided additional data on Candidates' graduation status approximately nine months after the project was initiated. An additional 450 candidates already in the database were identified as either Graduated or Non-Graduated for a final total sample of 671 (424 Graduates and 247 Non-Graduates); 30 females (5%) and 639 males. The mean age is 24 years (females, 25; males, 24). The mean age of Graduates is 24.6 and Non-Graduates is 23.6 ($p$<.00). Sixty-six percent (N=442) have a GED or high school degree while 19% have an Associate's degree or Technical Certification. Fourteen percent (N=95) have a BS or other advanced degree. Sixty-four percent are initial MOS candidates, while 35% have previous military service. There are 312 other candidates with missing information or who were dismissed for reasons other than academic performance.

# RESULTS

The MIDAS main and subscales were compared among the three groups (Graduates, Non-Graduates and Other). The Graduates' scales were not statistically different from the Other group, but differed from the Non-Graduates' in the same pattern as did Graduates. See Table 6.

TABLE 6. MIDAS MAIN SCALES COMPARISONS AMONG CANDIDATES

| Graduation Status | | Musical | Kinest | Math | Spatial | Ling | Interper | Intraper | Nature |
|---|---|---|---|---|---|---|---|---|---|
| NonGrad | Mean | 47.84* | 54.41 | 58.55 | 61.48 | 52.96 | 59.37 | 62.39 | 52.84 |
| | Sd. | 20.78 | 15.68 | 15.24 | 1l6.58 | 17.89 | 16.13 | 12.46 | 19.695 |
| Grad | Mean | 44.12 | 55.19 | 59.56 | 62.14 | 54.49 | 60.81 | 64.66** | 53.47 |
| | Sd | 21.36 | 14.84 | 15.04 | 16.03 | 16.96 | 14.57 | 12.12 | 19.34 |
| Other | Mean | 44.30 | 55.56 | 61.21 | 63.45 | 55.70 | 60.65 | 64.72 | 54.26 |
| | Sd | 22.38 | 15.96 | 15.19 | 17.58 | 17.85 | 14.86 | 12.31 | 19.39 |
| Total | Mean | 45.11 | 55.11 | 59.83 | 62.39 | 54.49 | 60.40 | 64.11 | 53.56 |
| | Sd | 21.58 | 15.40 | 15.16 | 16.67 | 17.49 | 15.06 | 12.29 | 19.43 |

* $p<.03$; ** $p<.02$

*Note:* NonGrad, $n= 247$; Grad, $n=424$; Other, $n= 312$.

MIDAS scale statistics for the final sample are very similar to those of the original first group of 321, with the Intrapersonal, Musical, and General Logic scales being significantly different between Graduates and Non-Graduates. The same eight subscales are also different between the two groups, at or approaching significance levels. Of the intellectual style scales, only the General Logic differentiates Graduates from Non-Graduates (65% vs. 62%, $p<.02$). See Tables 7 and 8.

TABLE 7. GROUP COMPARISON AMONG INTELLECTUAL STYLE SCALE

| Graduation Status | | Leadership | General Logic | Innovation |
|---|---|---|---|---|
| Non-Grads | Mean | 57.67 | 62.90 | 50.50 |
| | Sd | 15.08 | 13.86 | 15.55 |
| Grads | Mean | 59.04 | 65.41** | 49.79 |
| | Sd | 14.38 | 13.44 | 14.90 |
| Other | Mean | 58.91 | 65.45 | 51.80 |
| | Sd | 14.97 | 13.20 | 16.39 |
| Total | Mean | 58.66 | 64.79 | 50.61 |
| | Sd | 14.74 | 13.51 | 15.56 |

***p*<.02

*Note:* Non-Graduate, *n*= 247; Graduates, *n*=424; Other, *n*= 312

TABLE 8. GROUP COMPARISONS AMONG SUBSCALES WITH SIGNIFICANT DIFFERENCES

| Graduation Status | | Scales | | | | | |
|---|---|---|---|---|---|---|---|
| | | Music Appreciation | Composing | Persuasive | Personal Knowledge | Writing/ Reading | Working with People |
| NonGrad | Mean | 62.24* | 35.12* | 62.69 | 64.47 | 53.42 | 55.50 |
| | Sd | 22.85 | 26.67 | 20.14 | 16.71 | 22.45 | 22.18 |
| Grad | Mean | 58.11 | 29.92 | 66.58* | 70.17* | 57.18* | 59.02* |
| | Sd | 23.53 | 26.23 | 18.70 | 15.43 | 22.13 | 18.84 |
| Other | Mean | 56.89 | 32.89 | 67.34 | 67.80 | 55.84 | 56.12 |
| | Sd | 25.12 | 27.60 | 18.43 | 15.83 | 22.23 | 20.83 |
| Total | Mean | 58.76 | 32.17 | 65.84 | 67.99 | 55.81 | 57.21 |
| | Sd | 23.95 | 26.84 | 19.06 | 16.03 | 22.27 | 20.40 |

**p*<.05

*Note:* Non-Graduates, *n*= 247; Graduates, *n*=424; Other, *n*= 312.

