

Part 2: Technology

SECURITY BOOT CAMP

**An actionable test security
workbook for educators and
organizations delivering
online exams.**

WELCOME!

In the age of ubiquitous remote online testing, it is more essential than ever to ensure security, prevent cheating and theft, and lock down the validity and trustworthiness of your exams.

Even with the use of high-quality proctors, it's still possible for test takers to subvert the rules, steal test content, and gain an unfair advantage. The online testing environment provides an especially fertile breeding ground for such behavior.

That's where the **Security Boot Camp** comes in. This workbook series will highlight key test security concepts and provide actionable worksheets and resources to help you understand and apply these concepts to your program so you can make sound decisions for your security.

On page 3, you'll find **eight steps for improving the security of online tests**. This list serves as the outline for all three of the Security Boot Camp workbooks. In **Part 2** of Security Boot Camp, you'll learn ways to evaluate the **Technology** you use to shore up test security. Evaluating your online testing solutions, leveraging secure item types, and increasing the number of items on your tests are three key ways to ensure the long-term health of your exams.

So dust off that stylus or fire up that printer, give your trusted team members a call, and follow along. It's time to head to Security Boot Camp!

8 STEPS TO TAKE **RIGHT NOW** TO IMPROVE SECURITY FOR YOUR ONLINE TESTS

PART 1: PREPARATION WORKBOOK

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1

PUBLICIZE YOUR SECURITY MEASURES

2

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LEVERAGE SECURE ITEM TYPES

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TURN YOUR ITEM POOL INTO AN ITEM OCEAN

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An Open Letter to the World of Online Testing

from Dr. David Foster
CEO of Caveon Test Security



Hi there,

In just a few short weeks, the COVID-19 pandemic has upended nearly every aspect of our lives, including the way important testing is done. For those students, teachers, professors, candidates, testing organizations, and testing service vendors who have had their plans for taking or giving tests disrupted, I want to offer this message of optimism. Your exams can still be taken and administered securely, even during a pandemic.

Nationwide quarantines and social distancing measures have made it so we can no longer take tests in classrooms, at testing centers, or in other locations. To solve this problem, testing organizations are quickly introducing new solutions that will allow individuals to test online from their own homes. These methods often rely on the use of online proctors to keep those tests secure.

Let me state that I am a wholehearted advocate for this type of online testing. In 2006, I proposed the concept of online proctoring—also referred to as remote proctoring—at the annual conference of the Association of Test Publishers. In 2013, I reviewed the services of several new online proctoring vendors, [comparing them on the security features](#). Two years later, Caveon published its security [Standards for Online Proctoring](#), providing a way to evaluate the professionalism of any remote proctoring service. For any program considering the move to online testing, and wishing to create or use an online proctoring solution, I would recommend those two publications and others available on the [Caveon website](#).

However, I need to add a word of caution. Online proctoring is far from a security panacea. Although well-designed proctoring systems—online or onsite—provide some useful security features, tests remain vulnerable to a number of significant security threats that will undermine the test's soundness and trustworthiness.

I repeat—when you put your exams online, even if you are using a competent method of remote proctoring, the two *most dangerous* test security threats remain: **proctors cannot detect when individuals are stealing your test content, and they cannot stop individuals who are cheating by using pre-knowledge.** If these threats cannot be detected by online proctors or proctors working at testing centers, then they are free to do extensive damage.

Let me explain these threats in more detail (without all the industry jargon).

#1: Theft of Test Content.

The first of these threats is the sure theft of test content (your test questions and answers) by individuals using hidden cameras. These are the kind of cameras that can be concealed in a button, the frame of eyeglasses, a lapel pin, or simply appear to be part of the fabric of a shirt. They are capable of recording an entire test session in high-resolution digital video. They are inexpensive, widely available, and easy to set up and use.

Even though a proctor might be closely monitoring an individual taking an exam, if that individual is motivated to steal test questions (to share with a friend or sell online), they will be able to easily steal the entire test—with no risk of being caught! That information can then be easily shared with someone in the neighboring room, apartment, or even on another continent.

#2: Cheating Using Pre-knowledge.

The second threat that cannot be detected by proctoring is cheating on the test using pre-knowledge of the test content. The term “pre-knowledge” is used to describe any information gained about the content of the exam prior to testing. For example, a test taker could purchase the answers to test questions online and memorize them before taking the exam. This form of cheating follows the theft of content described above.

A person with access to the stolen content can cheat confidently and effectively, knowing in advance all the questions and their answers. No proctor, however diligent, can tell the difference between an honest test taker and one who has gained an unfair advantage through pre-knowledge.

