An Introduction to Artificial Intelligence and IBM Watson Education Initiatives

Rick Goldgar
Program Executive
IBM Watson Education
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IBM and Corehive Team

Rick Goldgar
Program Executive
IBM Watson Education
512-808-9921
rbgoldga@us.ibm.com

Madhu Konidena
CEO
Corehive
202-580-5492
Madhu@corehive.com

Sarat Vikas Jogavajjala
Solutions Architect
Corehive
361-720-7959
saratvj@corehive.com

Madhavi Kommi
Project Manager
Corehive
571-490-5620
kmadhavi@corehive.com

Agenda

- Introduction
- Artificial (or Augmented) Intelligence and Cognitive Technologies
- IBM Watson
- A look inside the box - Architecture and services
- Watson in industry
- IBM in Education
- Watson in Education
- The Future

What is Artificial Intelligence?

What is Intelligence in General?

The Notion of Intelligence has Fuzzy Edges

In one sense, the definition of artificial intelligence is easy. It is simply the notion that we can have something non-human (these days, usually computers) behave in ways that either mimic or actually "exhibit" human like intelligence. However, there are numerous problems with this definition:

There are various ideas about what constitutes "human intelligence," e.g " The borders of human vs. animal intelligence seems to grow ever more fuzzy.

- Octopus example - https://www.youtube.com/watch?v=GQwJXvlTWDw
- Koko example - https://www.youtube.com/watch?v=SNuZ4OE6vCk

The borders between human and computer "intelligence" are also growing more fuzzy.

- Eliza
- Google Search

The "tests" for success are often either very narrow or over-ambitious.

- Turing Test
- Humanoids - https://www.youtube.com/watch?v=THU-Mg6H994

With these in mind, just what are intelligent systems supposed to do? A particular task in a particular context, or more general thought, response and *independent goal determination*?

So what is (or is not) *Artificial* Intelligence

It depends on your definition of intelligence. If you are take a broad view, then you may call a number of things “intelligent.”

- Is Google Search is intelligent?
- Are Amazon and Ebay’s websites intelligent?
- Is your new car intelligent?

If you take a somewhat deeper view, you might claim that those things exhibit intelligence in a narrow and well defined domain, but they are not intelligent in the broad way that humans are intelligent.

A Deeper View of Artificial Intelligence

The deeper view suggests that an intelligent system:

1. **will learn** in some part *on its own* by interacting with its environment in ways that may not be completely predicted. It is *not just* programmed for a specific set of responses and does *not just* rely on a large, but specifically defined set of terms that it collects and stores.

2. **understands and interacts in "natural language,"** "natural," meaning in a human way, which is messy and ambiguous (unlike programming languages).

3. may **interact through its senses** (sensors) in ways that human's do.

4. may **"understand" and respond to implicit or non-literal aspects of language and sensory data**. For example, it may be able to tell by your face that you are in a bad mood and adjust its responses.

Such a system may function in a specific domain. but more broadly, supporting more than a particular task, in a particular context. It may have more general knowledge and responses. It may grow its knowledge and abilities independently of its original programming and not just through set parameters.

A Few Highlights in the History of AI

Depending on your views, artificial intelligence may go back thousands of years. However, as the relatively young scientific ***disciplines*** of *artificial intelligence and cognitive science* go, here are a few milestones:

1. 1960s - Blocks World – A very limited, **"artificial "world"** which has a set of behaviors.

2. 1972 – Mycin -antibiotic dosage **expert system**, logic in a large but limited domain.

3. 1997 IBM Deep Blue vs. Garry Kasparov – **Game theory** beating the best humans, using deep analytical techniques in a narrow but complex domain of knowledge

4. 2011 - IBM Watson and Jeopardy - **Artificial Intelligence in a broad domain.** Understanding associations, multiple contexts, rich human language (puns, metaphors, indirect speech) and responding in real time.

   See this: https://www.youtube.com/watch?v=C5Xnxjq63Zg

Setting the Scene – Artificial Intelligence Today

Several relatively recent innovations *together* make the promise deeper artificial intelligence more likely.

1. **Overcoming absolute truth** – Intelligence is not just logic. It is also interpretation, reasoned guesses, and associations. Today we may focus on creating systems with "good enough" responses to complex questions and situations, rather than failing to provide perfectly and exact answers to ambiguous situations.

2. **The low cost of computing power** – It takes huge amounts of computing power to do even a little bit of what the human brain does. It is only in the last 5-10 years that this much power has been economically available.

3. **Cloud and Distributed computing** – The ability to provide computing power instantly from anywhere in the world.

4. **The ability to manage and process Big Data** - Making complex decisions (e.g. stock trading in real time) takes enormous amounts of data and today that data must be "understood" and processed very quickly.

5. **The ability to manage and process UNSTRUCTURED data** –For example, texting, tweets, pictures, and emails. Unlike a bank account number and pin, this data is highly variable. The ability for computers to find *value* in this data is only recent and the ability to find rich value In such data is *very* recent.

6. **The Internet** – Years ago, the ability to "mash up" this data, available from large computer systems, in the cloud, was restricted to big corporations, the government and universities. Today, it is at *your* fingertips.

7. **Mobile Devices** – Years ago, the ability to access this data would require a land line and special skills. Today, *you* can get it on devices that cost a few dollars and a four year old can access it on a plane, anywhere, anytime.