The mean GPS score for the Grad and Non-Grad groups combined was 61.5%. Graduates' mean score was 62.7% and Non-Graduates was 53.9%. This 9% difference was significant at the .00 level. These statistics for the combined groups of Graduates and Non-Graduates are very similar to those obtained with the Phase 1 group independently. The main difference being that Non-Graduates for the final sample have a somewhat higher mean GPS score (54% vs. 52%) than the first group of Non-Graduates. See Table 9.

TABLE 9. GPS SCORE. GRADUATES VS. NON-GRADUATES, FINAL SAMPLE

| Graduation | GPS Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|
| Non-Grad | 53.93 | 15.45 | 1.104 |
| Graduates | 62.75* | 15.33 | .839 |

* $p<.00$

*Note:* Phase 2: Non-Graduates, $n$= 247; Graduates, $n$= 424.

Using the cut value of .55, the GPS score correctly predicted graduation status of 66.5% of all candidates. Eighty-one percent (81%) of successful graduates were correctly predicted, while 42.2% of Non-Graduates were correctly predicted. See Appendix 3 for details.

TABLE 10. ALL GRADUATION DATA: BINARY LOGISTICAL REGRESSION CLASSIFICATION

| Observed | Predicted | | |
|---|---|---|---|
| | Non-Grads | Grads | Percentage Correct |
| Non-Grads | 105 | 144 | 42.2 |
| Grads | 79 | 338 | 81.1 |
| Overall Percentage | | | 66.5 |

*Note: Cut value = .55*

# DISCUSSION

This research determined that successful graduates from EOD training have unique and measurable differences in their multiple intelligences skills and abilities. These differences are both statistically significant and meaningful. The scales that are higher for successful graduates are consistent with the skills needed to perform effectively as an EOD practitioner: self-understanding, visual-spatial problem-solving, general logic (common sense), reading/writing and leadership skills. An unexpected finding was that non-graduates displayed higher musical appreciation and expectations for success.

The second finding of this research successfully tested a prototype of a Graduation Prediction Scale (GPS) derived from a combination of MIDAS subscales. The GPS scale was able to differentiate between Graduates and Non-Graduates at levels of significance. Depending on the cut scores employed, the GPS can successfully predict Graduation status on average 66% of the time. Of course, this is for a sample of admitted EOD Candidates already pre-selected from among an array of applicants. At present it is not possible to know how well the GPS score will predict successful graduation of unscreened applicants, and field tests, or pilot programs will be necessary to determine effectiveness with respect to unscreened applicants.

However, the MIDAS-GPS has great potential to add incremental validity to the existing system of selecting candidates for EOD training. The goal of the MIDAS-GPS is not to serve as a "stand alone" measure to determine an applicant's selection, rather to add insight into the applicant's innate skills and abilities that are not readily apparent or made otherwise evident by existing assessment and selection processes. The purpose of the MIDAS-GPS is to enhance the recruitment decision-making process and support it with information about the applicant's "fit" for EOD training as compared to the characteristics of successful EOD practitioners. A potential secondary benefit is to provide an applicant with information about his or her own skills and abilities, which will ultimately guide him or her into a training program able to maximize his or her chances for overall success. The effective employment of these two strategies should increase the graduation rate from EOD training without a diminution of quality by fitting the Candidate's skills with job requirements and then supporting the trainee to maximize his or her chances for success.

## INTERPRETING THE GPS SCORE FOR EOD SELECTION DECISION MAKING

Of our sample's 671 EOD candidates, 37% (N=247) failed to graduate while 63% (N=424) graduated. These Candidates were selected using the ASVAB and in some cases an interview process with a current EOD practitioner. When the GPS score is added to the decision making process, the number of candidates who would fail to graduate is reduced; the amount of reduction depends upon the cutoff score used to guide decision making. In short, the higher the cut score used, the greater the chance that a candidate will, indeed, graduate. The downside however, is that fewer candidates, as compared to numbers of those selected using current approaches, will be selected for training because more applicants will be "screened out." In other words, if you only accept applicants with Very High Potential to graduate, you would lose a significant number of candidates who would have potentially graduated, despite having been identified as being in the High or Good Potential ranges. Several examples illustrate how this would work for our existing data.

