A Transformation to Learning Engineering

November 2016
Kaplan spans domains and geography

Kaplan University Group
- Kaplan University
- Kaplan Legal Education
- Kaplan Professional Education
- KU Nursing

Kaplan United Kingdom
- Kaplan Higher Ed – Europe
- Kaplan Professional – Europe

Kaplan International Colleges
- Kaplan Int’l Colleges
- Global Pathways
- Dublin Business School

Kaplan Test Prep
- KTP Grad
- KTP Pre-College
- KTP Med
- KTP Nursing
- KTP Bar Review
- Dev Boot Camp
- KTP International

Kaplan Asia Pacific
- Kaplan Higher Ed – Asia
- Kaplan Professional – Asia
- Kaplan Higher Ed – Australia

Kaplan Professional – Australia
- In Country Pathways – China
- BEO - HO
Putting evidence to work

- Start from how learning actually works
- Use technology to implement and enhance *good* solutions
- Use evidence to make progress
- Change practices at scale

Learning Engineering
“Learning engineering” at scale requires work

Exposure → Education → Effort → Evaluation
Exposure first

- Show the science
- Show a process
- Make examples
We know a lot about how expertise works

**Working Memory**

- Short retention
- Audio + video = benefits
- Verbal/conscious
- 3-5 things at once
- Slow processing
- Error-prone
- Highly flexible
- Can generate new insights/knowledge

**Long-Term Memory**

- Long retention
- Auto-connect to WM
- Non-verbal/Non-conscious
- Highly parallel
- Rapid processing
- Error-free (with proper training)
- Rigid – decisions and tasks must “fit”

Audio & Visuals aid memory
We also know quite a lot about motivation

**Motivation Beliefs**
- Value
- Self-Efficacy
- Attribution
- Mood

**Motivation Actions**
- Starting
- Persisting
- Mental Effort

**Learning/Results**
- Practice results
- Test results
- Fluency/ease
- Work results
This allows for a “learning engineering” process

Cognitive task analysis

Evidence-based instructional design

Pilot new evidence-based methods

Valid and reliable learning measures
Evidence-based instructional design matters

Cognitive task analysis

Rapidly test and scale learning innovations

Design & Deliver Adapt to Learners

Measure & Evaluate Adapt to Learners

Understand Expertise

Evidence-based instructional design
Design starts from how expertise gets acquired

<table>
<thead>
<tr>
<th>Stage</th>
<th>Implications for Instructional Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declarative</td>
<td>Clear information displays, e.g., job aids, examples, reference material</td>
</tr>
<tr>
<td>Procedural</td>
<td>Build varied Practice tasks, and rich feedback/coaching</td>
</tr>
<tr>
<td>Automated</td>
<td>Repeated frequent practice to build speed and accuracy</td>
</tr>
</tbody>
</table>
There’s specific guidance to make screens/lessons work better

<table>
<thead>
<tr>
<th>Principle</th>
<th>Description</th>
<th>Effect size (s.d. units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multimedia</td>
<td>Use relevant graphics and text to communicate content</td>
<td>1.4</td>
</tr>
<tr>
<td>Contiguity</td>
<td>Integrate the text nearby the graphics on the screen – avoid covering or separating integrated information</td>
<td>1.1</td>
</tr>
<tr>
<td>Coherence</td>
<td>Avoid irrelevant graphics, stories, videos, media, and lengthy text</td>
<td>0.9</td>
</tr>
<tr>
<td>Modality</td>
<td>Include audio narration where possible to explain graphic presentation</td>
<td>0.8</td>
</tr>
<tr>
<td>Redundancy</td>
<td>Do not present words as both on-screen text and narration when graphics are present</td>
<td>0.9</td>
</tr>
<tr>
<td>Personalization</td>
<td>Script audio in a conversational style using first and second person</td>
<td>0.8</td>
</tr>
<tr>
<td>Segmenting</td>
<td>Break content down into small topic chunks that can be accessed at the learner’s preferred rate</td>
<td>0.8</td>
</tr>
<tr>
<td>Pre-training</td>
<td>Teach important concepts and facts prior to procedures or processes</td>
<td>0.8</td>
</tr>
<tr>
<td>Etc.</td>
<td>Worked examples, self-explanation questions, varied-context examples and comparisons, etc.</td>
<td>??</td>
</tr>
</tbody>
</table>

The impact is not small!