As a test security company, we have established practical and actionable solutions for all test security threats, including the two described above. We freely share and discuss test security solutions when we attend conferences, conduct webinars, and through other resources available on our website. Our mission at Caveon is to keep *every* exam safe and the test scores valid and trustworthy for important decisions. At this time, if you are curious about adopting online testing and want to safely navigate these dangerous waters, please visit the website and request a free consultation. We are here to help.

To be clear, I'm not advocating that you abandon your goal of online testing or proctoring your tests. **I believe online testing is the future of this industry and has tremendous potential, but only if it is done *securely*.** I simply want to help make this transition as painless as possible by making you aware of the very dangerous threats that jeopardize your exams *before* they arise and help you understand that viable solutions do in fact exist.

Sincerely,



David F. Foster
Chairman & CEO
[Caveon Test Security](#)

LOOKING AHEAD

- What are some things you can do to make your tests more secure right away?
(Pages 13, 16, 23, 27-28, 35)
- What are your organization's testing needs?
(Pages 12-13)
- What features are important to look for in high-quality testing software?
(Pages 10-11, 16)

MODULE 3

EVALUATE YOUR ONLINE TESTING SOLUTION

QUESTIONS YOU MAY HAVE

- What technology solutions exist for remote online testing? (Page 13)
- What should I be looking for in high-quality testing tech? (Pages 10-11, 16)
- What threats should I be planning for? (Pages 14-15)

ONLINE TESTING TERMS AND CONCEPTS

Test Development

The process by which a test is conceptualized, designed, written, and reviewed before and after delivery.

Test Delivery

The process by which, either online or in-person, a test is administered to the person(s) who must take it.

Remote Proctoring

A service whereby trained individuals confirm the identity of test takers and observe online testing sessions to monitor for irregularities or violations.

Secure Online Testing

Tests that are delivered online and secured with a number of measures designed to prevent, detect, and deter fraud.

Randomization

In testing, randomization is an accepted practice of delivering or displaying items and answer options at random to test takers.

Integration

The bridging or union through API or LTI of two technologies to share cross-functional data in a secure fashion.

Versioning

During item development and review, versioning refers to the automatic tracking and logging of changes to an item within the test engine.

Test Engine

The technology behind a test's development and/or delivery.

QUALITY TESTS MUST BE SUPPORTED BY QUALITY TECH



KELLI FOSTER

Kelli has spent 33 years in the testing industry dedicated to developing cutting edge practices that elevate traditional exam development and delivery services by emphasizing security through innovation and design. Kelli has pushed exam development to become the vehicle by which other security solutions are realized.

Ultimately, delivering exams online is as customizable as the tests themselves. Depending on your needs, you could administer some or all of your exams virtually, with or without a proctor, directly to examinees' homes and offices.

You should start by determining your security and user experience priorities and then tailor your delivery practices to meet them. What features should you be looking for in an online testing software solution?

Security Measures

Look for security features like permission-based access and encrypted connections to keep your content safe during development. During delivery, your software should protect your content through features like proctor enhancements and watermarking.

Rapid Republishing

You'll want to be able to rapidly publish and republish your exams on your own terms. Look for software that allows you to D-I-Y.

Registration

If done correctly, implementing secure online testing can improve the testing experience for both you and your test takers.

Capability

Find technology that provides a wide range of capabilities, like innovative item types, dynamic security features, AIG, you name it.

Item Types

What item types do you need your software to support—multiple-choice, short answer, hotspot, build-list, DOMC? Choose wisely.

Data Collection

Test data should be easy to collect, access, and understand. Choose technology that includes robust data collection tools.

Cost

Affordable solutions are out there for programs of all sizes. Carefully weigh your options against your security needs.

Analysis Tools

Collecting data is one thing, but your technology should also support analysis for insight into the health of your program.

In the following module, we'll explore the nuances of online testing solutions. You'll have an opportunity to take stock of your unique testing technology needs and learn about different types of technology that can be used in testing.

Finally, we'll examine different threats that face the online testing world and brainstorm different methods to protect our tests.

Follow along as we explore the technology of testing!

