Item writing: SCAMPERing to a greater return on investment

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Traditional item development practices are “unique craft projects”

~ Luecht, 2013, p. 71
Recruit SMEs for item writing/reviewing → Train SMEs → SMEs write items

Item review → Trialling → Ready for operational use

Typical: Individual, piecemeal effort
What are some of the challenges you have with the traditional item writing approach?
How can we get a bigger ‘bang for our buck’ in the item writing process?

- Automated item generation
- Alternative item generation methods
- Idea generation techniques
“Automated item generation (AIG), in its most ambitious form, is the process of using item models to generate statistically calibrated items, with the aid of computer technologies.

~ Gierl & Lai, 2013, p. 26
Electronic cloning

- Generating multiple item variants by automatically producing alternatives for predefined item elements using pre-defined parameters.

- Example:
  
  What is $2 + 2$?

  Integer $< 0 \& >10$
Electronic cloning

- Issues (Gierl & Lai, 2013)
  - Items appear too similar to one another
  - Easy to detect by coaches and test preparation companies
  - Simplistic product from an overly simple item production process
Weak theory

“The idea behind this approach is to generate calibrated items automatically from design guidelines by using a ‘theory’ of invariance.” (p. 474)
The goal of automatic item generation from strong theory is to generate calibrated items automatically from design principles by using a theory of difficulty based upon a cognitive model,” (p. 474)
A hypothetical task model for an assessment on Irish dramatists

- Synthesize the literary themes amongst selected works
- Identify works with similar narrative styles
- Describe the plots of selected works
- Place works into their historical context
- Identify the works of specific Irish dramatists
- Associate dramatists with their works
“…as testing demand increase, the cost of item production can be enormous. The solution is to find a new design that allows organizations to manufacture as many items as needed…”

~Luecht, 2013, p. 74
Item modeling

- Item models (LaDuca, Staples, Templeton & Holzman, 1986; Bejar, 1996); shells (Haladyna & Shindoll, 1989); schema (Singley & Bennett, 2002); templates (Mislevy & Riconscente, 2006)

- Structural shell of an item with the item elements that can be manipulated to make new items highlighted
Five ships arrived in port on five consecutive days, Monday through Friday. The five ships are the *Independence*, the *Endurance*, the *Catalyst*, the *Prosperity*, and the *Stalwart*.

The *Prosperity* was the last to come into port.

The *Stalwart* arrived in port two days before the *Catalyst*.

The *Endurance* arrived in port on Tuesday.

What day did the *Independence* arrive?

<table>
<thead>
<tr>
<th>Item</th>
<th>Element 1</th>
<th>Element 2</th>
<th>Element 3</th>
<th>Element 4</th>
<th>Element 5</th>
<th>Element 6</th>
<th>Element 7</th>
<th>Element 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original</td>
<td>Ships</td>
<td>Port</td>
<td>Days</td>
<td>Independence</td>
<td>Endurance</td>
<td>Catalyst</td>
<td>Prosperity</td>
<td>Stalwart</td>
</tr>
</tbody>
</table>
Five trains arrived at a station in 15-minute intervals. The trains were travelling to London, Glasgow, Manchester, Birmingham, and Leeds. The first train arrived at 10.00 in the morning.

The train to Birmingham was the last to arrive at the station.
The Leeds train arrived at the station 30 minutes before the one to Manchester.
The train to Glasgow was arrived at 10.15.

What time did the London train arrive at the station?

<table>
<thead>
<tr>
<th>Item</th>
<th>Element 1</th>
<th>Element 2</th>
<th>Element 3</th>
<th>Element 4</th>
<th>Element 5</th>
<th>Element 6</th>
<th>Element 7</th>
<th>Element 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>New item 1</td>
<td>Trains</td>
<td>Station</td>
<td>15 min</td>
<td>London</td>
<td>Glasgow</td>
<td>Manchester</td>
<td>Birmingham</td>
<td>Leeds</td>
</tr>
</tbody>
</table>
At one school, five classes were held in consecutive time slots on Mondays. The classes were Art, Science, Geography, History and Music. History was the last class of the day. Music was held two sessions before Geography. Science was the second class of the day.

In what class session was Art held?
Item modeling


- Adaptation: Incorrect answer in one question becomes the correct answer to a new one
- Change the question asked and write new answer options
- 4 times more productive than traditional committee-based approach
Enhanced materials

- Becker & Olson, 2012
  - Use of NLP to generate ideas for item writers
    - Identify content from textbooks not covered by current item banks
    - Identify relationships that may be useful in generating distractors
  - Item templates
Becker & Olson’s item templates

- Find the Definition – Select the definition for a given term.
- Find the Term – Select the term for a given definition.
- Critical Characteristics – Identify the defining characteristics of an entity.
- Examples or Instances – Identify an entity based on specific examples.
- Cause and Effect – What is the effect of a particular action?
- Odd-One Out – Which of the listed items does not belong?
- Facts – What are the facts in a given situation?
- Concept Classification – How would you classify concepts into classes?
- Non-Examples – Which example does not align with the concept?
- Procedure Steps – Order the steps of a procedure.
- Procedure Rationale – Explain why a specific procedure is performed.
- Procedure Selection – Which procedure would be appropriate in a given situation?
- Precautions – What precautions are necessary in a given situation?
Research question:

Could this supplemental information increase the efficiency of item writers?