## GPS 76% AS THE VERY HIGH POTENTIAL CUT-POINT…22% REDUCED ATTRITION

For the population studied, addition of the MIDAS-GPS to the decision making process could have reduced attrition to 15% by selecting only those candidates who scored in the Very High Potential range (above 76%) of the GPS. However, only ninety-eight (98) candidates would have been admitted as compared to the 334 who actually graduated.

## GPS 65% AS THE HIGH POTENTIAL CUT-POINT…12% REDUCED ATTRITION

If the GPS score were lowered to 65%, the attrition rate would be 25%. At this cutoff score, greater numbers of EOD candidates would be admitted to training (202 vs. 334), and inevitably, with more candidates in the training pipeline, more graduate.

## GPS 60% AS THE GOOD POTENTIAL CUT-POINT…8% REDUCED ATTRITION

If a GPS score of 60% were used to select Candidates, attrition would be reduced to 29%. Again, even more candidates would be expected to graduate because an even greater number would be admitted (269 vs. 334).

It should be reiterated that simply looking at numbers of graduates can be deceptive. As stated earlier, the larger the number of candidates admitted to training, regardless of selection process, the larger the number of candidates likely to graduate. Graduate numbers alone however, does not address other areas of interest for recruitment and retention such as overall suitability for, or potential for longevity in the EOD career field. By understanding the intelligence characteristics of those already in the EOD career field, and admitting potential candidates who most closely match those characteristics, you not only increase probability of graduation from EOD School, but you increase the likelihood of contentment with, and retention in the career.

That being said, the overall efficacy of any instrument for screening or assessment and selection depends on a number of factors beyond the accuracy or precision of the instrument being used. First, there are individual factors and circumstances influencing attrition that cannot be predicted ahead of time, e.g., illness, familial issues, or a host of other non-academic situations that affect the student's ability to retain information and focus on academic success. Second, the need for, and pool of available applicants at the time of selection will guide how much tolerance there is for higher attrition rates, and ultimately which cut value will be feasible to employ. For example, if demand for graduates is low, but the pool of applicants is large, a higher cut-value might be desirable in an effort to graduate only the most highly qualified candidates. Conversely, if the applicant pool is low and the demand for graduates is high, a lower cut value might be justifiable in order to increase yield. Ultimately, any decision regarding what constitutes any pool of applicants' suitability for training is a matter of professional judgment by practitioners in that discipline. Tests and assessments only serve to inform judgment, and are merely "tools" whose efficacy can only be maximized when used by those knowledgeable and experienced in their use; simply possessing a saw and hammer does not make one a carpenter.

## CANDIDATE SELECTION: A PROCESS OF TRIANGULATION

The three points that can be calibrated to select EOD Candidates: Academic skills – reading and math scores, etc., which can be determined from the AFSVAB or similar tests; the MIDAS-GPS which quantifies Intrapersonal, General Logic, Leadership, and Visual/Spatial problem-solving; and motivation, which is often expressed as enthusiasm, willingness to learn, commitment, and effort. Of course this information is best identified through person-to-person interaction with the individual, which is done by using appropriately crafted questions during a structured interview format. This provides a mechanism to ensure consistency in assessing an applicants' potential, and allows the interviewer to identify qualitative indicators that can be included in the interviewer's notes and annotated in the applicants' suitability report.

Appendix 4 provides four tables that illustrate how the MIDAS-GPS may be employed to inform the decision making process, and shows the graduation rate for a given range of GPS scores. The first table describes the graduation rate of all candidates at an unspecified education level. To increase predictive accuracy however, subsequent tables and their data are broken into three education levels which can be matched to the candidates own education level. They are as follow: High School/GED; ACT (Associates, Certification or Technical degree); and Advanced (BS and above).

For example, if an applicant has a GPS score of 50%, and his education level is unknown, then the data shows an average predicted graduation rate of 66%. If this same individual has a High School education, the adjusted predictive graduation rate *drops* to 53%. If the applicant has an Associate's degree the adjusted predictive graduation rate *increases* to 67%. If he has a bachelor's degree the adjusted predictive graduation rate *drops* back down to 57%. It should be noted that these percentages are based on relatively small numbers of candidates at each education level. Therefore, additional data will be needed to ensure that the GPS is calibrated properly to education level and accurately reflects a candidate's graduation potential.