- 50% (1 standard deviation)
- 84% (1.1 standard deviations)

Normal Distribution Diagram

- Probability of Cases in portions of the curve
- Standard Deviations From The Mean
- Cumulative %
- Z Scores
- T Scores

Values

Probability

95% of values

1 sd

99% of values
Evidence shows our intuitions aren’t the best guides: LSAT Logical Reasoning example

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Education</th>
<th>Effort</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study 8 worked examples</td>
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</tr>
<tr>
<td>Study 15 worked examples</td>
<td></td>
<td></td>
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<tr>
<td>Use Existing Kaplan On Demand Instruction</td>
<td></td>
<td></td>
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<tr>
<td>Test Only – No instruction</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>N</th>
<th>Time (mins)</th>
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</thead>
<tbody>
<tr>
<td>153*</td>
<td>8.2</td>
</tr>
<tr>
<td>148*</td>
<td>12.8</td>
</tr>
<tr>
<td>107</td>
<td>99.3</td>
</tr>
<tr>
<td>84</td>
<td>NA</td>
</tr>
</tbody>
</table>

* Significant difference from “No Instruction”
Motivation/meaning interventions work too

• Students received initial surveys on their “uniqueness” needs
• Intervention students wrote on “what it means to be distinct” and strategies for them to achieve this
• A few weeks later, asked to share how to be distinctive through scholastic achievement
• Passing, grades, and persisting to next course all significantly improved
Have to be careful – what we think is “good” may not be

- Comparison of course teacher view vs. independent teachers’ markings

Based on 10 randomly selected papers from a writing course
Education of key personnel is next

- Show the science
- Show a process
- Make examples

- Refine process
- Train IDs
- Market exposure
Need to train for different components of Learning Engineering
Learning science pushes us to backwards design
Research gives us clearer guides to help with hard outcomes

<table>
<thead>
<tr>
<th>Knowledge Component</th>
<th>Practice/Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Procedure</strong></td>
<td>Decide when to use; perform the steps</td>
</tr>
<tr>
<td><strong>Fact</strong></td>
<td>Recall fact in task context; spaced repetition</td>
</tr>
<tr>
<td><strong>Concept</strong></td>
<td>Classify, identify or generate examples and non-examples</td>
</tr>
<tr>
<td><strong>Process</strong></td>
<td>Identify causes of faults in a process; predict events in a process</td>
</tr>
<tr>
<td><strong>Principle</strong></td>
<td>Decide if principle applies; predict an effect; apply principle to solve a problem, explain a phenomenon or make a decision</td>
</tr>
</tbody>
</table>
Building valid and reliable assessments “the Kaplan Way”

Purpose
- Identify assessment purpose(s)

Objectives
- Analyze knowledge and skills and define assessment objectives

Tasks
- Design tasks to cover objectives

Rubrics
- Design scoring or marking guides

Reporting
- Create reporting plan

Validation
- Develop and Implement validation strategy for purpose(s)
Training for developers is key

BE201: Cognitive Task Analysis
BE101: Instructional Design

BA101: Assessment Blueprint Development
BA102: Writing Effective Multiple Choice Items (BETA)
BA103: Assessing Complex Knowledge and Skills Using Multiple Choice Questions (BETA)

Building Valid Short Answer and Performance Tasks
Assessment Validation

Launches:
- BE201: In development
- BA102: In the queue for 2017

In the queue for 2017:
- BA101
- BA103

Colors:
- Blue: Launched
- Orange: In development
- White: In the queue for 2017
It’s real work to alter how a large number of IDs build... 