EVALUATE YOUR TESTING NEEDS

DO YOU HAVE ENOUGH ITEMS FOR MULTIPLE FORMS? _____

HOW MANY TESTS DO YOU PLAN TO DELIVER PER YEAR? _____

On a scale of none to all, how many of your test deliveries will take place online in the coming year (as opposed to paper-and-pencil deliveries)?

none _____ some _____ all

WHICH OF THESE DESCRIBES YOUR TESTING SCHEDULE?
(SELECT ALL THAT APPLY)

- ☐ Year-round (delivering tests all the time)
- ☐ Cyclical (delivering tests in predetermined phases)
- ☐ Seasonal (delivering tests only during a specific time of year)
- ☐ Evergreen (content changes only when breached or leaked)
- ☐ Evolving (content domain requires frequent updates)

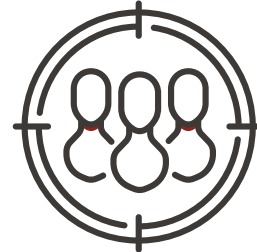
WHAT KIND OF PROCTORING SOLUTIONS WILL YOU EMPLOY?
(SELECT ALL THAT APPLY)

- ☐ I plan to self-proctor my own tests
- ☐ I plan to proctor by "Record-and-Review" test sessions
- ☐ I plan to hire or train proctors to remotely proctor live sessions
- ☐ I hadn't planned on proctoring my tests

THE TECHNOLOGY OF TESTING



Authentication Solutions



Candidate Management Systems



**Test Development and Item
Banking Systems**



Test Delivery Engines



Badging and Credentialing



Proctoring Solutions

THREATS TO SECURE ONLINE TESTING

Imagine that you have a test taker who is hoping to cheat to get a better score on your exam, or a group of people hoping to profit by stealing and selling your exam content. Below are some methods they could use. The methods listed are of particular concern for online testing.

CHEATING

An attempt to gain advantage

- ☐ Using pre-knowledge of exam content
- ☐ Using a proxy test taker
- ☐ Using cheat sheets
- ☐ Getting help from an expert while testing
- ☐ Copying answers from a neighbor

THEFT

An attempt to profit from intellectual property

- ☐ Stealing content using digital photography
- ☐ Stealing content by recording the screen
- ☐ Transcribing content verbally
- ☐ Stealing content by hacking into a server
- ☐ Memorizing content to share with others

WHAT CAN PROCTORS DETECT?

THREAT	DETECTABLE BY PROCTORS	WHAT IS ANOTHER TEST SECURITY METHOD YOU COULD EMPLOY TO ELIMINATE THIS THREAT?
Using pre-knowledge of exam content	<input type="checkbox"/>	
Using a proxy test taker	<input checked="" type="checkbox"/>	
Using cheat sheets	<input checked="" type="checkbox"/>	
Getting help from an expert while testing	<input type="checkbox"/>	
Copying answers from a neighbor	<input checked="" type="checkbox"/>	
Stealing content using digital photography	<input checked="" type="checkbox"/>	
Stealing content by recording the screen	<input type="checkbox"/>	
Transcribing content verbally	<input checked="" type="checkbox"/>	
Stealing content by hacking into a server	<input type="checkbox"/>	
Memorizing content to share with others	<input type="checkbox"/>	

QUESTIONS TO ASK YOUR VENDOR ABOUT THEIR TESTING ENGINE

- What is the name of your test security engine? (Many vendors use the same one.)
- Does the engine support the randomization of items and answer options?
- Does the engine support forms building?
- What test designs does the engine support?
- Does it support test designs that protect test content (such as CAT, LOFT)?
- Does the engine support self-protecting items? (Like DOMC™ items and SmartItems™.)
- How easy is it to develop exams using this engine?
- Do exam developers like using this engine?
- Does the engine support versioning, and does it track item changes?
- What exam development steps does it support and make easier (such as blueprinting, item reviews, cut score setting)?
- What item types does the engine support?
- How easy is it to access your exam data?
- With this engine, how do you modify and republish existing exam content?
- Does the engine offer customizable settings (for calculators, access to external/ supporting materials, branding, etc.)?
- What candidate communication does the engine make possible (such as instructions to test takers, presentation of honor codes, surveys, candidate feedback, etc.)?
- How many exams can the engine deliver simultaneously?
- Is the engine integration-friendly? (Can it easily integrate with custom environments, remote proctoring, voucher systems, etc.?)
- What are the engine's reporting capabilities?
- Does the engine offer proctors the tools to monitor and make real-time interventions?

NOTES / BRAINSTORMING PAGE

TO-DO LIST

TASKS	PRIORITY	DUE DATE	
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MODULE 4

LEVERAGE SECURE ITEM TYPES

QUESTIONS YOU MAY HAVE

- What are the benefits of secure test design? (Pages 20-22, 30)
- What ways can I make my test designs more secure? (Pages 22-23, 27-28)
- What are secure item types, and how do they work? (Pages 20-22, 27-29)

TEST DESIGN TERMS AND CONCEPTS

Computerized Adaptive Testing (CAT)

A CAT selects items from a large pool, matching the difficulty of an item from the pool to the ability level of the test taker. For example, a high-ability test taker would ideally see only the more difficult items. A CAT is not scored based on the percentage or number of items answered correctly, but on the level of difficulty for the questions an individual is able to answer correctly.