## NEXT STEPS

1) Develop instructions for administration and interpretation of the MIDAS-GPS for use during the recruitment, interviewing, and selection processes for EOD candidates
2) Pilot the MIDAS-GPS at one or two recruiting stations, as well as several In-Service recruiting operations
3) Investigate the potential need for two different methods of calculating the GPS score; one for new recruits and one for those requesting reclassification from another Military Occupational Specialty
4) Develop guidelines for those administering MIDAS and interpreting the GPS, on implications of the GPS score and the five constituent MI scales

## LIMITATIONS AND RECOMMENDATIONS

The MIDAS-GPS should be considered as only one piece of information in the decision-making process, and it must be understood that scores must be viewed in combination with other sources of information if a true picture of the applicant's suitability for EOD training is to be established. To be effective, the MIDAS-GPS needs to be carefully inserted in the decision-making process at a point

where it will provide "value added" information along with other sources of data such as education, ASVAB scores, work history/prior training, interviews, and motivation/attitude.

The MIDAS-GPS also needs to be administered to applicants from a variety of cultural backgrounds in order to ensure elimination of any potential cultural bias. In addition, because the MIDAS-GPS is a self-report instrument, the results need to be carefully reviewed and the validity of the results estimated through dialog with the applicant. Ideally, the applicant should be provided an opportunity to review and verify his or her profile prior to any decision is made regarding acceptance into the EOD training program.

Finally, it would be beneficial to cross-validate, or compare and contrast the results of this study, which focuses on EOD School candidates, with a variety of individuals from other training programs. It is likely that if this assessment approach is valid for EOD School candidates, that it could be used for other specialized training programs that require individuals with unique profiles.

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# APPENDIX 1: THE MIDAS: MAIN SCALES, INTELLECTUAL STYLE AND SUBSCALES

Musical: *To think in sounds, rhythms, melodies and rhymes. To be sensitive to pitch, rhythm, timbre and tone. To recognize, create and reproduce music by using an instrument or voice. Active listening and a strong connection between music and emotions.*

Vocal Ability: a good voice for singing in tune and in harmony

Instrumental Skill: skill and experience in playing a musical instrument

Composer: makes up songs or poetry and has tunes on her mind

Appreciation: actively enjoys listening to music of some kind

Kinesthetic: *To think in movements and to use the body in skilled and complicated ways for expressive and goal directed activities. A sense of timing, coordination for whole body movement and the use of hands for manipulating objects.*

Athletics: ability to move the whole body for physical activities such as balancing, coordination and sports

Dexterity: to use the hands with dexterity and skill for detailed activities and expressive moment

Logical-Mathematical: *To think of cause and effect connections and to understand relationships among actions, objects or ideas. To calculate, quantify or consider propositions and perform complex mathematical or logical operations. It involves inductive and deductive reasoning skills as well as critical and creative problem-solving.*

Everyday Math: to use math effectively in everyday life

School Math: to perform well in math at school

Everyday Problem Solving: able to use logical reasoning to solve everyday problems, curiosity

Strategy Games: good at games of skill and strategy

Spatial: *To think in pictures and to perceive the visual world accurately. To think in three-dimensions and to transform one's perceptions and re-create aspects of one's visual experience via imagination. To work with objects effectively.*

Space Awareness: to solve problems of spatial orientation and moving objects through space such as driving a car

Artistic Design: to create artistic designs, drawings, paintings or other crafts

Working with Objects: to make, build, fix, or assemble things

Linguistic: *To think in words and to use language to express and understand complex meanings. Sensitivity to the meaning of words and order among words, sounds, rhythms, inflections. To reflect on the use of language in everyday life*.