Summary of the Overview of Artificial Intelligence

- Due to the innovations described above, we are on the edge of something new, something I cannot predict.
- I think it will change much of what we do, like the internet has changed what we do.
- I think it will have great benefits and value.
- I think it could also create a lot of problems.
- We at IBM are trying to help the world get the value and limit the problems. I will talk more about that later.

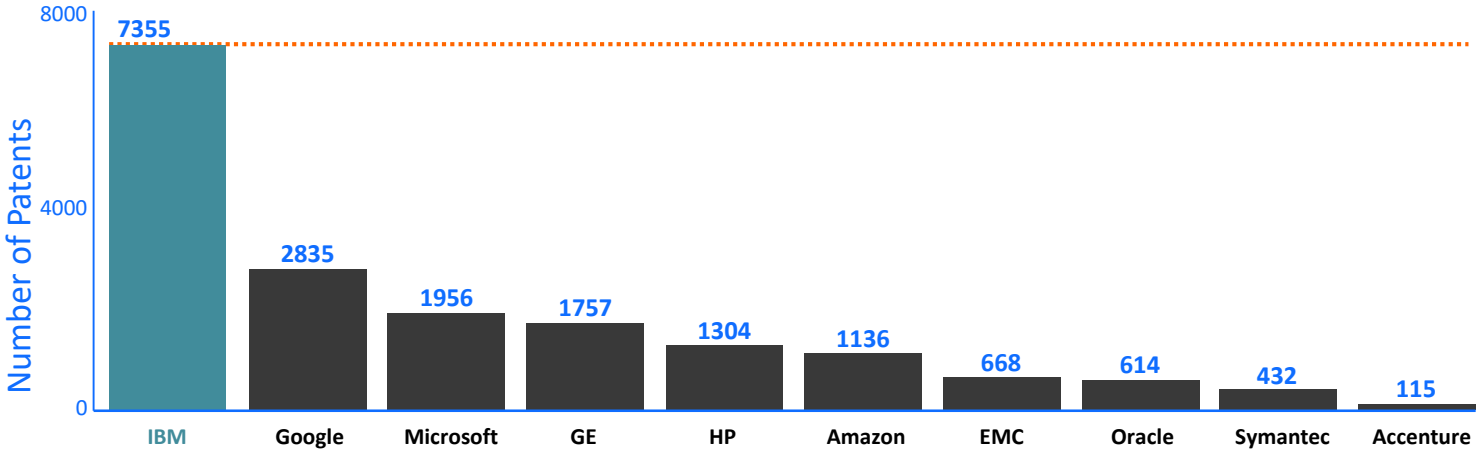
Questions / Discussion?

IBM Watson

Watson is the Child of IBM Research

- IBM Research is a major source of innovation at IBM and for the world
- IBM Research has been established for more than 70 years
- 2017: 3000 researchers and scientists at 12 global labs on 6 continents
- 2017: 6 Nobel prizes; 10 national medals of technology; 5 national medals of science; 6 Turing awards.

2016



IBM – MIT Partnership

Sep 6, 2017

IBM launched a 10-year, $240 million investment to create the MIT–IBM Watson AI Lab in partnership with MIT, where fundamental AI research will be conducted to unlock the potential of AI.

MIT is one of the earliest and strongest centers for AI research.

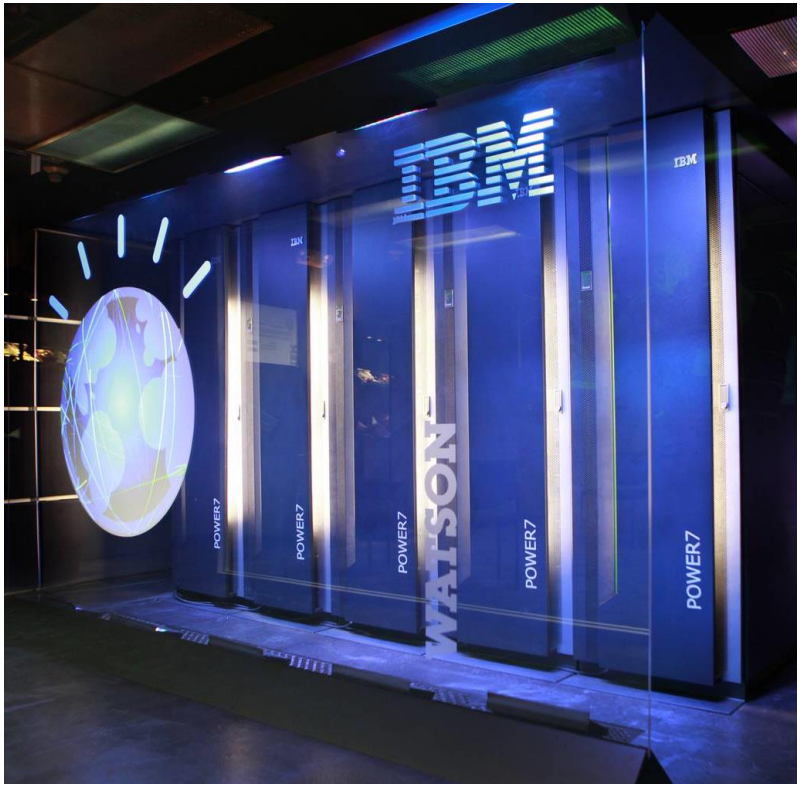
See http://ibm.biz/mit-ibm-watson-ai-lab

What is Watson?