2-month online self-study (40 hours)  
2-day workshop  
Team Projects 4 months coaching  
Transfer to products

<table>
<thead>
<tr>
<th>Online Course</th>
<th>Workshop</th>
<th>Analysis</th>
<th>Micro Design</th>
<th>Development</th>
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<tbody>
<tr>
<td>Week -8</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>Deliverables</td>
<td>POs</td>
<td>Specs</td>
<td>Draft Scripts</td>
<td>Final Scripts</td>
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<tr>
<td>Coaching</td>
<td>2hr</td>
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<tr>
<td>Team review / preview ...</td>
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<tr>
<td>Team review / preview ...</td>
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<tr>
<td>Production</td>
<td>Author</td>
<td>Revise</td>
<td>Moodle</td>
<td>Rebuild</td>
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<tr>
<td>Delivery</td>
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</table>

Macros: 
1. Product Quality 
2. Macro Design 
3. Analysis 
4. Micro Design 
5. Development 
6. Implementation 
7. Evaluation 
8. Motivation
Serious effort to expand across organization

- Show the science
- Show a process
- Make examples
- Refine process
- Train IDs
- Market exposure
- Wider use
- Community
- Set GM goals
We knew there was (is) much potential to improve*

<table>
<thead>
<tr>
<th>Category</th>
<th>Product</th>
<th>1</th>
<th>2</th>
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*Example: Ratings from Kaplan Way for Learning checklist, applied to 9 Kaplan products

Quality: high: >= .7, med: <= .7, low: <= .3
More use of learning science principles does help

Existing courses

- Outcomes and content not precisely aligned
- Limited demonstrations, worked examples, and practice
- General assessment rubrics
- High reliance on discussion boards

Redesigned courses

- Outcomes and content aligned
- One lesson per objective
- Demonstrations and worked examples
- Practice, feedback before assessment
- Detailed scoring guides
- Less discussion/more practice
- Standard instructor materials
- Monitoring and support for motivation
Result: much greater student success

- **11%** higher success rate
- **28%** increase
- Students in redesigned courses were **1.6 times** more likely to be successful

**Adjusted student success rates with 95% confidence limits**

Wald Chi-Square: 10.42, df=1, n=895, Sig<.001.
With scale, we can run many tests

For illustration purposes: Based on CM 107 (College Composition)
Each band represents 8 sections, each with 25 students (a total of 200 students)
With scale, we have the option to continue to improve further.

<table>
<thead>
<tr>
<th>Adaptive</th>
<th>Assessment &amp; CLA</th>
<th>Learning Strategies</th>
<th>Media Principles</th>
<th>Motivation &amp; Self Efficacy</th>
<th>Social Norming</th>
<th>Worked Examples</th>
<th>Others</th>
<th>Open Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>SmartBook</td>
<td>CLA Re-Scoring</td>
<td>Self-Explanation</td>
<td>Advanced Organizers</td>
<td>Judgments of Learning</td>
<td>Badging</td>
<td>Early</td>
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<tr>
<td>MyLab</td>
<td>Assessment</td>
<td>Self Summary</td>
<td>Coherence</td>
<td>Motivational Priming</td>
<td></td>
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<td>Section Size</td>
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<tr>
<td></td>
<td></td>
<td>Self Test</td>
<td>Continuity</td>
<td>Self Efficacy</td>
<td>Iconographs</td>
<td>Later</td>
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<td>Challenge Exams</td>
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<td>Modality</td>
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<td>Orientation</td>
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<td>Multimedia</td>
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<td>Faculty Dashboard</td>
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<td>Redundancy</td>
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</tr>
</tbody>
</table>

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**Media Principles**
- Advanced Organizers
- Coherence
- Continuity
- Modality
- Multimedia
- Redundancy

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**Motivation & Self Efficacy**
- Judgments of Learning
- Motivational Priming
- Self Efficacy

---

**Social Norming**
- Badging

---

**Worked Examples**
- Early
- Later

---

**Others**
- Section Size
- Orientation
- Faculty Dashboard

---

**Open Courses**
- Challenge Exams
Need to check:
Impact of faculty dashboards on first year college social studies course

![Bar chart showing retention rates for Attendance, LMS minutes, and Number of assignments.](chart)

- **Attendance**: 65%
- **LMS minutes**: 80%
- **Number of assignments**: 85%

**N:**
- 653
- 625
- 498

* Improved learning outcomes
§ Improved retention
Established a Learning Architect Community: E.g., to look in detail at learning measurement issues

Anyone connected with learning at Kaplan

Anyone interested in learning measurement at Kaplan

Key leaders who drive learning measurement within their business units

Small groups focused on specific measurement issues and challenges
Established a General Manager review process to focus on learning tradeoffs and essential ingredients for quality

