
TOWES Validation Study

**Report:
Criterion-Related Studies for the
Psychometric Evaluation of
TOWES**

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Executive Summary

The Test of Workplace Essential Skills (TOWES) was developed specifically for the Canadian Workplace to assess individuals' essential skills. These skills are divided into three domains each represented by a subscale of TOWES: Reading Text is demonstrated when individuals are able to understand and use information found in continuous text formats including memoranda, regulations, policies, etc.; Document Use requires individuals to locate and use information contained in information displays such as entry forms, tables, schematics, maps, and graphs; and Numeracy where individuals are required to demonstrate their skill at applying arithmetic operations to numbers that appear in printed materials such as monetary calculations, scheduling, accounting, or data analysis.

Data for the study was obtained at ten occupation-oriented training sites and three workplace sites from May 2002 to December 2003. Additional results from data collected at one worksite (not originally part of the study) were made available and included in the findings. Each data set had unique outcomes associated with the specific setting. Several conclusions can be made after a review of the findings.

1. The subscales of the TOWES (Reading Text, Document Use, and Numeracy) are intercorrelated with one another. Depending on the sample, there was more or less shared variance between them.
2. The TOWES scores are most likely affected by number of years of formal education. The more formal education a person has, the more likely they are to perform better on the TOWES test.
3. The TOWES subscales are correlated with other tests of ability. The degree of overlap is not large, and thus TOWES provides unique information about respondent skill levels above and beyond other types of tests.
4. TOWES is quite useful in predicting occupation-oriented training outcomes. Scores are most useful in helping to identify individuals that may have difficulty in a program. This information may be used to ensure an individual has access to essential skills upgrading.
5. There were some workplace outcomes linked to TOWES scores. These results are promising and suggest that skill level should be a consideration in employment settings.

Any study has methodological limitations that warrant review.

1. All relationships examined were correlational. TOWES scores were related to criterion variables of interest, but cannot be said to CAUSE the variable to change. To make this claim, an experimental design would need to be used, but it is not often possible to construct such experiments in field settings.
2. There were very few opportunities to collect workplace outcome measures. Collection of these variables takes a large commitment of time and effort on the workplace's behalf, and would need to have a clear added value to the employer. Future research should include workplace administrators as important stakeholders in the process, so they will be motivated to provide the resources needed to collect such information.

3. We were subject to administrative constraints because data was collected for us at the various sites. It was not feasible to ensure that the most important data was collected; we were not directly involved at each site. This does not infer that the administrators who were kind enough to assist us did a poor job. Only that as a researcher nothing beats “being on site” to clarify questions, observe when a variable should be included, etc. We simply did the best we could, as did the on-site administrators who in most cases volunteered their valuable time to assist us.
4. Depending on the site, demographic variables were included as potential covariates in some analyses and not in others. This is problematic when making direct comparisons across all sites.
5. All collected data used percentage correct scores on the TOWES subscales. This is a problem for two reasons. First, percentage correct assumes a similar level of difficulty for each item. Second, different versions of the TOWES test were used at the different sites; this makes comparisons across sites impossible. There is currently a change in this scoring protocol underway. Specifically, test takers will receive a score from 0 – 500 based on Item Response Theory assessments of the TOWES test. This will provide more accurate values of test scores that can be used in the future.

Introduction

This report focuses on the criterion-related studies of TOWES that were carried out over the duration of this validation study (May 2002 – December 2003), or where archival data was collected at several field sites in 2002-2003. Criterion-related validity hypothesizes and tests the direction and strength of relationships between specified predictors (in this case, the TOWES subscale scores) and criteria (outcomes such as subsequent performance). These can be carried out concurrently (data is collected on the predictors and criteria simultaneously) or predictively (data is collected on the predictor and the criteria data are collected at a later point in time). These analyses were conducted to establish the extent that knowledge about an individual's performance on TOWES assists in predicting their performance on a criterion. The more diverse the samples on which the type of data was collected, and the more diverse the criteria, the better able judgments can be made about the validity of the predictor in various situations.

The sites where data was collected were primarily of two types: occupation-oriented training and workplace-oriented.

