



# **Web-Based Assessment: Issues and Applications in Personnel Selection**

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## Web-Based Assessment: Issues and Applications

### Introduction

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***“Computers in the future may have only 1,000 vacuum tubes and perhaps weigh 1.5 tons.”***

- Popular Mechanics, March 1949

**50 years later: Pentium 4 processor is released Y2K**

- contains 42,000,000 transistors



## Web-Based Assessment: Issues and Applications

### Introduction

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**The use of technology-based assessment continues to increase as systems become more practical and cost-effective**

- “Moore’s Law” (1965) has held true -- computer information processing capability doubles about every 2 years
- *Technology-based assessments now rival paper-based program costs*

***This session examines key issues that emerge when employers adopt Web-Based Testing (WBT)***

- **Practical issues:**
  - Why adopt WBT? What benefits do employers value and leverage?
  - When to adopt? When is WBT a good fit?
- **Technical Issues:**
  - What are Technology requirements and considerations for users?
  - What are important Psychometric considerations and how are they addressed?
- **Case Studies:**
  - Discussion will draw from experience in developing and implementing PSI’s new WBT platform -- **ATLAS**
  - Examples will be provided including public and private sector programs

## Web-Based Assessment: Issues and Applications

### Leveraging Benefits of WBT

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#### *Why do employers adopt WBT?*

- **Consider these potential benefits in determining whether WBT will be valued in your setting.**
  - ❑ **Efficiency:** reduced staff time for test preparation, administration, scoring, reporting, information management
  - ❑ **Reliability:** scoring & data management are more accurate and efficient
  - ❑ **Speed:** reduced time for decision-making enables reaching more top candidates before they accept other positions - reduces testing volume
  - ❑ **Security:** reduced likelihood of lost test booklet or materials – before, during, after testing
  - ❑ **Flexibility:** 24/7 remote delivery helps expand recruitment, reach a broader candidate pool,
  - ❑ **Integrated functions:** assessment information can be merged with with HR systems - simple applicant tracking or complete talent management system
  - ❑ **Data Mining & Warehousing:** opportunities learn from data
    - optimize test use and interpretation
    - evaluate program effectiveness (utility, norms, trends)

## Web-Based Assessment: Issues and Applications Leveraging Benefits of WBT

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### ***What are the cost considerations?***

- **The assessments:**
  - WBTs are now priced the same as paper-pencil forms
- **Technology:**
  - A single PC & DSL line costs less than \$1,200 annually, and can easily test 500 to 1,000 candidates annually
    - assume 2-4 candidates tested daily
  - Requires tech support - often leveraged from other areas of the organization
- **Potential cost savings**
  - printing; shipping; storage; security; disposal
  - *scanning hardware; data entry*
  - staff: administration, scoring, reporting, data management
    - *every 10% of admin staff time saved may be worth \$3,000 or more per year*

## Web-Based Assessment: Issues and Applications

### Practical Considerations for Implementing WBT

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#### ***What types of assessment programs are well-suited for WBT?***

- **Continuous testing, “rolling recruitment”**
  - smaller, more frequent sessions (up to 30 candidates is common)
- **Wide range of assessments**
  - Knowledge, skills, abilities, personality, attitudes
- **Appropriate physical environment**
  - Same as paper-pencil: quiet, comfortable, free from distraction
- **Proctoring**
  - Normally required for cognitive ability testing
  - Different role for proctor - verify and supervise
- **Unproctored delivery**
  - Appropriate for certain types of assessments
  - Applicant screening: job applications, certain personality, biodata, preliminary skill screening
- **Existing technology and support**
  - Hardware & software (e.g., training labs, work stations, kiosks)
  - Requirement: basic PC, web browser (IE), internet connection
  - IT support – most organizations have staff to support business systems

## Web-Based Assessment: Issues and Applications

### Example - Implementing WBT

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#### Example #1 – New California Entry-level Corrections Officer Exam