- Derived from experts or expert associations and/or regulatory bodies
- Tied in with domain specific research (if any)
- Clearly described and tied to what learners are intended to be able to decide and do

- Research-based development processes
- Expert reviews
- Item, test and scoring reliability studies
- Evidence that assessment does what it’s supposed to do (e.g., accurately predict future test scores; measure competence)

- Lesson components are tightly aligned with learning outcomes
- Course proactively addresses student motivation

Focus for Sept 2016
Focus for April 2017
Focus for Sept 2017
Over time, need to continue evaluation

- Show the science
- Show a process
- Make examples

- Refine process
- Train IDs
- Market exposure

- Wider use
- Community
- Set GM goals

- Initial tools/rubric
- Evidence review
- Detailed measures
We put in place a “Kaplan Way” checklist:

<table>
<thead>
<tr>
<th>Category</th>
<th>Rating</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Objectives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Assessment</td>
<td></td>
<td></td>
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<tr>
<td>3. Practice</td>
<td></td>
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</tr>
<tr>
<td>4. Examples</td>
<td></td>
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<tr>
<td>5. Information</td>
<td></td>
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<tr>
<td>6. Multimedia</td>
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<tr>
<td>7. Overviews</td>
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<tr>
<td>8. Integration</td>
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<td>9. Motivation</td>
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<td>10. Organization</td>
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<tr>
<td>11. Usability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Personalization</td>
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</tr>
<tr>
<td><strong>TOTAL SCORE (1 - 12)</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
This means systematic attention from teams

Product Quality Report: Product Overview

Category
1. Objectives
2. Assessment
3. Practice
4. Examples
5. Information
6. Multimedia
7. Overviews
8. Integration
9. Motivation
10. Organization
11. Usability
12. Personalization

TOTAL SCORE

Product Quality Report: Ratings Summary

|----------|---------------|---------------|-------------|-------------|----------------|---------------|-------------|----------------|---------------|-----------------|-------------|---------------------|---------|

Product Quality Report: Comments Summary

Category
1. Objectives
2. Assessment
3. Practice
4. Examples
5. Information
6. Multimedia
7. Overviews
8. Integration
9. Motivation
10. Organization
11. Usability
12. Personalization

TOTAL SCORE

Product Quality Report: Appendix

CATEGORY: <e.g., Overviews>
STRENGTH (or OPPORTUNITY): <short description here>

<Add one screen capture per slide to illustrate strengths or opportunities of the product>
At scale, we can look at the overall outcome of many pilots.

Kaplan University  Research Pipeline Focus and Progress (11/2015)

- Four key focus areas; Dozens of randomized control trials over past two years.
- Several early studies proved inconclusive – led to more structured pilot design process.
- Yielding several “go / “no go” decisions based on evidence of improved outcomes.

![Graph showing pilot study outcomes](attachment://graph.png)

- **Result in definite implementation recommendation**
- **Definite recommendation to NOT implement**
- **Inconclusive and no firm recommendation**
- **In Process and recommendation not yet determined**
Can look in detail at specifics:

Health Care QBank Question Analysis Results

PBS Comparison 15Q2 to 16Q2
Measurement & Evaluation – Kaplan Professional US
Tactical Work, Financial Svcs. - Used CTT to identify a way to improve testing for a client

Item Difficulty vs. Discrimination:

- X-axis: Difficulty is the % of correct responses for a given item on the final exam
- Y-axis: Discrimination is the % correct responses for the top quartile, minus the % correct responses for the bottom quartile
- Marks: Represent individual question items
All this matters if you’re after good “learning engineering”
Where to find out more?

• Location of course on using (and downloading) a learning science checklist:
  
  [http://goo.gl/f1RCAu](http://goo.gl/f1RCAu)

• Bror’s Blog for more on “learning engineering”:
  

• Recent Ithaka article on applying learning engineering at KU:
  
  [https://goo.gl/l1hRZM](https://goo.gl/l1hRZM)

• Contact me:
  
  [bror.saxberg@kaplan.com](mailto:bror.saxberg@kaplan.com)
April 20, 2015
Why We Need Learning Engineers
Chronicle of Higher Education