Watson is a large scale computing environment consisting of both hardware and software, over a 1000 cognitive technology algorithms, housed at IBM, in a secure cloud.

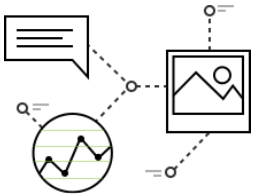
Watson is used to create cognitive systems able to understand, answer, predict and make recommendations for chosen domains.

Watson uses sophisticated natural language, reasoning, machine learning and knowledge representation technologies. In specific domains, Watson can interact in much the same way as humans



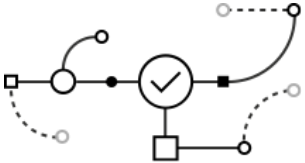
Watson can greatly enhance human experience

understand.



Cognitive systems understand imagery, language and other unstructured data like humans do.

reason.



They can reason, grasp underlying concepts, form hypotheses, and infer and extract ideas.

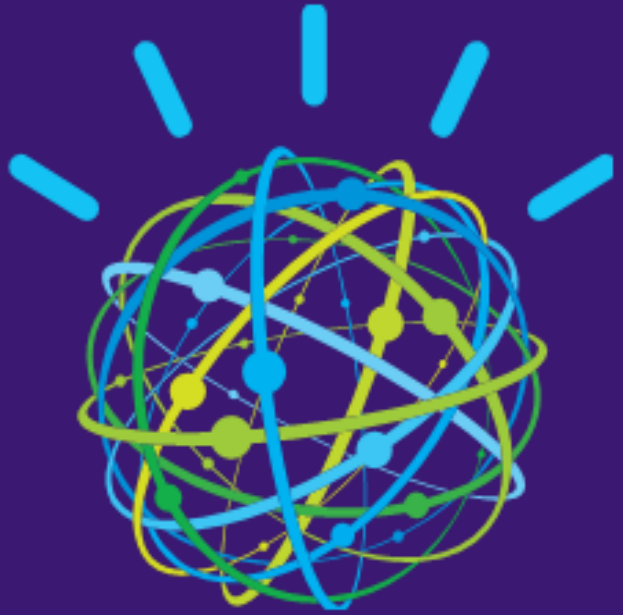
learn.

With each data point, interaction and outcome, they develop and sharpen expertise, so they never stop learning.

interact.

With abilities to see, talk and hear, cognitive systems interact with humans in a natural way.

Watson – How it Works



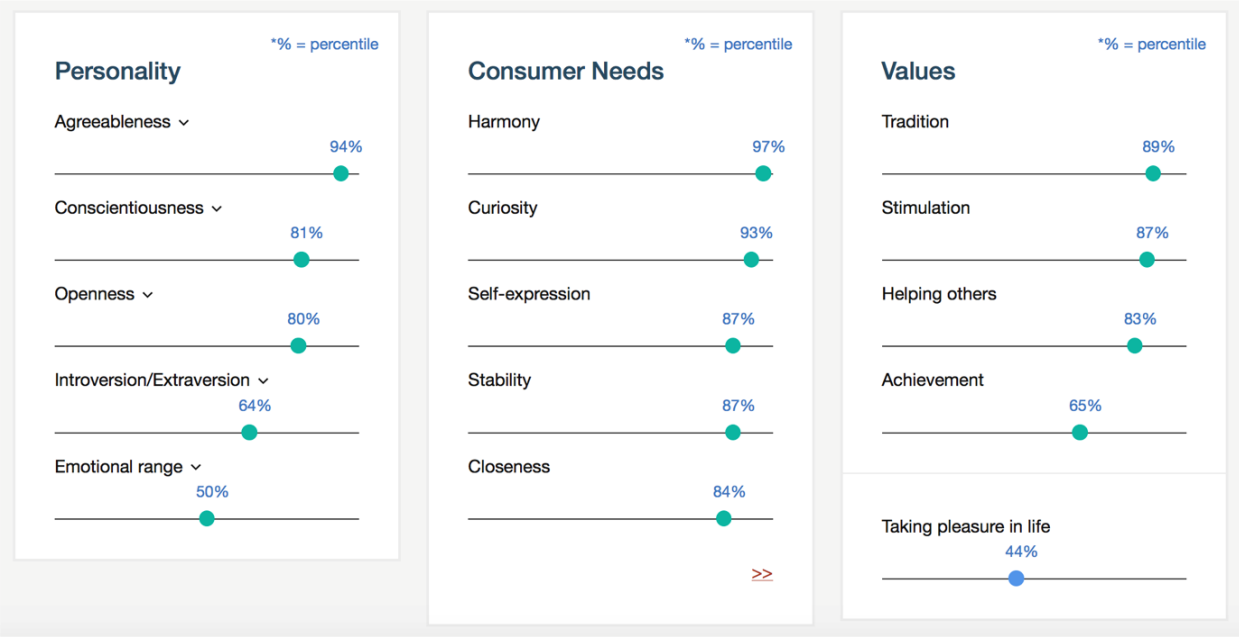
Some Other Interesting Watson Videos

- A World with Watson (2 minutes)
- How Watson Works video (8 minutes)
- How Watson answers a question (7 Minutes)
- Watson Personality Insights (2 minutes)
- Watson and Social Media (2 minutes)
- An example Watson API - Tradeoff Analytics (3 minutes)