- **Assessment: 2-hour power test battery delivered on PSI's ATLAS platform**
  - Cognitive Ability – Reading comp, writing skills, reasoning & perceptual abilities
  - Work Attitudes: Big-5 dimensions – conscientiousness, agreeableness, etc.
- **Setting: County Probation Departments**
  - 2 large Southern California counties
    - 1 established testing lab, 30 web-connected PCs
    - 1 first time web testing, 20 PCs
  - 2 small northern California counties
    - First time web testing, 1 web-connected PC
- **Implementation**
  - Staff training – PSI provided “Webinar” training on test delivery, reporting
  - System set-up & pretest – technology guidelines; simulate loaded conditions
  - Administration – 1 or 2 proctors + IT staff available
- **Results**
  - Successfully conducted a dozen sessions, tested several hundred candidates
  - Atlas provided immediate score results - enabled rapid scheduling of interviews & planning for training & recruitment -- “just in time, right- sized” test orders
- **Lessons Learned:**
  - Technology set-up & pretest is key – don't assume existing business systems will work “as is” for personnel testing

## Web-Based Assessment: Issues and Applications

### Example - Implementing WBT

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#### Example #2 – Call Center Rep (CSR) Test Battery

- **Assessment: 1-hour timed test battery delivered on ATLAS:**
  - Basic Skills Tests – 4 short, “speeded” tests of verbal, reasoning & perceptual skills
  - ViewPoint – work & service attitudes, consistent with Big-5
- **Setting: National Telecommunications company**
  - Approx 40 testing locations
  - Call center training work stations used for testing
  - IT support readily available
- **Implementation:**
  - Staff training – “Webinar” training on test admin, reporting
  - System setup & pretest – scoring & reporting options; technology guidelines
- **Results**
  - Used successfully to test thousands of candidates
- **Lessons Learned**
  - Timed cognitive tests can be successfully implemented on WBT
  - Tech-oriented business/jobs are very well-suited for WBT



## Web-Based Assessment: Issues and Applications Technology Considerations for Delivery

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*What are some of the important technical considerations for WBT?  
What issues should WBT systems address?*

- **4 key technical features of WBTs:**

- **Architecture** - ensure accurate and reliable delivery
- **Presentation** - *preserve* test content appearance, placement, and accessibility
- **Navigation** - enable examinees to answer questions and advance similar to paper-based tests
- **Security** – preserve the integrity of the assessment

## Web-Based Assessment: Issues and Applications Technology Considerations for Delivery

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### *Examples of essential delivery features to look for in a WBT system:*

- Test-at-a-time download/upload ensures delivery is not affected by web traffic (no latencies or “screen paints”)
- Accurate, robust timer algorithm to support timed tests
- Display test questions & passages without scrolling – no hidden text
- Full-screen presentation (Kiosk mode) to standardize test presentation & navigation
- “Status bar” to determine test progress
- Test sequencing to standardize administration
- Examinee tutorial

## Web-Based Assessment: Issues and Applications Technology Considerations for Security

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*Examples of essential security features to look for in a WBT system:*

- Browser functions disabled (cut, paste, print)
- Key-based test session
- Encrypted data transmission (SSL)
- Passwords & file permissions restrict outside access
- On-line security agreements
- Proctored administration

## Web-Based Assessment: Issues and Applications

### Psychometric Considerations

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#### *What are important measurement-related issues that must be addressed?*

- **Validity** – skills, abilities, and characteristics must not be affected by the delivery system
- **Reliability** – scores must be stable and consistent
- **Norms** – score distributions must exhibit desired characteristics (mean, dispersion, shape)
- **Equivalence** - mixed use of paper and web-based cognitive tests requires consideration of the *equivalence* of scores
- **Candidate acceptance** – the assessment must be well-accepted by candidates to ensure success of the program (consequential validity)

## Web-Based Assessment: Issues and Applications

### Psychometric Considerations

**Validity** - Research by PSI and others supports the cross-mode validity of cognitive and non-cognitive tests

- Computer & paper-based scores measure the same thing - adjusted  $r$ 's near unity