The occupation-oriented training sites were:

1. Bow Valley College (Calgary, AB) – Practical Nurse Program (*see Appendix 1*)
2. Bow Valley College (Calgary, AB) – Office Administration Program (*see Appendix 2*)
3. Bow Valley College (Calgary, AB) – ESL Professionals Program (*see Appendix 3*)
4. Metro Community College (Edmonton, AB) – Pre-Employment, Pre-Apprenticeship and Pre-High School Programs (*see Appendix 4*)
5. Northern Alberta Institute of Technology (Edmonton, AB) – Construction Trade Apprenticeship Program (*see Appendix 5*)
6. Painters Apprenticeship (Vancouver, BC) – Painter Apprenticeship Program (*see Appendix 6*)
7. Preparatory Training Program (Toronto, ON) – Employment Readiness Programs (*see Appendix 7*)
8. Saskatchewan Institute of Applied Science and Technology (Regina, SK) – Employment Readiness Training Programs (*see Appendix 8*)
9. Vancouver Community College (Vancouver, BC) – ESL Basic Skills (*see Appendix 9*)
10. Douglas College (Vancouver, BC) – Private Security Training Program (*see Appendix 10*)

The workplace-oriented sites were:

1. Halifax Employer Association (HEA) (Halifax, NS) – Longshore Workers (*see Appendix 11*)
2. International Brotherhood of Electrical Workers (IBEW) (Toronto, ON) – Electrician Apprentices (*see Appendix 12*)
3. Suncor (Ft. McMurray, AB) – Heavy Equipment Operators (*see Appendix 13*)
4. Canadian Petroleum Products Institute-Western Distribution Task Force (Alberta) – Petroleum Professional Drivers

The data came from a wide variety of settings. The outcome measures varied from site to site, and are explained in detail in the individual site reports attached as the Appendix to this summary.

The organization of this report is as follows:

- Interrelationships between the TOWES subscales
- Relationships of TOWES scores with demographic variables
- Relationships of TOWES scores with other cognitive ability measures
- Relationships of TOWES scores with occupation training outcomes
- Relationships of TOWES scores with workplace outcomes
- Appendices

Interrelationships Between the TOWES Subscales

TOWES is comprised of three subscales: Reading Text, Document Use and Numeracy. Because all subscales assess aspects of cognitive ability, there was likely a significant relationships among the subscale scores. This was the case in all but one of the data collection sites.

1. The relationship between Reading Text and Document Use scores ranged from a low of 0.29 to a high of 0.94.
2. The relationship between Reading Text and Numeracy scores ranged from a low of 0.40 to a high of 0.93.
3. The relationship between Reading Text and Document Use scores ranged from a low of 0.37 to a high of 0.92.

The shared variances of the scores ranged from 8% to 88%. It was not unexpected to find such relationships. As noted later in this report, all assessments of cognitive skills tend to be intercorrelated with one another. The method for collecting the data for each subscale was the same (i.e., a paper-and-pencil test).

Based on these findings, it is important that individuals using the test information are aware that high (or low) scores on one of the subscales will likely result in high (or low) on the others.

Relationships of TOWES Scores with Demographic Variables

Several sites provided demographic information and TOWES test scores. Again, these were widely varied (gender, age, years of education, etc.). Whenever this data was available, we assessed the relationship with TOWES test scores. Only statistically significant relationships between the variables are reported here. The specific values are reported in the associated Appendix.

1. At the HEA: Number of years of education was positively related to all of the TOWES subscales. As years of formal education increased, so did scores on the TOWES subscales.
2. At Metro: Number of years immigrants had resided in Canada was positively related to Numeracy scores. Those who had lived more years in Canada had higher Numeracy scores. Having prior work experience was negatively related to Document Use scores. Those with prior work experience had lower Document Use scores.
3. At NAIT: Number of years of education was positively related to all of the TOWES subscales. As years of formal education increased, so did scores on the TOWES subscales.
4. At Painters: Age was positively related to all of the TOWES subscales. As age increased so did scores on the TOWES subscales. It is important to note that this was a very young sample.
5. At SIAST: Gender was related to Numeracy, with men scoring higher. Years of formal education was related to Numeracy; those with more years of formal education scored higher. Visible minority status was significantly related to all of the TOWES scales; those who were members of visible minorities scored lower.
6. At Suncor: Race (white versus non-white, where non-white was most often Aboriginal) was correlated with Document Use; non-whites scored lower. Gender was related to Document Use and Numeracy; women scored higher on Document Use and men higher on Numeracy. Education level was related to Reading Text; those with more education had higher scores.

