Computer-Based Testing:
Considerations for Planning and Use

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Introduction

• Much has changed in 15 years!
  - Better, faster, cheaper technology
  - CBT has gone from bleeding edge to state-of-the-art
Looking Back

• 1995 CLEAR Resource Brief
  – Primary focus was transition from paper to CBT
  – Computer-Adaptive Testing was emerging
  – Most CBT-delivered questions looked the same as questions delivered in paper exams
  – Most CBT testing was done in vendor-owned testing centers

What’s Changed?

• Technology drivers
  – Software automation
  – System integration
  – The Internet

• Social networks & communication
  – Internet adoption rates
  – Online banking, iTunes
Internet use has passed “Tipping Point”

CBT Considerations

1. Common CBT System Designs
2. Content Management Systems
3. Test Assembly & Security
4. Test Delivery Options
5. Key Considerations
6. Planning & Risk Management
7. Conclusions & Future Trends
1. Common CBT System Designs

- CBT
- IBT
- Internet delivery methods
- Vendor system integration
CBT System - Example
IBT System - Example

Internet

Primary hosted system: Site 1

Backup hosted system: Site 2

Remote Server

Test Management
Candidate Registration
Test Delivery

Users

Load balancer

Firewall
Internet Delivery Methods

- Supporting different testing models
  - Server-based test pool delivery
  - Server-based test form delivery
  - Item-by-item online delivery during test
- Data capture & recovery methods
- Test purging & onsite retention policies
Vendor System Integration

- Collection of candidate fees
- E-commerce charges & policies
- Candidate registration & scheduling
- Test delivery & administration
- Scoring & reporting
- Invoicing
2. Content Management Systems

- Item bank & test form management
  - Vendor-managed systems
  - Client-managed systems
Vendor-managed Systems

• Typical Requirements
  – Programs fit tests to vendor’s system & software
  – Vendor fees whenever tech support is required
  – Lead time to amend test items & introduce new forms

• Advantages
  – Program staff deliver item changes & new test forms to vendor staff to be implemented for them
  – Less need for program staff to learn vendor systems, limitations or software requirements
  – Shared costs with other users
Client-managed Systems

• Typical requirements
  – Program staff to master use of online test management tools
  – Software development, maintenance, and licensing fees

• Advantages
  – Control item content & enter new forms directly
  – Client-specific system features, functions & test centers
3. Test Assembly & Security

- Technology-driven testing practices
  - Computer-generated tests
  - Innovative item types
  - Security
Computer-generated Tests

• Item Bank-based Exams
  – Advantages vs. Fixed Forms
  – Cost, time, maintenance, exposure

• LOFT
  – Linear on the fly
  – Fixed-length equivalent test forms

• CAT
  – Adaptive
  – Variable length, non-equivalent test forms
Innovative Item Types

- Multi-media
- Multiple-answer multiple-choice, complex scoring
- Drag & drop
- Hot spot
- Constructed response & automated scoring
- Simulations – scenario tests
- Decision tree/branching
Security

• Proctoring & Management
  – Automated functions
  – Technology enhanced practices

• Biometrics
  – Fingerprint & palm print readers
  – Facial recognition software

• Data Forensics
  – Analytics
  – Digital signatures
4. Test Delivery Options

- Dedicated Test Center Networks
- On-Demand Temporary Test Centers
- Migrating Paper to CBT
- Event-based vs. On-demand Sessions
- Migrating among CBT vendors
Changing Array of CBT Vendors

- Prometric
- PearsonVue
- PSI
- Kryterion
- ACT (mainly in community colleges)
- AMP (mainly in H&R Block offices)
- Education & training networks (CATS, ITS, Pedagogue, NOCTI, Questionmark, et. al.)
Dedicated Test Center Networks

- Vendor-owned & operated test centers
- Contracted centers in college & community college test centers
- Contracted centers in private facilities such as corporate training centers
- Client-directed test center networks
On-Demand Temporary Test Centers

- Conferences & association meetings
- Employer facilities on the job
- Remotely proctored testing in candidates’ homes and offices
- Limited security certification tests
- Unproctored practice tests
Migrating Paper to CBT

• Prepare, update & expand item banks
• Assemble test specifications or forms to meet delivery system requirements
• Set scoring & reporting criteria within vendor delivery system
• Amend test policies & practices to match CBT delivery details
Event-based vs. On-demand Sessions

- Paper-based programs are typically window-based
  - Mass testing sessions
  - Manual administration, scoring & reporting
- CBT suited for continuous testing
  - Automated administration & scoring
  - Immediate results
- Transition from “windows” to on-demand requires planning & transition
Migrating among CBT Vendors

- Monitor changes in delivery options
- Respond to changes in match between program needs & CBT delivery options
- Prepare, update & expand item banks
- Assemble test specifications or forms
- Set scoring & reporting criteria within new CBT vendor delivery system
- Amend test policies & practices to match CBT delivery details
5. Key Considerations

- Measurement Considerations
- Practical - Administrative Considerations
- Candidate Considerations
- Cost Considerations
Measurement Considerations

• Event testing
  – Allows analyses that may reveal problems in performance or data soon after they occur

• On-demand testing
  – Assumes that item pre-testing, calibration & scoring have identified most potential problems

• Small-volume programs
  – may retain the weak elements of both models

• Migration from paper to computer forms
  – Requires psychometric analysis – equivalence, testing time
Practical-Administrative Considerations

• Candidate registration & notification
• Verify test scheduling procedures
• Permitted test aids & references
• Retesting options
  – How soon vs. how many test forms?
  – May impact size of item pool required
Practical-Administrative Considerations

- Problem resolution policies & procedures
  - Loss of power to a test center
  - Loss of internet connection to a center
  - Chain of authority in resolving a problem
  - Proctor procedures for restarting tests
  - Waiving retest fees when a test center proctor fails to follow procedures
  - Discovering & resolving possible security breeches with follow-up investigations
Candidate Considerations

• Test-taking strategies may differ
  – CAT does not allow returning to a question
  – Forward-only testing also blocks returning to or skipping a question

• CBT security may change exam
  – Randomized item order
  – Randomized response order

• Candidates may expect instant response
  – Investigations of problems still take time
Cost Considerations

• Delivery models impact cost
  – Unproctored testing
  – Candidate-initiated proctored testing
  – Program-directed test center networks
  – Vendor-staffed & managed test centers

• Vendor policies impact candidate fees
  – Cancellation & rescheduling deadlines
  – Audit invoices carefully
6. Planning & Risk Management

- Risks to CBT Systems
- System Planning & Design
- Planning Checklist
Risks to CBT Systems

• Planning: today & tomorrow
• Resources: people, funding
• Technology: design, implementation, maintenance
• Support: IT, client, candidate
• Management: change, delivery, growth
System Planning & Design

Reynolds & Weiner (2009)
Planning Checklist

• **Buy or Build?**
  – Conduct a cost-benefit analysis

• **Impact on existing business processes?**
  – Will changes in business processes will be required?

• **Implementation Planning**
  – Work with a range of SMEs: IT, Software developers, Psychometricians, Operations, Customer Service

• **Planning for growth and change**
  – Systems are dynamic and must be designed to accommodate changing needs and requirements.
7. Conclusions & Future Trends

• CBT is the state-of-the art
  – Best practices are maturing
  – Cost-effective, research-based guidance

• Assessment practices are evolving
  – Higher fidelity to the job
  – Shorter development cycles

• Delivery models are evolving
  – IBT, new devices
  – Technology-based proctoring
Thank you

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References