Test Type	Cross-mode $r^*$	No. R's	Study
<b>Cognitive-Power</b>	.97	123	<i>Mead &amp; Drasgow (1993) - various tests</i>
<b>Cognitive-Hybrid</b>	.98	8	<i>Gibson &amp; Weiner (1997) -BST</i>
	.97	7	<i>Chandler (2003) -BST &amp; EAS</i>
	1.0	6	<i>Weiner, et al (2003a) -EAS</i>
	.95	10	<i>Weiner, et al (2003b) -BST</i>
<b>Cognitive-Speeded</b>	.72	36	<i>Mead &amp; Drasgow (1993)</i>
	.86	4	<i>Gibson &amp; Weiner (1997) -BST</i>
	.90	2	<i>Chandler (2003) -BST &amp; EAS</i>
	.87	1	<i>Weiner, et al (2003a) -EAS</i>
	.85	2	<i>Weiner, et al (2003b) -BST</i>
<b>Personality</b>	.92 to 1.0	232	<i>Finger &amp; Ones (1999) -MMPI</i>

\*disattenuated cross-mode  $r$

## Web-Based Assessment: Psychometric Considerations

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**Equivalence:** *Carefully constructed WBTs can be expected to have construct equivalence (validity).*

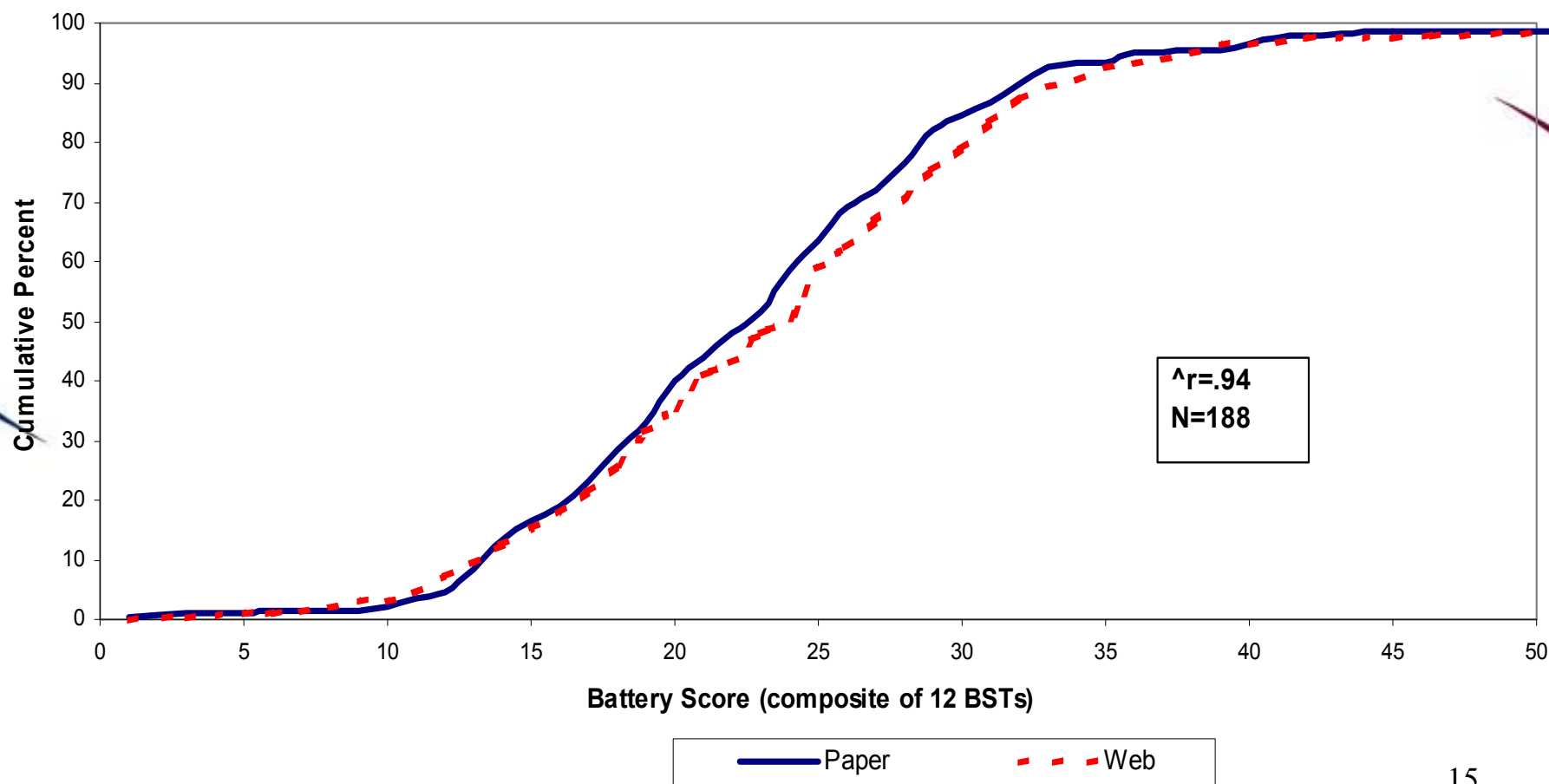
- *However, normative adjustments may be required for certain cognitive ability tests, particularly if they are time-restricted.*