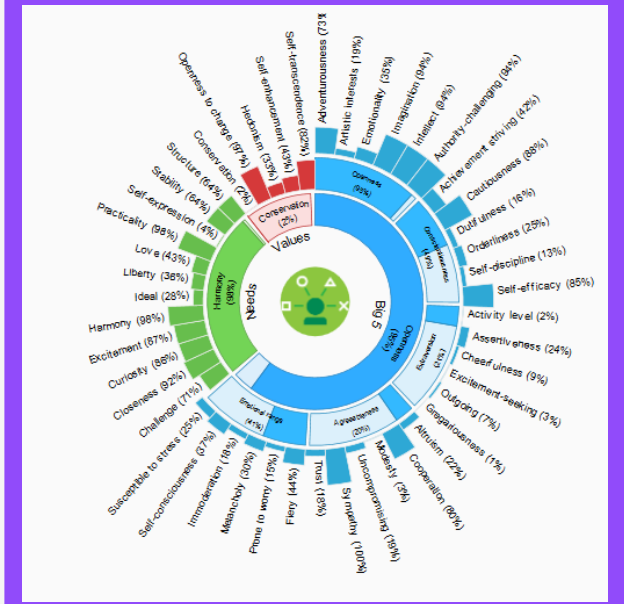
Watson Technologies and Industry Solutions

Watson Personality Insights

IBM Watson personality insight–Oprah



https://personality-insights-livedemo.mybluemix.net/

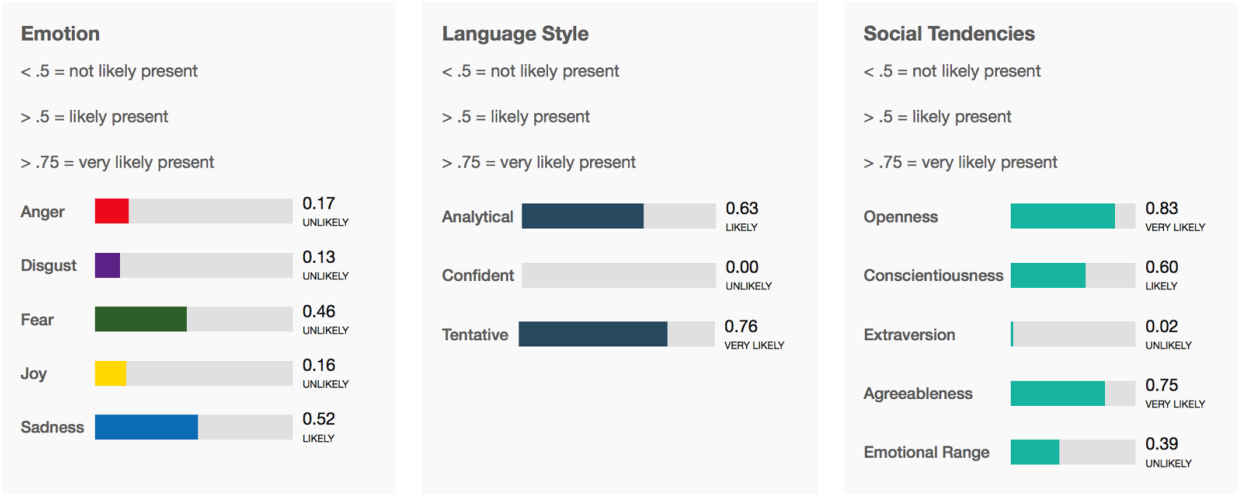


Try it yourself:

https://personality-insights-livedemo.mybluemix.net/

Watson Tone Analyzer

IBM Watson tone analyzer–Socrates final speech



https://tone-analyzer-demo.mybluemix.net/?cm_mc_uid=11507491530614868386987&cm_mc_sid_50200000=1486838698

Try it yourself:

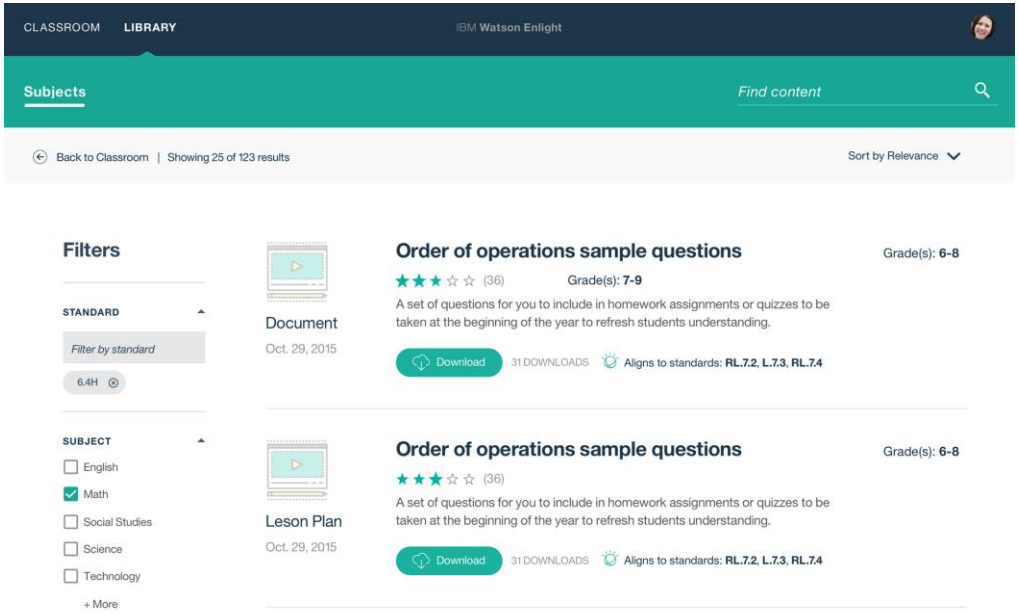
https://tone-analyzer-demo.mybluemix.net/

