NAVIGATED LEARNING
- a “GPS for Learning”

Pram
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Dr. Prasad “Pram” Ram

- Founder, Gooru.org, researched and developed learning technology to support Navigated Learning.
- Director of Research at Google, led projects on Maps, News, Books, Translation, Search and Ads.; Engineering leader at Yahoo!, Research Scientist at Xerox PARC.

Learning Navigator

- Prototyped at Google by Pram and founded in Silicon Valley to bring “Google Maps for Learning”.
- Informed by practice and backed by science, developed technology, prototypes and implemented in programs in US schools.
- Developed the Learning Navigator and using that to bring math proficiency within 3 years for everyone.
Navigation

“You Have Arrived at Your Destination”

- Starting Point
- Destination
- Route

- Drive
- Reroute
- Arrive

Eliminate the Anxiety of Travel
Simplicity of Use, Assured Success
**Precision Medicine**

“You are healthy and ready to go home”

**Precision medicine** is an approach to patient care that allows doctors to select treatments that are most likely to help patients based on a genetic understanding of their disease.

- Variety of experts involved in the treatment
- Obsess over the individual
- Coordinated by data backbone

**Focus on the Individual**

Start with what works for people like you, Finetune to make it precisely work for you
To Navigate a learner, first Locate them, then Curate activities, Facilitate practices, Mediate pathways and Integrate communities

Educators, Researcher & Developers open-source their work and practice

Route and reroute learners using principles of learning

Engage the class, monitor performance and personalize interventions

Digital learning is digital data from full-spectrum learning

“Lat-Long” for Learning; Learner Identity;
Route the learner to their destination
Reroute to enable Mastery in each Concept

ROUTE
Generates a pathway considering user proficiency, preferences, portfolio

LOCATE
Using a diagnostic, Navigator locates the student’s current knowledge and skills

STUDY
Uses learning activities and assessments to learn a concept. Checks on progress during study

MASTERY
Students are provided a signature assessment to establish their mastery on a competency

DESTINATION
Student establishes a learning goal, that can be a topic or grade level proficiency

REROUTE
Student is made a “reroute” suggestion by the system or teacher based on performance

www.gooru.org
Laddered solution to reach every student
Navigator works when students have no devices or connectivity

1. Teacher with a Tablet / Phone
2. Parents with Smartphones
3. School with computer lab
4. Class with Projector
5. Station Rotation Model
6. 1-to-1 offline computers
7. 1-to-1 Devices with broadband

LOCALIZED | ACCESSIBLE | ECOSYSTEM

www.gooru.org
Common Data Backbone for Collective Impact

Monitor and Suggest

Student
Locate-Route-Reroute-Mastery

Competency

Partners
Evidence of Learning

Teacher
Personalize Intervention

Curriculum Designer
Curate lessons and assessments
Navigator - Student Experience
“You have arrived at your destination”

Student’s knowledge, skills and mindsets are located with precision.

Students obtain a learning route based on their profile.

Study using Navigate Math content that spans grades 2-8.

Receive reroute suggestions based on performance.

Review progress by inspecting their learning path.

Learning route based on profile and reroute based on performance.

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Navigator - Educator Experience
Monitor Students, Personalize Instructions and Professionally Develop

Teacher monitor their students progress and performance and can personalize their interventions

Teacher receive suggestions for students based on curriculum and non-cognitive skills performance

Teachers receive suggestions for their own professional development informed by their class performance
Navigator - Curriculum Designer Experience
Curate open resources and organize them into Navigator courses

**EXPRESSIONS & EQUATIONS**

**Integer Exponents**

Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.

**TAGGED TO THIS COMPETENCY**

CREATE SEARCH ADD FROM LIBRARY

NEXT COMPETENCY
Evidence of Learning for All Administrators
All stakeholders measure efficacy by tracking learning outcomes

Duration
Monthly

JAN 2018
FEB 2018
MAR 2018
APR 2018
MAY 2018
JUN 2018
JUL 2018
AUG 2018
SEP 2018
OCT 2018
NOV 2018
DEC 2018
Performance by Grade

1 1st Grade 28% 92% Average
2 2nd Grade 28% 91% Average
3 3rd Grade 28% 90% Average
4 4th Grade 28% 87% Average
5 5th Grade 28% 82% Average
6 6th Grade 28% 77% Average
7 7th Grade 28% 65% Average
8 8th Grade 28% 61% Average
9 9th Grade 28% 56% Average
10 1st Grade 28% 54% Average

State of Connecticut

USA

157,092 Competences Gained
SINCE LAST MONTH

1st District
38,662 TOTAL
37% since June
2nd District
32,099 TOTAL
37% since June
3rd District
30,978 TOTAL
37% since June
4th District
28,810 TOTAL
37% since June
5th District
26,543 TOTAL
37% since June

150k New Users in July
37% since June

75% Performance
64% Top Activity
64% Mastery

91k Suggestions Made
37% since June

26m Avg. Session Time
11% since June

Top Provider
BBC Networks
84,019 activities provided this month

62k Class Activities Conducted
37% since June

www.gooru.org
2.8 years of growth in one year for 3 years in a row

**URBAN EDUCATION**
- Pre-algebra & student agency
- Avg of 2.8 years of growth per year measured by NWEA MAP
- Taught across 3 schools by teachers ranging from first year to veterans

**LEADERSHIP PUBLIC SCHOOLS**
- 82% Low-income
- 83% First in family to go to college

80% of incoming freshman enter with math skills below 9th grade.