### **Example - Recent PSI Study (Weiner, et al, 2003b)**

- **Web-paper form equivalency study (N=424 paid volunteers)**
- **Timed cognitive ability tests – PSI’s Basic Skills Test series**
  - 12 tests of verbal, reasoning, numerical & perceptual skills
- **Design: Repeated measures, counter-balanced**
  - (1) WBT only, (2) paper forms only, (3) Both

## Web-Based Assessment: Psychometric Considerations – Validity & Equivalence

### Web & Paper BST Battery Score Distributions (Weiner, et al, 2003b)



## Web-Based Assessment: Psychometric Considerations

### Equivalence Research: Normative Adjustments

- Compare means & variance across modes

Problem Solving (BST5)	Difference			
	N	Mean	Variance	$r_{\text{paper-web}}$
	188	0.87	4.54**	.96

- **PSI 2003b**
- Derive linear equating formula for web-paper score conversion

$$Y' = A * (X) + B$$

- Assess fit of linear model
  - Conversion table; plot



## Web-Based Assessment: Psychometric Considerations

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***Examinee acceptance of the web interface is important to ensure measurement quality.***

- *Our experience is that examinees generally favor WBT*

### ***Study of PSI's Employee Aptitude Test Series (2003a)***

- *310 university students completed survey after taking tests*
- *Completed 14 web and/or paper forms of timed cognitive ability tests*
- *Repeated measures, counter-balanced design*

## Web-Based Assessment: Psychometric Considerations

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### *Examinee Acceptance Results*

- *Computer-based test-taking experience is reasonable and acceptable*  
**78% agree / 5% Disagree / 18% In between**
- *Preference for “high-stakes” testing purposes (e.g., job eligibility):*  
**51% computer; 34% paper**
- *Tests perceived as fair*  
**web only: 65% agree                      paper only: 66% agree**
- *Tests perceived as difficult:*  
**web only: 23% agree                      paper only: 29% agree**
- *Computer proficiency (self rating) correlated with perceived ease of the test (.23)*  
– **suggests need for tutorial and practice tests**

## Web-Based Assessment: Practical and Technical Issues

### Lessons Learned

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*WBT is used successfully in public and private sector personnel selection programs*

- ***Characteristics of successful programs:***
  - Existing or planned technology infrastructure
  - Organizational commitment to utilize technology
    - provide appropriate technical support
  - Multiple leverage points
    - Speed, power, security, data management
  - Flexible, continuous testing schedule (vs. mass testing)

## Web-Based Assessment: Practical and Technical Issues The Future

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### *The future of WBT – what to look for:*

- ***More integrated functionality***
  - *Recruitment, assessment, performance management*
- ***Seamless interchange between systems – HR XML standards***
  - *Easier use of multiple vended solutions*
- ***Innovative test formats***
  - *Simulations, multi-media, multitasking, tailored content, banking*
- ***Artificial intelligence – expert HR and assessment***
  - *“turbo test”*



## **Thank you**

**For further information, contact:**

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