Watson Content Library Using Watson Discovery Services

70%

of Learning Professionals state that a lack of Content Discoverability prevents true Learning Transformation.

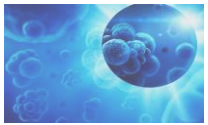
- Aligning content to standards
- Extracting keywords / metadata
- Assessing text readability
- Supporting a variety of formats
- System is trained through content



Watson Health

Watson Health

Leveraging the Cloud and Cognitive Platform



Oncology & Genomics

Government

Life Sciences

Value-Based Care

Imaging

100M+ patient records	**30B+** images managed	**5M+** genomic alterations	**200M+** lives	**2B+** social determinant data points	**4M+** drug patents	**40M+** research documents

Patient Similarity | Deep Learning | Sequence Learning | Natural Language Processing | Domain-specific Annotation/Curation

HIPAA enabled | GxP enabled | Purpose-built for health data | End-to-end security | Within a QMS

5

Medical researchers use Watson Health to make decisions from a repository of over 23 million articles, updated daily.

Watson Technology and Industry Videos

- Watson in Health - helping fight cancer (3 minutes)
- Watson in Global Finance (4 minutes)
- Decision support in the Energy Industry (2 minutes)
- Watson in Agriculture (2 minutes)

IBM Watson in Education

IBM – In Education Since the 1950s

2011

Smarter Cities® Challenge grants announced

2013

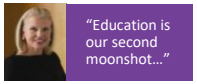
Watson division created

2014

Strategic partnership with Apple

Digital environment for adaptive learning

2016



Watson Education: A new business unit focused on life-long learning

IBM and Sesame Street create a strategic partnership

2017

IBM Foundations releases Teacher Advisor

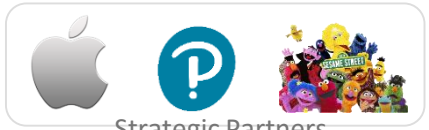
First Watson Classroom customer: Coppell ISD

IBM & Sesame Street prototype Early Language Learning at Gwinnett, GA

IBM and ESC10 partnership

IBM Watson Classroom is in nine States

Watson Education Platform



Strategic Partners

Offerings

Watson Classroom
Teacher Mediated Personalized Learning

Watson Tutor
1:1 tutoring at scale

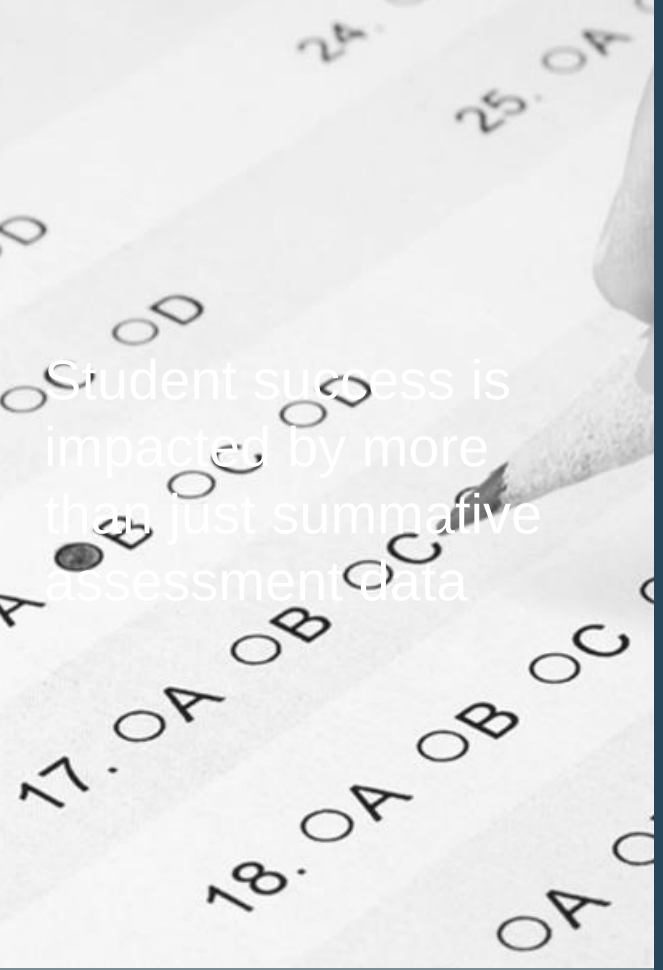
Education AI Services

- Pedagogical Model
- Cognitive Learning Library
- Master Student View/Lifelong Learner Record
- Mastery Analytics
- Question Recommender
- Short Answer Scoring
- Learner Model
- Domain Model
- ...