Testwiseness

Some test questions—typically traditional multiple-choice formats—provide a large number of cues pointing to the correct option or pointing away from incorrect options. Some individuals are better at using these cues than others, and achieve higher scores as a result. Those scores are boosted by skills (often referred to as "test-taking skills") that are irrelevant and introduce unfair systematic error.

Discrete Option Multiple Choice Item (DOMC)

Instead of showing all of the options at one time, options are randomly presented one at a time. For each presented option, the test taker chooses YES or NO. When the question is answered correctly or incorrectly, no more options appear, and the next question is presented.

Linear-on-the-Fly Test (LOFT)

A test design where items are pulled from a large pool during an exam. The items are pulled in a stratified random fashion, constrained by requirements that might include trying to equate difficulty of items on the exams of every test taker. For LOFTs, it is also possible to simply randomly select items from the pool.

SmartItems

A SmartItem uses special technology during development and delivery so that the item changes each time it is administered and completely covers the skill being measured.

ITEM DESIGN: THE UNSUNG SECURITY HERO



DAVID FOSTER

A psychologist and psychometrician, David has spent 37 years focused on innovating the design of items and tests to eliminate the debilitating consequences of cheating and testwiseness. He has served on numerous boards and committees, authored articles for industry publications and journals, and has presented extensively at industry conferences.

We've all seen the classic tale unfold: A supervillain threatens something priceless, and a superhero swoops in to save the day. It happens in comic books, movies, and often in real life.

Even the testing industry is not safe from the threat of supervillains. In my opinion, there are two villains who plague us, and in doing so introduce unfairness into our test scores. They are:

Testwiseness: Using test-taking cues to answer a question correctly. This villain regularly adds about 10% of junk to a test score.

Cheating: Using pre-knowledge of questions and other inappropriate ways to answer a question correctly. While I don't know exact numbers, I know that this villain adds a massive amount of junk to cheaters' scores. Worse than that though, cheating destroys trust in ALL test scores.

These villains are irrelevant, obvious, and damaging. They are “irrelevant” because both have absolutely no relationship to the skill or construct the test was designed to measure. They are “obvious” because they exist in acknowledged abundance in all multiple choice questions, and because cheating continues mostly unchecked in every testing program in the world. They are “damaging” because they produce real hurt to the validity of test scores, reputations of individual testing programs, and the confidence society has in the testing industry as a whole.

Most importantly, these supervillains are unfair toward honest test takers who do not have the desire to cheat or have access to “test-taking skills” training. These individuals become the real victims of unfairness—their scores are seen as lower compared to the higher invalid scores of others, and because of this, these victims often miss out on important educational and employment opportunities.

While a security solution for online testing should be targeted toward a program’s unique threats and will likely be multi-faceted, let’s introduce you to an important aspect of exam security that could become your hero: Item Design.

What is Item Design?

Item design is how an item is created and delivered. Item types, such as multiple choice or matching, are straightforward examples of item design.

Some designs are meant to solve security challenges. For instance, randomizing options for multiple-choice items is a standard way to easily reduce the test theft threat of memorizing alphabetical placement of keys and the test cheating threat of copying answers. Randomizing has been widely adopted because of how easy it is to do and because of how much of an impact it has on specific threats.

Our proclivity to design our way around test security threats then isn’t new; however, thanks to technology, our designs are getting smarter.

While they might not be able to ride in on a white horse or show up in a spaceship, there are two testing superheroes that are capable of saving the day and protecting these individuals from unfairness. These two superheroes come

into play when we simply change the design of a test—one that deals with testwiseness and the other with cheating. When deployed together, they decimate, decapitate, and dissolve these villains right before our eyes.

These superheroes are:

The Discrete Option Multiple Choice (DOMC™): DOMC gives options for multiple choice items one at a time, preventing in the simplest way almost all testwiseness.

SmartItems™: SmartItems cover entire skill domains in a single item, presenting an unlimited number of item renderings. With SmartItems, you still adhere to the highest standards of measurement, but completely eliminate stealing items and make almost every type of cheating impossible. Surprisingly, for these superheroes, there is no exaggeration in these statements. They have superpowers like the testing world has never seen before.

When deployed, SmartItems and DOMC items make it so every test taker has a fair chance of displaying what she or he has learned through studying or by experience on the job. Test takers don't have to worry anymore about being unfairly evaluated. Users of the test scores can make confident decisions. Incredibly, there are no victims anymore. (Well, other than the business models of superficial test prep companies and braindump sites. Good riddance!)