These findings were not surprising. Years of education was most often related to higher TOWES scores. More years of formal education should be related to scores on cognitive ability tests. Gender was not often related to TOWES scores overall. The pattern of men scoring higher on Numeracy is consistent with other measures of such skills. Race (in this case whites versus non-whites) was related to TOWES scores, with non-whites doing more poorly.

The purpose of this data collection exercise is not to prescribe public policy. However, one implication of these findings is that attention needs to be paid to visible minority groups in raising their essential skills levels. In addition, at the broader societal level, formal education should be deemed to be critical in ensuring that essential workplace skills are present in the up and coming members of the workforce.

Relationships of TOWES Scores with Other Cognitive Ability Measures

At several sites, other tests used to assess skills were also administered. The significant relationships found are presented in the following table. In all instances the relationships are positive: scores on the criterion scales increased as scores on the TOWES increased.

SITE	TOWES SUBSCALE	CRITERION SUBSCALE
Bow Valley College- Practical Nurses	Reading Text	TABE Math Grade Equivalent
		TABE Applied Math Grade Equivalent
	Numeracy	TABE Math
		TABE Math Grade Equivalent
		TABE Applied Math Grade Equivalent
	Bow Valley College-Office Administration	Reading Text
TABE Reading Grade Equivalent		
TABE Math		
TABE Math Grade Equivalent		
Document Use		TABE Reading
		TABE Reading Grade Equivalent
		TABE Math
		TABE Math Grade Equivalent
Numeracy		TABE Reading
		TABE Reading Grade Equivalent
		TABE Math
		TABE Math Grade Equivalent

SITE	TOWES SUBSCALE	CRITERION SUBSCALE
Bow Valley College-ESL Professionals	Reading Text	TABE M5
		CLB Listening
		CLB Reading
	CLB Writing	
	Document Use	TABE M5
		CLB Listening
		CLB Reading
	CLB Writing	
	Numeracy	TABE M5
CLLB Reading		
CLB Writing		
Halifax Employer Association	Reading Text	Aptitude
		GATB-Manual Dexterity
	Document Use	Aptitude
		GATB-Spatial Skills
		GATB-Motor Skills
		GATB-Manual Dexterity
	GATB-Eye Hand Coordination	
	Numeracy	Aptitude
		GATB-Spatial Skills
		GATB-Motor Skills
		Apticom Eye-Hand-Foot Coordination

SITE	TOWES SUBSCALE	CRITERION SUBSCALE
IBEW	Reading Text	NJATC-total
		NJATC-Algebra/Functions
		NJACT-Reading Comprehension
	Document Use	NJATC-total
		NJATC-Algebra/Functions
		NJACT-Reading Comprehension
	Numeracy	NJATC-total
		NJATC-Algebra/Functions
		NJACT-Reading Comprehension
Vancouver Community College	Document Use	Gates-MacGinty Reading Test

Various tests were used at these sites. The significant correlations were generally of moderate magnitude, indicating that while there is some overlap in the assessment process, more variance of the TOWES tests and the other instruments are unique. This finding suggests the most appropriate use for TOWES; if TOWES scores were unrelated to other tests of ability, one would question their validity. On the other hand, TOWES needs to be unique enough to add information to test score users over and above that of other test instruments.

Relationships of TOWES Scores with Academic Outcomes

At eight sites, scores on TOWES were related to some sort of occupation training outcome. They were primarily course or examination grades (it is noted whenever this was not the case), and are called “proximal” measures. They are similar to the construct under investigation. The following table indicates the site, TOWES subscale related to the criterion, and criterion. In all instances the higher the TOWES score the better the performance on the criterion.