General AI Services

- Conversation
- Speech
- Vision
- Tone Analyzer
- Personality Insight
- ...

IBM Cloud



Student success is impacted by more than just summative assessment data

Role model presence in the home

Living conditions and situations

Social services and health status

Nutrition and quality of food

Environmental factors

Language and cultural factors

#WatsonEdu

If we can integrate the silos of data and content, we can provide actionable insights that drive an optimized learning experience.

Know Me

Update student profile on the go from learner inputs, advisor meetings and an ever growing set of data points.

Guide Me

Suggest options for student to execute on current goals & increase engagement with learning.

Help Me

Collaborate with the student to develop goals around academic & social integration

IBM Blockchain Technologies for Education

Blockchain is a set of technologies that provides:

1. A de-centralized (distributed database) ***shared*** ledger history (chain) and record of ownership of something of value (e.g. a land deed, a college degree),
2. With the ability for *authorized* entities to update (add a block to the chain) but they *cannot* change the history.
3. The blockchain blocks (records) are certified by an appropriate organization (e.g. trust company, college) through
4. "smart contracts" and "policies" to manage conditional actions (e.g. student grant funding based on degree status)
5. Blockchains have a high capability of detecting any attempts at fraud.

SHARED LEDGER

Distributed system of record shared across business network

PERMISSIONING

Ensuring appropriate visibility; transactions are secure & authenticated

SMART CONTRACT

Business terms embedded in database & executed with transactions

CONSENSUS

Transactions are endorsed by relevant participants

IBM Blockchain can help students, colleges and employers manage credentials more effectively than traditional systems

Reducing Costs
Verifying credentials is inefficient and costly, while assessing and qualifying prior work for new education programs is very costly

Trust and Fraud
Employers report that 20% of applicant degree credentials are not accurate

Regulatory Requirements
Multiple professions require licensing and ongoing credentialing by state or national authorities (e.g. lawyers, doctors, nurses, teachers, etc.)

Pathways to Employment
Improving the exchange of credits for prior learning provides better pathways to new skills

Empowered Learners
A blockchain skill record will be pervasive in the future and will enable self-sovereign data management and learning progress

For an overview of IBM Blockchain click the icon to see the video

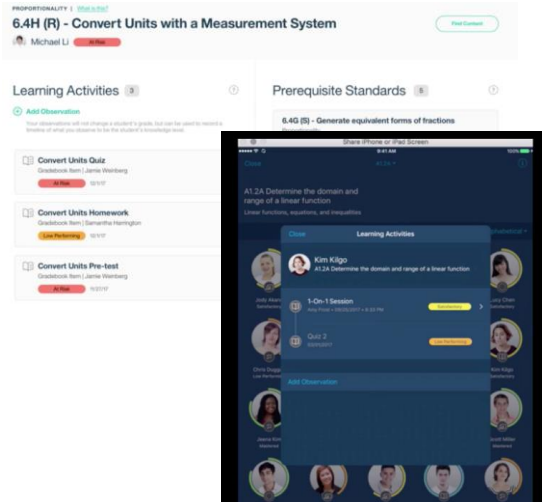
Watson Education – A Journey Supporting Lifelong Learning

Wordplay Early Learning

- Tackling the 30M word gap for young learners
- Built in collaboration with Sesame Workshop

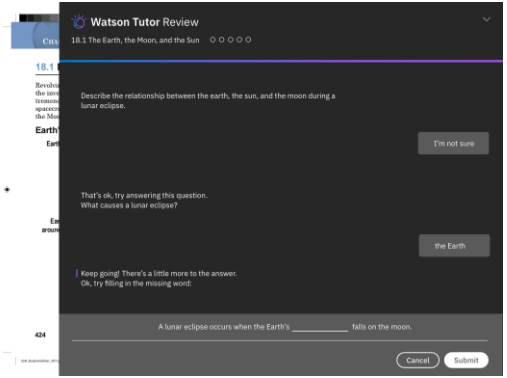
Watson Classroom

- Transforming the way teachers, principals, administrators, students and parents work together



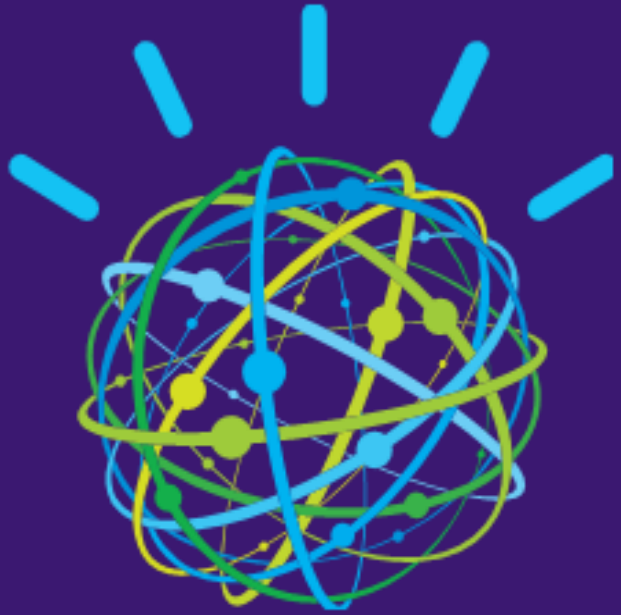
Intelligent Tutor

Transforming the learning experience for the college student with cognitive technologies, in collaboration with Pearson