Christensen Institute Report, July 2016

The above results are not from navigator for math, but, from a research prototype called navigate math which also included extensive classroom practices and non-cognitive skills development.
Locate the Learner
update their progress in real-time

Grade 8
Grade 5

DOMAINS

LEVELS

LEVELS

DOMAINS

19 Competencies

Learning Pathway

Solving Equations
Ordering rational numbers
Equivalent Fractions
Divide Big Numbers
Factor pairs

D1
D2
D3
D4
D5
D6

Numbers and Ops
Operations & Alg. Thinking
Numbers and Ops in Base Ten
Numbers and Ops-Fractions
Expressions & Equations
Number System
Measurement and Data
Probability & Statistics

Gooru
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Develop Navigator Courses
Tagged to competencies and complete with assessments

Navigator Course

- Unit
  - Lesson
    - Collections
    - Assessments
  - Lesson
    - Unit
    - Unit

Framework defines metadata structure for every level - Course, Unit, Lesson, Collection, Assessment, Resources and Questions

Learning Objectives
Essential Questions

Playlist of resources
Playlist of questions

Collections include resource types like Interactives, videos, web pages, images, audio, pdf and 9 question types

Aligned to competencies, micro-competencies
Aligned to competencies, concepts, level of rigor

8 machine-scorable item types
Free response items with rubric scoring
Facilitate Classroom Practices with Monitoring and Live Assessments

Students achieve academic success and develop non-cognitive skills with support from teachers and peers.

The Learning Navigator
(click to watch the video)
Goal: 2x the outcome for students with 20% less work for teachers

<table>
<thead>
<tr>
<th>States</th>
<th>Clusters</th>
<th>Schools</th>
<th>Teachers</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andhra Pradesh</td>
<td>44</td>
<td>969</td>
<td>1,421</td>
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<tr>
<td>Uttar Pradesh</td>
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<td>18</td>
<td>243</td>
<td>421</td>
<td>6,103</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>445</strong></td>
<td><strong>5,664</strong></td>
<td><strong>23,357</strong></td>
<td><strong>765,425</strong></td>
</tr>
</tbody>
</table>

80% of incoming freshman enter with math skills below 9th grade.
Community-powered navigated learning
Stream of Data after every Learning Activity is used to suggest the next activity.

Essentials of a Navigator
- Data after every activity
- Machine Learning and AI techniques used to compute learner and activity vectors
- Science of learning coupled with Learner Identity and Curated Activities used to make suggestions
- Data backbone coordinates interactions across the ecosystem
Big Data Operationalizes Science of Learning

User activity stream data is logged. Using AI techniques metadata is computed. Learner profile values are computed. Search engine for learning identifies top resources. Suggestions combine profile, catalog and principles.

1. User activity stream data is logged.
2. Using AI techniques metadata is computed.
3. Learner profile values are computed.
4. Search engine for learning identifies top resources.
5. Suggestions combine profile, catalog and principles.
How is a Reroute Suggestion Made?
Combines Learner Identity, OER Catalog and Learning Principles

WHAT IS REROUTE

STUDY
Learn with activities
Monitor progress

REROUTE
“reroute” based on performance

MASTER Y
Establish mastery

HOW DOES IT WORK

OER have LRMI Metadata
- Name, Title, Description, Rights, Media Type, etc.
Compute Activity Vectors from big-data
- Competency, Relevance, Engagement, Efficacy
Compute Learner Vectors from big-data
- Authority, Context, Preference, Citizenship, Reputation

LEARNER IDENTITY

PRINCIPLES OF LEARNING

SUGGESTIONS OF ROUTE & REROUTE

OER CATALOG

www.gooru.org
Route and Reroute Suggestions using Principles of Learning Science

Locate learner’s knowledge and skills

- engage in constructing knowledge
- stretch learning experience
- revisit a concept
- frequent embedded assessments
- choice fosters engagement

<table>
<thead>
<tr>
<th>Event</th>
<th>Condition</th>
<th>Action</th>
<th>Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performs poorly in an assessment</td>
<td>Good student with mastery in dependent competencies</td>
<td>Suggest to reinforce concepts &amp; stretch learning</td>
<td>Revisit a concept &amp; stretch</td>
</tr>
<tr>
<td>Performs poorly in an assessment</td>
<td>Average student with gaps in prerequisite competencies</td>
<td>Fill gaps in learning and engage in constructing knowledge</td>
<td>Construct foundational concept</td>
</tr>
</tbody>
</table>
THANK YOU

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Navigator Informed by Practice and Backed by Science
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