EXAMPLES OF SECURE ITEM AND TEST DESIGN

Randomization
of item or
option order

Computerized
Adaptive Test
(CAT) design

Linear on the Fly
Test (LOFT)
design

Discrete Option
Multiple Choice
(DOMC) items

SmartItems

Performance-
based items

Utilization of
multiple forms

Rapid item pool
expansion

Rapid Item
Replacement
Policies

INNOVATIVE ITEM TYPES

What are some common reasons why people might avoid embracing secure test design?

Ask yourself... Have you fallen for these logical fallacies? If so, why?

COMMON RELUCTANCE

"We need to stick with the standards."

BUT WHY?

It is easy to confuse long-standing methods with standards. For example, using multiple choice questions is a method, not a standard.

DO I FEEL THIS WAY?

"I'm good at what I do."

People are comfortable doing what they have learned to do and what they have always been doing. Change is difficult.

"How do I know it will work?"

Some are afraid of what will happen if they try new things, unsure whether a new approach will bring the promised benefits. Should you opt to play it safe and avoid new risks?

COMMON RELUCTANCE

"It needs more
research."

BUT WHY?

Some people prefer
to rely on the solid,
but fairly slow
process of scientific
research.

DO I FEEL THIS WAY?

"Who else is doing
it?"

Late adopters are
more willing to let
others blaze the trail.
They won't try new
methods without the
confidence that it
has already worked
for others in the
industry.

"I don't have the
time."

A person may not
have the time to learn
about and understand
the value of new tools
and procedures.

"I don't want to be
criticized or de-
accredited."

Adopters of new
technology are wary
to battle the critics.

COMMON RELUCTANCE

"That might be hard
to pull off."

BUT WHY?

Implementing new
technology can
take substantial
time and resources,
particularly at the
beginning. Some
individuals may not
be willing to
undertake the initial
work it requires to
implement those
new ideas.

DO I FEEL THIS WAY?


"That scares me a
bit."

It's true that
developing and
using a new
process or tool may
not immediately
result in a positive
experience. That's
the risk one takes
with innovation. For
some, it is better to
avoid that risk
altogether.

WHAT ARE SMARTITEMS™?

Self-protecting items, otherwise known as SmartItems, employ a proprietary technology that's resistant to cheating and theft. To view examples of SmartItems, see page 29.

EXERCISE: Using the boxes on the left, rank these benefits in order of least impactful (#7) to most impactful (#1) to your unique testing organization. Consider the reasons behind their importance. Do they outweigh the concerns you explored above?



They can render in millions of ways.

One well-designed SmartItem can render in millions of ways and present different renderings of the item to each test taker. That's an amazing amount of variability!



They promote fairness.

SmartItems actually enhance the fairness of your exams by eliminating the two largest sources of unfairness: testwiseness and cheating.



They prevent cheating.

With so many renderings, you can no longer cheat by sharing test content, by buying questions and answers, by asking a friend to take the test and tell you what they saw, etc.



They mitigate the testwiseness effect.

Success on an exam should depend on the depth of an examinee's knowledge, not their ability to tactically take tests. DOMC™ items have also been shown to reduce the effects of testwiseness on scores.



They can curb ballooning costs.

SmartItems ensure that you don't need to replace or fix your test until the skills you are measuring are revised, curbing the draining costs that typically accompany content theft endeavors or a security breach.



They can't be stolen.

Well, they can, but it won't matter. A SmartItem covers the entire breadth and depth of a skill, rendering differently for each test taker. So, memorizing a SmartItem answer key would be a much poorer tactic than just studying the materials.



They work with any item type.

Whether your questions are multiple choice, drag-and-drop, short answer, etc., converting them to SmartItems is possible. SmartItems are not an item type; they're a *treatment* for any kind of item. Whatever item types you use, you can make them render in unlimited ways.

WHAT IS DISCRETE OPTION MULTIPLE CHOICE™ (DOMC)?

DOMC items are similar to multiple choice items; however, for DOMC items, a computer presents answer options one at a time, randomly, to the candidate. The candidate must then select "Yes" or "No" for each answer option. To view examples of DOMC items, go to page 29.

With this design, **option pools are protected from exposure**, which means that item content is very difficult to steal and cheat with successfully.

The following are three key outcomes that programs can expect to see after converting a bank from multiple choice to DOMC:

PRO TIP:

Simply upgrade your multiple choice items to DOMC items, or combine them with the power of SmartItems to layer your items with security.

REDUCE ITEM CONTENT EXPOSURE

DOMC items expose options at a much lesser rate (by as much as 50 percent!) making them somewhat ineffective to steal and share. The more options an item has, the less the exposure rate.