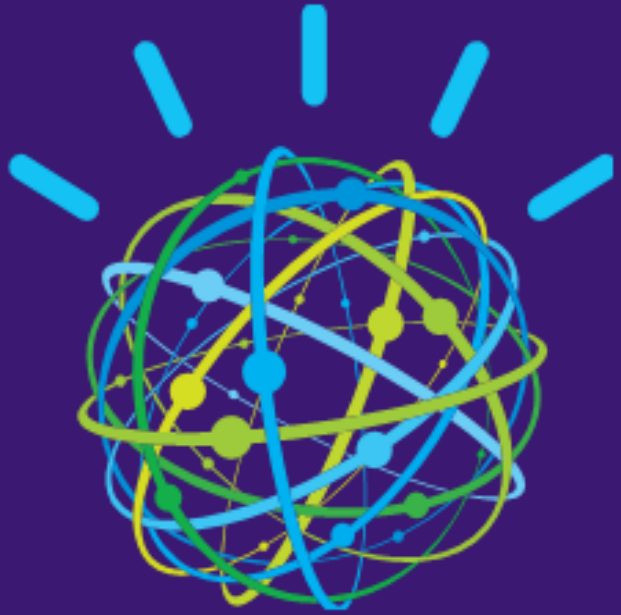


Wordplay

The IBM - Sesame Workshop Collaboration for Early Language Acquisition

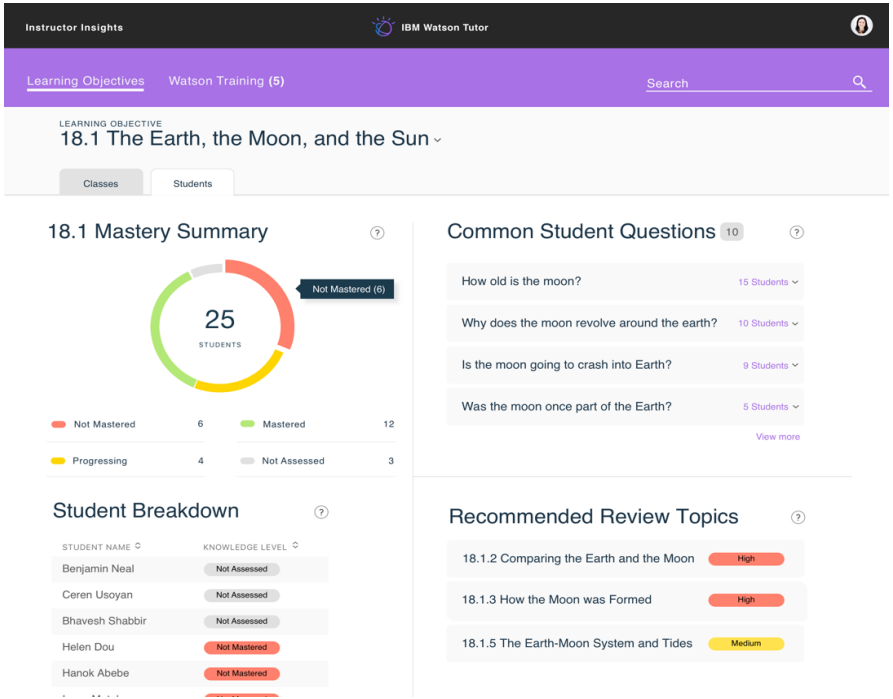


Watson Tutor - Pearson Revel powered by IBM Watson
Higher Education Personalized Online Course Tutoring

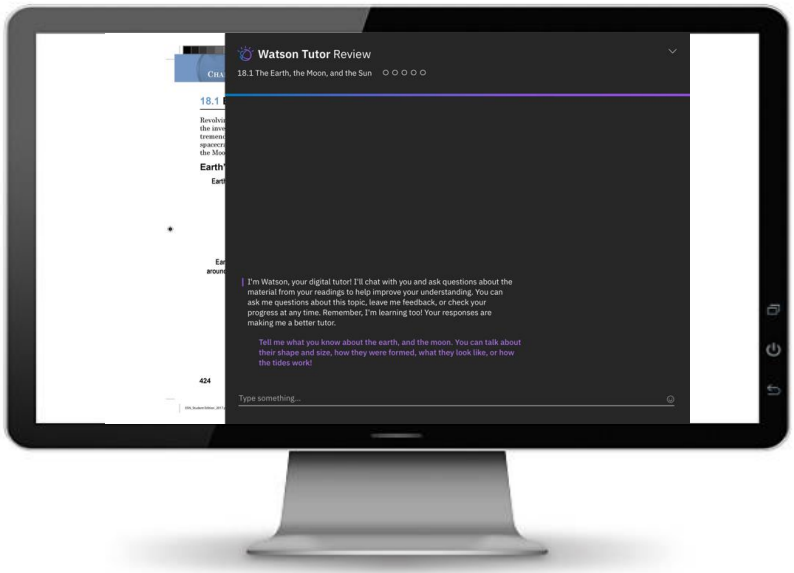


Watson Tutor

Instructor View



Student View



Watson Tutor – Value

Value for Students

- Always available tutoring support
- Improve mastery of course material
- Personalized natural language dialog
- Easy access to relevant content