Findings:

Experimental group with supplemental information was more productive – 23.2% increase in the total number of items written.
“Every test item begins with an idea in the mind of the item writer. The production and selection of ideas upon which test items may be based is one of the most difficult problems facing the item writer.”

~Ebel, 1951, p. 190
Item writing ‘ideas’ challenges

- SMEs are expert at the ‘science’ of item writing, but not the ‘art’
- Some content areas difficult to develop items in
- ‘Writer’s block’ experienced by item writers working individually
- Coming up with plausible distractors for multiple-choice items
Idea generation methods

- Comedy workshop format (Droegemueller, et al., 2005)
  - Group of 4 to 6 SMEs
  - SME selects major content area
  - Another SME selects more specific content
  - Group brainstorms on plausible answers
  - Recorder types and projects discussion on screen
The SCAMPER technique
(Ebel, 1996; Michalko, 2006)

S - Substituting something
C - Combining it with something else
A - Adapting it to something else
M - Modifying or Magnifying it
P - Putting it to another use
E - Eliminating something
R - Reversing or Rearranging something
How can a paper clip be improved?

What can be substituted for the paper clip?
What can be combined with the paper clip?
How can the paper clip be adapted?
How can the paper clip be modified (or magnified)?
How can the paper clip be put to a different use?
What can be eliminated from the paper clip?
How can the paperclip be rearranged?
Using SCAMPER in item writing

- Take a content area from the test blueprint
- Select a specific topic within the content area
- Work as a group to generate ideas for items using the SCAMPER technique to build more items from a single original idea
Take a content area from the test blueprint
  ▪ Content area: Drug interactions (from a pharmacy blueprint)
Select a specific topic within the content area
  ▪ Drugs which interact with prednisolone
Original item idea
  ▪ Barbituates (key) decrease the effectiveness of prednisolone
    Possible distractors – aspirin; methotrexate (side effects increased by prednisolone), warfarin (effectiveness decreased by prednisolone), clarithromycin (increase risk of side effects)
Barbituates (key) decrease the effectiveness of prednisolone

Possible distractors – aspirin; methotrexate (side effects increased by prednisolone), warfarin (effectiveness decreased by prednisolone), clarithromycin (increase risk of side effects)

▪ Substitute another drug for prednisolone

▪ Combine two drugs in the stem and ask which drug they both decrease the effectiveness of

▪ Adapt the item to ask which drug increase the risk of side effects from prednisolone

▪ Modify the item to ask which drug prednisolone increases the risk of side effects from

▪ Put the item to another use by asking about drug-food interactions

▪ Eliminate the drug group (barbituates) and ask about specific barbituates instead

▪ Reverse the item and put barbituates in the stem
Exercise: Using the SCAMPER technique in item writing

- SCAMPER cards and content areas/topics are provided.
- Brainstorm about items for the content areas/topics based upon the SCAMPER technique on a card.
- As ideas are exhausted, go on to another SCAMPER card (and another content area/topic, if you would like).
“The way to get started is to quit talking and begin doing”

~Walt Disney
When? 

- When writers need an injection of new ideas
- When introducing new writers into an existing test development project
- When writing for a test programme with a high turnover of items
- When moving to a new administration model
- Focus on projects with particular blueprint areas in need of development
- Where there is limited reference material or cost constraints
- Use items that have performed well as a basis for generating more items
Why not?

No need to fundamentally change your process

Only a small amount of set-up time required

Doesn’t need to stand-alone other generation techniques possible alongside
**Other Ideas - SCAMPER**

**Substitute it** - Use cognitive levels instead of SCAMPER cards with prompts

**Combine it** – Use it during an item writer training session as an ice breaker

**Adapt it** – Use SCAMPER in review meetings to foster more productive feedback with suggestions

**Modify it** – Consider using it as an idea generating technique rather than an item writing technique

**Put it to another use** – Use it for writers when writing from home to spark new ideas

**Eliminate something** – Can non-SMEs be used to generate items?

**Reverse it** – Using SCAMPER to fix retired/poorly performing items
Objectives

- Use SME time wisely
- Generate more items in a shorter time period

Further considerations

- Experience/preferences of item writers
- Quality of items generated

Skill in item writing depends not only upon prolific inventiveness but also upon discriminating judgment in the selection.

- Becker & Olson
Final thoughts

- More research needed in effective item development techniques
- *Efficacious* item writing involves not only item writer productivity but also a consideration of desired content & psychometric properties
- Creative thinking techniques may assist in boosting item writer productivity
- These could be combined with more structured means of examining the underlying construct model for better targeting of items to psychometric properties
References