SITE	TOWES SUBSCALE	CRITERION SUBSCALE
Bow Valley College – Practical Nurses	Reading Text	Interpersonal Communications
		Maternity Nursing
		Nursing Science Basic Skills
		Pediatric Nursing
		Program Withdrawal (higher scores less likely to withdraw from program)
	Document Use	Interpersonal Communications
		Mental Health Nursing
		Nursing Science Basic Skills
		Pediatric Nursing
	Numeracy	Maternity Nursing
		Nursing Science Basic Skills
		Pediatric Nursing
		Program Withdrawal (higher scores less likely to withdraw from program)

SITE	TOWES SUBSCALE	CRITERION SUBSCALE
Bow Valley College – Office Administration	Reading Text	Business Communications I
		Interpersonal and Organizational Skills
		Keyboard
	Document Use	Business Communications I
		Interpersonal and Organizational Skills
	Numeracy	Business Communications I
		Business Communications II
		Computers at Work
		Document Processing II
		Preparation for the Workplace
		Excel
		Interpersonal and Organizational Skills
		Internet
		Keyboard
		Outlook
Office Services		
Word		
Document Processing III		
Metro Community College	Document Use	Program stream (higher scores relate to more academically rigorous stream)
	Numeracy	Program stream (higher scores relate to more academically rigorous stream)

SITE	TOWES SUBSCALE	CRITERION SUBSCALE
NAIT	Reading Text	NAIT Final Marks
		Trade Math
		Alberta Final Exam Scores
	Document Use	NAIT Final Marks
		Trade Math
	Numeracy	NAIT Final Marks
		Trade Math
		Shop
		Alberta Final Exam Scores
	Painters Apprenticeship	Reading Text
Math, Year 3		
Inter-provincial Exam		
Document Use		Final Exam, Year 2
		Math, Year 3
Numeracy		Blueprint, Year 3
Preparatory Training Program	Reading Text	Program Type (higher scores relate to more academically-oriented program)
	Document Use	Program Type (higher scores relate to more academically-oriented program)
		Follow-up (higher scores relate to currently in a training program vs. not in a training program)
Vancouver Community College	Document Use	Success in completing course (higher scores relate to more completion)

SITE	TOWES SUBSCALE	CRITERION SUBSCALE
Douglas Community College	Reading Text	Basic Standards Training 1
		Basic Standards Training 2
		Completing Program with Distinction
	Document Use	Basic Standards Training 1
		Basic Standards Training 2
		Completing Program with Distinction
	Numeracy	Basic Standards Training 1
		Basic Standards Training 2
		Completing Program with Distinction

These findings are very encouraging. At various sites, it was often found that TOWES scores would predict performance in training. Given the high cost of training and education, results suggest that TOWES scores can be very useful particularly in these types of contexts.

Relationships of TOWES Scores with Workplace Outcomes

At four sites, scores on TOWES were related to some sort of workplace outcome. These are what are called “distal” measures. That is, they are quite distant from the construct under investigation.

1. At HEA: Scores on Reading Text and on Numeracy were related to the decision to hire the applicant. In both instances the relationship was negative: as scores on the TOWES increased, applicant likelihood of being hired decreased.
2. At SIAST: Scores on Numeracy were related to 6-month follow up activity of the participants. As Numeracy scores increased the participant was more likely to be either working or engaged in furthering their education.
3. At Suncor: Scores on all three of the TOWES subscales were related to hiring decision. The higher the score, the more likely the applicant was to be hired. In this context, there is a minimal score on the TOWES subscales that must be met in order for the applicant to be hired. Scores on Numeracy were also related to scores on the Post-test for Hauling Knowledge. As scores were higher, so were the post-test scores.
4. This next site is one where the data was collected and analyzed as part of a separate project. The project was entitled “The Link Between Essential Skills and Safety Performance Among CPPI-certified Petroleum Professional Drivers in Alberta”. The research was conducted by the Canadian Trucking Human Resources Council (CTHRC) in partnership with the Canadian Petroleum Products Institute – Western Distribution Task Force (CPPI-WDTF). Specifically, TOWES was administered to 231 petroleum professional drivers in Alberta and demographic information also collected. At this particular site, TOWES scores were calibrated to a skill level score ranging from 0 – 500. Driver safety performance records (from 1996 to March 2003) were obtained from the database maintained by the CPPI-WDTF. Relationships were found between TOWES test scores and age (younger individuals scored higher), and between TOWES test scores and years of education (those with more years of formal education scored higher). Those drivers with higher TOWES scores on all three subscales were less likely to have had a safety-related incident.

Because there are so many variables that have the potential to have an impact on workplace performance measures, it was not surprising that only a few of the variables assessed in this study were directly related to TOWES test scores. However, given the small number of sites where we were able to collect data and the results we found, we are hopeful that future research will continue to support these initial findings.

TOWES Validation Study

Appendices 1 - 13