CHUNK Learning: Proof of Concept

By

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TEACHER: WHY I COULD NEVER BE A MATH TEACHER:
WILL WE EVER USE ANY OF THIS ALGEBRA?
YOU WON'T, BUT ONE OF THE SMART KIDS MIGHT.

https://www.smbc-comics.com/comics/1479054311-20161113.png
The Challenge

I'm still waiting for the day that I will actually use

in real life

The Vision

A modular real-time and adaptive teaching-learning method for enhanced and personalized education which enables the student to heuristically discover and learn based on personal background and interests.
Curated Heuristic Using a Network of Knowledge

A personalized, adaptive learning platform.

CHUNK Learning breaks away from the predictable pattern of traditional education models and provides content delivery that respects the different capabilities, learning styles, and approaches to problem-solving of every learner. Students are empowered by a system that ensures learning is efficient, flexible, and respectful of their time.

- Offers intense, short, and focused educational modules
- Stimulates interest and demonstrates relevance of topics
- Integrates new information with learner’s pre-existing knowledge
- Provides personalized and individualized education
- Optimizes content and methodology delivery to meet the needs of each learner
Why?
Why CHUNK Learning now?

- Science of Learning
- Network Science
- Digitally Native Students
- Personalized Online Resources
Educational Landscape

**Traditional Education**
- Linear
- Teaching to the ‘average’ student
- One time access to SME
  - Supplement with online resources (YouTube, Khan Academy, etc.)

**A 21st Century Education**
- Chunked, modular & networked
  - Future work: badges
- Adaptive & respectful of learner’s time
- Based on own skills & abilities
- Prior experiences and interests
- SME curated resources
  - Human element
Are you going to shorten the text here and/or change the order of appearance for the animation?

Isenhour, Michelle (LTC), 7/27/2019
How?
How CHUNK Learning? User Profiles!

Each learner maintains an “online” profile:
- Personal Background
- Competency
- Preferred Instructional Methods
- Skills
- Interests
- Goals
- Type of Learner

**Learner Profile:**
- Cyber Systems
- Civilian, 20 years experience
- Active Learner
- Good with Python, C, Fortran
- Slow Reader
- Slight Test Anxiety
- Loves Professor Isenhour

**Learner Profile:**
- Operations Research
- Lieutenant, US Navy
- B.S. in Systems Engineering
- Mad Skillz with Excel
- Wants to Learn R
- Interested in Wargaming and Wargame Analysis
How CHUNK Learning?

Individualized Instruction

- **Objective**: meet students where they are (pace & needs)
- Recognizing that students have different
  - gaps
  - backgrounds
  - skills and
  - prior experiences
- Variety of curated activities to meet the academic needs of each student
  - PPT
  - videos
  - PDF/html
  - demos
  - code, etc.
- Instructor facilitated education
How CHUNK Learning? 
Personalized Student Learning

- **Objective**: engaged & active learner, supporting deep & long-lasting learning
- Anchoring to existing experiences
- Tailoring to personal interests of various learners
  - accessible, respectful of users’ time
  - academic and career goals
  - best fit learning modality
- Promoting active learning
  - managing own learning
  - generating exploratory engaged life-long learners (TED talks)

"You have brains in your head. 
You have feet in your shoes. 
You can steer yourself in 
any direction you choose!"

**DR. SEUSS**
*Oh! The Places You’ll Go!*
METHODOLOGY
The Concept

Legend

Why Learn?  
How Used?  
Methodology  
Assessment

A modular real-time and adaptive teaching-learning method.
The Concept

Curated Heuristic Using a Network of Knowledge for Continuum of Learning (CHUNK Learning)

A modular real-time and adaptive teaching-learning method.
The CHUNKlets

Why Learn it?
• 1-3 minute video highlighting why the student should learn the concept.

How to Use it?
• 3-5 minute video on how the concept is used in practice (discipline based).

Methodology
• A combination of instructional methods: assigned reading, slide review, example problems, in-person discussion or lecture, etc.

Assessment
• Some form of assessment – test, report, etc. Opportunities for remedial learning incorporated.
Sample CHUNK

Selecting a Statistical Programming Environment

This CHUNK introduces students to some of the typical statistical programming environments, primarily R, MATLAB, Python, and JMP. At the conclusion of this CHUNK, students must decide on which statistical package they will use to complete their cases of short courses. However, it is okay for students to change their mind and switch between multiple packages as they progress through their Statistics and Data Analysis short courses.