DETER THEFT AND CHEATING

On average, only 2.5 answer options per item are shown to a test taker. This means that thieves (and braindump sites) cannot easily capture a complete item, and many who try are likely to give up. Cheating efforts become much more futile with incomplete items.

SAVE ON ITEM DEVELOPMENT COSTS

The secure design of DOMC gives this item type a longer shelf life than many other items. Items that last longer do not have to be replaced as often, thus saving programs long-term development costs.

INTERACTIVE EXAMPLES

DOMC ITEMS: BASIC SCIENCE

<http://trydomc.com/tests/10>

The best way to acquaint oneself with something new is to see it in action. Here's a fun trivia quiz in the DOMC format. Test your knowledge of art, culture, and more while getting to know this intelligent item type:

<https://sei.caveon.com/launchpad/sample-domc-test/domc>

TEST YOUR KNOWLEDGE: GAME OF THRONES SMARTITEM QUIZ

https://sei.caveon.com/launchpad/game-of-thrones-season-1?fbclid=IwAR2vSSSga5b4TaUuiCAfTEAMi_NEhp3apasRIV08nJgpsmVvnSdNstbkYnc

IT CERTIFICATION: ORACLE

<examples.caveon.com/oracle>

THE BENEFITS OF SECURE ITEM AND TEST DESIGN

1

BETTER MEASUREMENT

In addition to bolstering security, the newer and more advanced item types and methods of test design can measure the abilities of test takers far better than their archaic counterparts.

2

REDUCED EXPOSURE

New forms of secure item and test design are primarily guided by the concept of reduced exposure. By reducing the relative amount of content your test takers see, you'll reduce the risk of item exposure to other groups.

3

LONGER-LASTING EXAMS

Reduced exposure leads to longer-lasting item pools, so you can wait much longer between performing maintenance on your exams. Content is less likely to be breached or benefit test takers who've somehow gotten access to it.

4

MITIGATED COSTS

Walking hand-in-hand with reduced exposure is the lovely benefit of mitigated costs. Longer-lasting item pools require less maintenance and damage control than traditional multiple choice items.

5

RESTORED VALIDITY

The combined power of more accurate measurement and increased security leads to the restored validity of test scores. Test takers and stakeholders will all be able to respect and trust the scores of your important exams (in case you didn't know—all of your exams are important!).

NOTES / BRAINSTORMING PAGE

TO-DO LIST

TASKS	PRIORITY	DUE DATE	
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MODULE 5

TURN YOUR ITEM POOL INTO AN ITEM OCEAN

QUESTIONS YOU MAY HAVE

- What are the benefits of having a larger item pool? (Pages 35, 38)
- What is rapid item pool expansion, and how do I achieve it? (Pages 34, 36-37)
- How strong is my item pool? (Page 36)

ITEM POOL TERMS AND CONCEPTS

Item Pool Expansion

The practice of producing enough items to have replacements on hand in the event of a breach. These items can also be used in secure test design.

Graphical User Interface (GUI)

A user interface to a technology that is mostly graphical and is generally considered to be easy to use. Users of most smartphones and tablets complete tasks on those devices because they encounter GUIs.

Variable

In AIG, a variable is inserted into some portion of the item content that will produce change. That variable is tied to a source of data that it can then pull from during generation to produce permutations of the Generator.

Automated Item Generation (AIG)

The practice of using computer code or a GUI to generate items without having to manually write each one. This can be done in a number of different ways and to varying degrees of complexity and psychometric validity.

Generator

In AIG, the Generator is the basic blueprint of the item. It consists of all the components of your item (such as the stem or answer options) and can contain any number of variables to result in the number of permutations desired.

SECURING YOUR EXAMS THROUGH RAPID ITEM POOL EXPANSION



TARA WILLIAMS

With a BFA and MFA in creative writing and a combined 16 years of experience in teaching and training, Tara Williams has made a career of breaking down complex topics into more digestible pieces, tailored to meet the needs of unique audiences. Having presented at various industry conferences, including ATP and COTS, Tara's expertise in psychometric editing, cloning, DOMC, SmartItems, and AIG are virtually unparalleled. Though she now manages exam development projects, Tara has taught English in South Africa, as well as undergrad writing and literature at George Mason University.

Now that you've learned all about secure test design, you may be wondering: *What do I need to do to make that happen?*

The answer lies in your item pool. See, many of the secure test designs we discussed in Module 4 (CAT, LOFT, using multiple forms) require a deep bench of items. But creating tons and tons of items is a lot easier said than done. Traditional methods of item writing can be costly and unattainable for smaller testing organizations. Manually writing the volume of items needed to achieve these secure designs takes forever. And as we know—time is money.