Expressive Sensitivity: skill in the use of words for expressive and practical purposes

Rhetorical Skill: to use language effectively for interpersonal negotiation and persuasion

Written-academic: to use words well in writing reports, letters, stories, verbal memory, reading / writing

Interpersonal: *To think about and understand another person. To have empathy and recognize distinctions among people and to appreciate their perspectives with sensitivity to their motives, moods and intentions. It involves interacting effectively with one or more people in familiar, casual or working circumstances.*

Social Sensitivity: sensitivity to and understanding of other people's moods, feelings and point of view

Social Persuasion: ability for influencing other people

Interpersonal Work: interest and skill for jobs involving working with people

Intrapersonal: *To think about and understand one's self. To be aware of one's strengths and weaknesses and to plan effectively to achieve personal goals. Reflecting on and monitoring one's thoughts and feelings and regulating them effectively. The ability to monitor one's self in interpersonal relationships and to act with personal efficacy.*

Personal Knowledge / Efficacy: awareness of one's own ideas, abilities; able to achieve personal goals

Calculations: meta-cognition "thinking about thinking' involving numerical operations
Spatial Problem Solving: self awareness to problem solve while moving self or objects through space

Effectiveness: ability to relate oneself well to others and manage personal relationships

Naturalist: *To understand the natural world including plants, animals and scientific studies. To recognize, name and classify individuals, species and ecological relationships. To interact effectively with living creatures/ discern patterns of life and natural forces.*

Animal Care: skill for understanding animal behavior, needs, characteristics

Plant Care: ability to work with plants, i.e., gardening, farming and horticulture

Science: knowledge of natural living energy forces including cooking, weather and physics

## INTELLECTUAL STYLE

LEADER- Leadership: *To use language effectively to organize and solve interpersonal problems & goals.*

____Communication ____Managerial skill ____Social adeptness

Innovative: *To work in artistic, divergent, imaginative ways. To improvise and create unique answers, arguments or solutions*.

General Logic: *To deal with problems in an intuitive, rapid and perhaps unexpectedly accurate manner. To bring together a wide amount of information and to make it part of a general and effective plan of action.*

Canfield Learning Style Inventory: 17 scales

Reading
Qualitative
Competitive
Listening
Independence
Authority
People
Peer
Goal setting
Numeric
Instructor
Iconic
Detail
Organization
Inanimate
Direct Experience
Expectation for Success

# APPENDIX 2: TOTAL SAMPLE CANDIDATES DESCRIPTIVE STATISTICS, N=983

TABLE 11. MIDAS MAIN SCALE MEAN SCORES

| Main Scales | Mean | Sd |
|---|---|---|
| Intrapersonal | 64.12 | 12.29 |
| Spatial | 62.40 | 16.67 |
| Interpersonal | 60.41 | 15.06 |
| Logic-Math | 59.85 | 15.16 |
| Kinesthetic | 55.12 | 15.40 |
| Linguistic | 54.50 | 17.49 |
| Naturalist | 53.57 | 19.42 |
| Musical | 45.13 | 21.58 |

TABLE 12. INTELLECTUAL STYLE MEAN SCALE SCORES

| Style | Mean | Std. Deviation |
|---|---|---|
| General Logic | 64.81 | 13.55 |
| Leadership | 58.67 | 14.74 |
| Innovative | 50.61 | 15.55 |

TABLE 13. SUBSCALES MEAN SCORES

| Subscale | Mean | Std. Deviation |
|---|---|---|
| Spatial Problem Solving | 70.99 | 17.926 |
| Spatial Awareness | 70.30 | 19.206 |
| Personal Knowledge | 68.00 | 16.032 |
| Problem Solving | 67.39 | 20.072 |
| Working with Objects | 67.30 | 17.181 |
| Athletics | 66.88 | 20.596 |
| Persuasion | 65.85 | 19.058 |
| School Math | 63.25 | 25.806 |
| Self Effectiveness | 63.08 | 17.115 |
| Management | 62.69 | 18.247 |
| Sensitivity to Others | 59.56 | 18.340 |
| Science | 59.53 | 22.458 |
| Rhetoric | 59.49 | 18.580 |
| Social Management | 58.90 | 20.354 |
| Musical Appreciation | 58.77 | 23.942 |
| Logic Games | 57.70 | 18.082 |
| Working with People | 57.21 | 20.392 |
| Animal Care | 56.98 | 23.485 |
| Calculations | 56.48 | 21.511 |
| Writing / Reading | 55.83 | 22.271 |
| Everyday Math | 54.79 | 20.992 |
| Art Design | 53.60 | 23.402 |
| Communication | 52.05 | 19.180 |
| Expressive Sensitivity | 48.07 | 20.228 |
| Dexterity | 43.10 | 17.249 |
| Plant Care | 40.87 | 23.526 |
| Vocal Music | 35.18 | 27.519 |
| Instrumental Music | 34.07 | 29.835 |
| Composing Music | 32.19 | 26.835 |