Why

- What is RStudio and Why Should You Download It?
  10 min 13 sec

- Why JMP?
  5 min

How

- SPSS, SAS, R, Stata, JMP? Choosing a Statistical Software Package of Two
  2 min

- Quantitative Analysis Guide: Which Statistical Software to Use?
  6 min

Methodology

- Getting Started with R: Download and Install
  4 min 52 sec

- Getting Started with JMP: Download and Install
  10 min

Assessment

- Blog Entry #2 - Selection of a Statistical Programming Environment
  6 min
Current Methodology:  
**CHUNK and CHUNKlet Recommendations**

Each exploratory user receives:

- A **CHUNK recommendation** based on keywords that are categorized relating to **content**
  - Discipline
  - Skill
  - Topic

- From it, a **CHUNKlet recommendation** based on keywords that are categorized relating to **likeability and style**
  - Instructor
  - Author
  - Application
  - Activity Type
  - Learning Method
Current Methodology:  
*User profile & preferences*

Current recommendation system

- Syntactical similarity of keywords: CHUNKlet recommended based on its similarity to user’s profile keywords

- Content relevancy feedback: positive or negative on of the content in the completed CHUNKlet

- Quality feedback: rating of 1-5 on the quality and usefulness of the CHUNKlet

How can the user’s profile automatically update based on the feedback of completed CHUNKlets? And what is the impact?
Using Network Science: Ontological vs syntactic CHUNKs similarity in the network

Visible to students (ontological: pre-requisites)

- Three layers of nodes: users, CHUNKlets, and CHUNKs
- Edges: all edges are present with different weights based similarity

Will be used for recommender system (syntactic similarity)

By Daniel Diaz, Paul Keeley, Nickos Leondaridis-Mena, Matt Mille, and Ralucca Gera at NPS
Methodology

Updating user’s profile

Capture the user's experience on completed CHUNK/CHUNKlet:

- If YES → what about it did you like the most. A handful of representative keywords will populate the screen.
  - Content related keywords for CHUNK
  - Method related keywords for CHUNKlets
  - If these keywords are not already present in the user's profile, they are added for future recommendations.
    - If the keyword is already present, then its value is multiplied by a scaling factor

- If NO → the key word is multiplied by a degradation factor

Did you enjoy this CHUNK/Chunklet?
- Yes ✓
- No

What did you enjoy most about this CHUNK (Numbers, Inequalities, and Absolute Values)?
- Algebra ✓
- Economics ✓
- Engineering

What did you least enjoy about this Chunklet (Category 'Why')?
- Christopher Christakis
- Video ×
Visual Results: Dynamic profile vs static profile

*Same Profile*

Updating a user’s profile at the end of each CHUNKlet prolongs the user’s relevant exploratory path.

Updating profile: 'network', 'science'

Static profile: 'network', 'science'

Legend:
Nodes: CHUNKlets
Edges (red lines): the path taken by user (the width of the edges is proportional to the similarity of the user to that CHUNKlet).

Because the user’s profile is not updated at the end of each CHUNKlet, the user cannot acquire new keywords, no new edges are added to the path.

By Daniel Diaz, Paul Keeley, Nickos Leondaridis-Mena, Matt Mille, and Raluca Gera at NPS
Visual Results: Network discovery
4 different profiles

Recommender System (no randomness): the different paths taken by each user demonstrate that our recommender system provides unique & appropriate recommendations based on user input

The Null profile
{}

Network science profile
{'network','science'}

Physics profile
{'rockets','physics','newton','motion'}

Space profile
{'space','war','nuclear'}

Visually: unique & appropriate recommendations based on user input
ASSESSMENT
Assessment: Current Piloting Efforts

I) Remediation

- Diagnostic and prescriptive (pretest, remediation, post-test): filling in gaps in knowledge/skills for specific math/physics topics for NC3 certificate
- Reinforcing previous learning
- Expanding current knowledge & skills
- Connector between related skills
- Develop knowledge and skills – logical/mathematical domain

II) Classroom augmentation

- Some type of hybrid teaching:
  - Raluca: “flipping the interest in topic”
  - Michelle: “CHUNK enriched instruction” -- demo now!
The Future

- Extend proof of concept to include:
  - Author interface and content management system
  - Recommender system with integrated AI
  - System and user analytics interface (report generation)

- Develop research questions and instruments to assess:
  - System operation and functionality
  - Student learning

- Build video repository...need help from subject matter experts across every discipline
  - Why Learn it?
    - 1-3 minute video highlighting why the student should learn the concept.
  - How to Use it?
    - 3-5 minute video on how the concept is used in practice (discipline based).

- Solicit ideas on how to incorporate disciplinary knowledge at varying levels of breadth and depth
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We welcome your thoughts!
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