In "Module 5: Turn your Item Pool into an Item Ocean," we'll explore the many reasons why every testing organization should be prioritizing item pool expansion and secure test design. Then we'll learn about some different methods of item pool expansion. I urge you to compare and contrast these methods against your own unique needs.

Finally, we'll dive into Automated Item Generation (AIG) and learn just how it works. In the end, you'll be able to approximate how much you could save by using AIG to rapidly expand your item pool.

Strap on your water wings. We're transforming this pool into an ocean!

WHAT ARE THE BENEFITS OF AN EXPANSIVE ITEM POOL?

If security is your priority, then AIG has a lot to offer.

A rapidly-expanded item pool can...

LIMIT ITEM EXPOSURE

Numbers don't lie. More items in your item pool means that fewer eyes see each item. Limit item exposure by rapidly increasing your item pool and stay one step ahead of content thieves and aging exams.

KEEP YOU AHEAD

To combat item theft, it is important to stay one step ahead of prying eyes. AIG makes it possible to refresh your item pool as often as necessary, as painlessly as possible.

BLOCK PRE-KNOWLEDGE

A larger pool of items can prevent test takers from using pre-knowledge by making it harder for them to predict what their test questions will be or accurately guess what the correct answers are. Nice try!

USE FEWER HUMANS

Maintain an extra layer of security by involving fewer individuals in the item writing process. AIG enables smaller teams to do more with less. Efficiency and security all rolled into one.

GET ADAPTIVE

Secure test designs such as CATs, LOFTs, and the use of multiple forms require fairly large item banks to pull off. That hasn't always been attainable, but thanks to automated item generation, it's now possible to do more with fewer resources.

EVALUATE YOUR ITEM BANK

HOW MANY ITEMS ARE CURRENTLY IN YOUR ITEM BANK? _____

HOW MANY FORMS DO YOU HAVE IN RESERVE? _____

WHEN WAS YOUR EXAM DATA LAST
EVALUATED FOR PSYCHOMETRIC SOUNDNESS? _____

HAVE YOU EVER HAD A SECURITY BREACH? YES NO

DO YOU KNOW IF YOUR ITEMS HAVE BEEN EXPOSED ONLINE? YES NO

DO YOU HAVE ACCESS TO SUBJECT MATTER EXPERTS THAT
COULD QUICKLY CLONE OR REWRITE COMPROMISED ITEMS? YES NO

IN THE CASE OF A SECURITY BREACH, HOW LONG
WOULD IT TAKE YOUR TEAM TO WRITE, EVALUATE,
AND REPUBLISH YOUR EXAMS? _____

ARE YOU CURRENTLY USING ANY PROTECTIVE ITEM
OR TEST DESIGNS THAT HELP EXTEND ITEM LIFE? _____

WHAT ITEM TYPES DO YOU CURRENTLY UTILIZE IN YOUR ITEM BANK?

☐ MULTIPLE CHOICE

☐ MATCHING

☐ SHORT ANSWER

☐ DOMC

☐ HOTSPOT

☐ BUILD-LIST

☐ SMARTITEMS

☐ OTHER

METHODS OF ITEM POOL EXPANSION

WRITING TONS OF ITEMS

One way to expand an item pool is to sit down and manually write lots of items. This method is nice because SMEs are highly involved, but the cost and the duration of the project can quickly add up.

TIME ● ● ● ● ●
COST ● ● ● ● ●
EFFORT ● ● ● ● ●

THEORY-BASED GENERATION

This method of item pool expansion requires developers to use heavy-duty computer programs to build item models based on principles of cognitive psychology. SMEs are left out in the cold.

TIME ● ● ● ● ●
COST ● ● ● ● ●
EFFORT ● ● ● ● ●

DESIGNING WITH A GUI

Recent advances in user interface technology have made it possible for subject matter experts to re-enter the equation and build items themselves using a graphical user interface to drag and drop.

TIME ● ● ● ● ●
COST ● ● ● ● ●
EFFORT ● ● ● ● ●

SKILL-BASED ITEM GENERATION

Using this method, one single item covers the breadth and depth of a skill or objective, and data sources are added to yield every permutation of an item/objective, expanding item pools dramatically.

TIME ● ● ● ● ●
COST ● ● ● ● ●
EFFORT ● ● ● ● ●

YOUR METHOD

What methods of item pool expansion have you used in the past? What methods do you use now? About how much time, money, and effort do you expend? Answer the questions below and color in your bubbles to compare against the methods above.