# APPENDIX 3: LOGISTIC REGRESSION

Logistic regression, also called a logit model, is used to model dichotomous outcome variables. In the logit model the log odds of the outcome is modeled as a linear combination of the predictor variables. For all calculations in our model, N=671

TABLE 14. OMNIBUS TESTS OF MODEL COEFFICIENTS

| | | Chi-square | df | Sig. |
|---|---|---|---|---|
| Step 1 | Step | 51.222 | 7 | .000 |
| | Block | 51.222 | 7 | .000 |
| | Model | 51.222 | 7 | .000 |

TABLE 15. MODEL SUMMARY

| Step | -2 Log likelihood | Cox & Snell R Square | Nagelkerke R Square |
|---|---|---|---|
| 1 | 829.211(a) | .074 | .101 |

*Note:* Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

TABLE 16. CLASSIFICATION TABLE

| Observed | | Predicted | | |
|---|---|---|---|---|
| | | Non-Grads | Grads | Percentage Correct |
| | Non-Grads | 105 | 144 | 42.2 |
| | Grads | 79 | 338 | 81.1 |
| | Overall Percentage | | | 66.5 |

*Note:* Cut value = .550

TABLE 17. LOGISTIC REGRESSION EQUATION VARIABLES

| | B | S.E. | Wald | df | Sig. | Exp(B) |
|---|---|---|---|---|---|---|
| General Logic | -.016 | .010 | 2.592 | 1 | .107 | .984 |
| Music Appreciate | -.005 | .004 | 1.351 | 1 | .245 | .995 |
| Composing | -.010 | .004 | 7.098 | 1 | .008 | .990 |
| Writing/Reading | .009 | .005 | 4.073 | 1 | .044 | 1.009 |
| Persuasive | .006 | .005 | 1.132 | 1 | .287 | 1.006 |
| Person Knowledge | .027 | .008 | 11.977 | 1 | .001 | 1.028 |
| Education | .232 | .076 | 9.213 | 1 | .002 | 1.261 |
| Constant | -.700 | .436 | 2.573 | 1 | .109 | .497 |

# APPENDIX 4: GPS INTERPRETATION BY EDUCATION LEVEL

TABLE 18. ALL EDUCATION LEVELS

| GPS Range by Category | | Graduation Rate | Graduation Status | | |
|---|---|---|---|---|---|
| | | | NonGrad | Grad | Total |
| Low | 0 – 46% | 44% | 79 | 62 | 141 |
| Moderate | 47 – 60% | 66% | 62 | 118 | 180 |
| High | 61 – 74% | 67% | 61 | 124 | 185 |
| Very High | 75 – 100% | 82% | 22 | 99 | 121 |
| | | | 36% | 64% | 100% |

*Note:* N=627

TABLE 19. HIGH SCHOOL EDUCATION

| GPS Range by Category | | Graduation Rate | Grad Status | | |
|---|---|---|---|---|---|
| | | | NonGrad | Grad | Total |
| Low | 0 – 41% | 43% | 40 | 30 | 70 |
| Moderate | 42 – 54% | 53% | 70 | 79 | 149 |
| High | 55 – 74% | 64% | 61 | 107 | 168 |
| Very High | 75 – 100% | 77% | 7 | 24 | 31 |
| | | | 43% | 57% | 100% |

*Note:* N=418

TABLE 20. ACT – ASSOCIATES – CERTIFICATION – TECHNICAL EDUCATION, N= 117

| GPS Range by Category | | Graduation Rate | Grad_Status | | |
|---|---|---|---|---|---|
| | | | NonGrad | Grad | Total |
| Low | 0 – 47% | 38% | 5 | 3 | 8 |
| Moderate | 48 – 66% | 67% | 16 | 33 | 49 |
| High | 67 – 74% | 80% | 5 | 20 | 25 |
| Very High | 75 – 100% | 77% | 8 | 27 | 35 |
| | | | 29% | 71% | 100% |

*Note:* N=117

TABLE 21. ADVANCED EDUCATION: BS AND ABOVE

| GPS Range by Category | | Graduation Rate | Grad_Status | | |
|---|---|---|---|---|---|
| | | | NonGrad | Grad | Total |
| Low | 0 – 56% | 57% | 3 | 4 | 7 |
| Moderate | 57 – 69% | 78% | 4 | 14 | 18 |
| High | 70 – 79% | 69% | 11 | 24 | 35 |
| Very High | 80 – 100% | 91% | 2 | 21 | 23 |
| | | | 24% | 76% | 100% |

*Note:* N=83