HOW MANY ITEMS DO YOU AIM TO CREATE? _____

WHAT'S YOUR COST PER ITEM? _____

WHAT METHOD OF EXPANSION WILL YOU USE? _____

APPROXIMATELY HOW MUCH EFFORT DO YOU PLAN TO EXPEND? _____

TIME ● ● ● ● ●

COST ● ● ● ● ●

EFFORT ● ● ● ● ●

CAN AIG DEFEND YOUR TESTS?

SECURITY THREAT	IS IT MITIGATED BY AIG?	WHAT IS ANOTHER TEST SECURITY METHOD YOU COULD EMPLOY TO ELIMINATE THIS THREAT?
Using pre-knowledge of exam content	<input checked="" type="checkbox"/>	
Using a proxy test taker	<input type="checkbox"/>	
Using cheat sheets	<input checked="" type="checkbox"/>	
Getting help from an expert while testing	<input type="checkbox"/>	
Copying answers from a neighbor	<input checked="" type="checkbox"/>	
Stealing content using digital photography	<input checked="" type="checkbox"/>	
Stealing content by recording the screen	<input checked="" type="checkbox"/>	
Transcribing content verbally	<input type="checkbox"/>	
Stealing content by hacking into a server	<input type="checkbox"/>	
Memorizing content to share with others	<input checked="" type="checkbox"/>	

COMPARE AND CONTRAST: MANUAL ITEM WRITING AND AUTOMATED ITEM GENERATION

200 Manual Items

Let's explore what it looks like to write 200 items manually.

The design and development phases of the manual item writing process are combined. It can cost a program from **\$200-\$2,000** to build and vet one single item. Assuming a low-end cost, we can develop our first item for **\$200**. *(What's your Cost Per Item? See below)*

To develop the remaining 199 items, we must lather, rinse, and repeat using the same process of manually writing item after item, **199 times**, at a cost of **\$200** per item. Those costs really start to add up.

When item content needs to be updated, we'll have to write and vet an entire new set. This might not be financially possible for some, resulting in the possibility that items will be used on live exams past their expiration date. *(Have you used compromised items?)*

Redeveloping items to replace our expired ones requires item writers to manually create more. Let's assume we need to replace 50% of our items because of exposure. *(Has your item pool ever been exposed?)*

200 AIG Items

Let's create those same 200 items using Automated Item Generation.

The design phase of AIG items simply consists of a template build. Though it can take 2-3x longer to develop a template than it does to write a singular item, we're still **saving time**. This one template can produce **hundreds** of other items.

To develop the remaining 199 items, we simply tell the system how many items we'd like to generate and where to sort them. Though these items will still need to be reviewed and vetted, the **savings are huge**.

AIG helps you easily acquire a large enough item pool to implement secure test designs like CATs, LOFTs, and more. Using secure test designs, the **natural longevity** of our items is extended, and with AIG, generating more is a breeze. *(How long do your items usually last?)*

In many cases, generating new AIG items doesn't even require using a fresh template. Make changes to your templates or create a new one from scratch for similar costs. *(Would you adjust your template or start over?)*

WHAT WOULD AIG SAVE YOU?

200 Manual Items

Enter the listed values in the equation below to calculate the cost of 200 manual items.

_____ **x 200 =**
COST PER ITEM

_____ **SUBTOTAL**

MAINTENANCE COSTS: HIGH

MANUAL REWRITING OF
EXPOSED ITEMS CAN NEARLY
DOUBLE DEVELOPMENT COSTS

x 2

_____ **TOTAL**

200 AIG Items

Enter the listed values in the equation below to calculate the approximate cost of creating 200 AIG items. *

_____ **x 3 =**
COST PER ITEM

_____ **COST OF AIG
TEMPLATE**

MAINTENANCE COSTS: LOW

SECURE TEST DESIGN AND RAPID
REPLACEMENT OF EXPOSED
ITEMS CUTS DOWN ON COSTS

**NO^{*}
COST**

_____ **TOTAL**

* In many cases, you will not have to create a new AIG template in order to generate more or newer items from it. However, this may be the most practical solution in some cases. You may want to budget by assuming you'll create 2 or 3 AIG templates.

* The foundational costs of licensing Caveon AIG are not included in this equation.



NOTES / BRAINSTORMING PAGE

TO-DO LIST

TASKS	PRIORITY	DUE DATE	
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WHAT'S NEXT? WOW! YOU'RE THROUGH PART 2.



Security Boot Camp Part 3:
Evaluation will dive into all the ways you can beef up security for your program, of any size, once it's up and running.

DOWNLOAD PART 3

Learn more over at
caveon.com