Value for Instructors

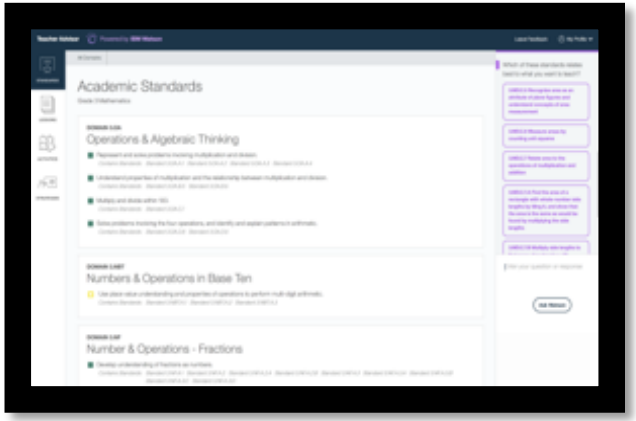
- Insight into student and class mastery
- Personalized student support at-scale
- Identify common student questions
- Identify areas for further review

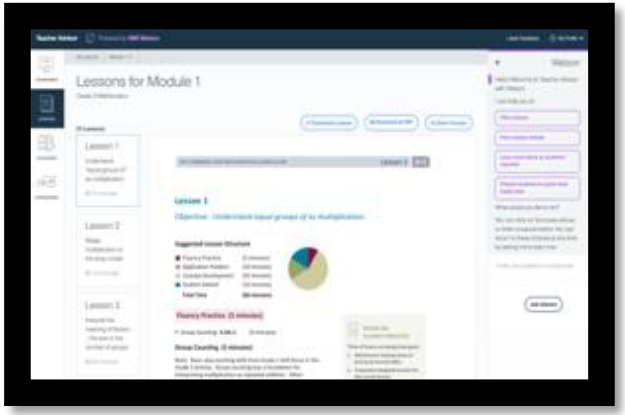
Value for Institution

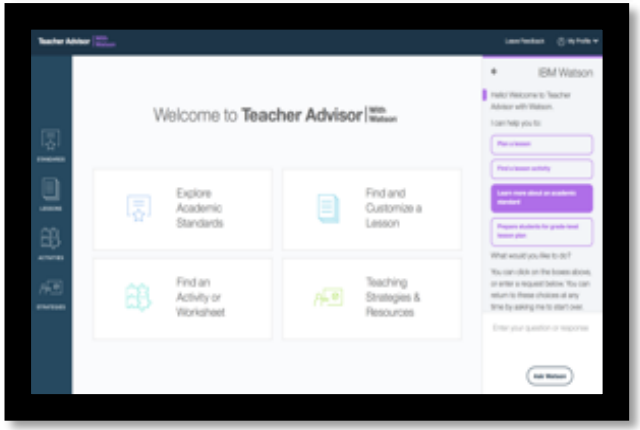
- Solution that scales across campuses and products
- Reduce costs for TAs and tutors
- Improve student learning outcomes
- AI leadership with IBM Watson

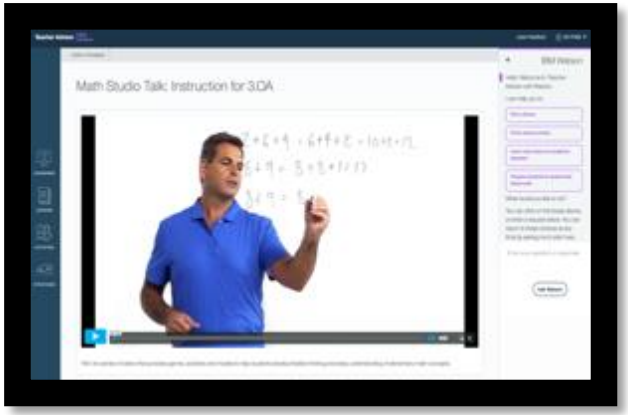
Teacher Advisor - A K12 Watson Philanthropic Free Resource for Teachers

Access lessons, strategies and professional development resources.









IBM Watson Classroom Edition

Personalized learning for the whole student

Educators interact with students, noting both evidence of learning and social insights that can be shared by peer educators

Tracks each individual student achievement using established learning progressions

Analyzes learning content to provide educators with personalized content recommendations

IBM Watson Classroom Edition

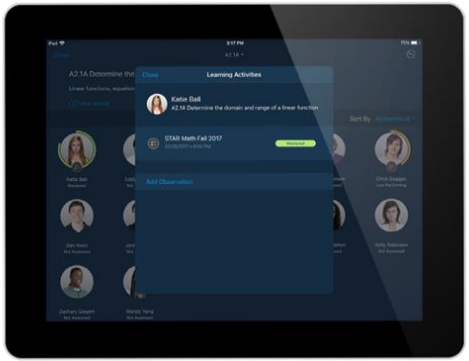
Changing the way educators engage with their students

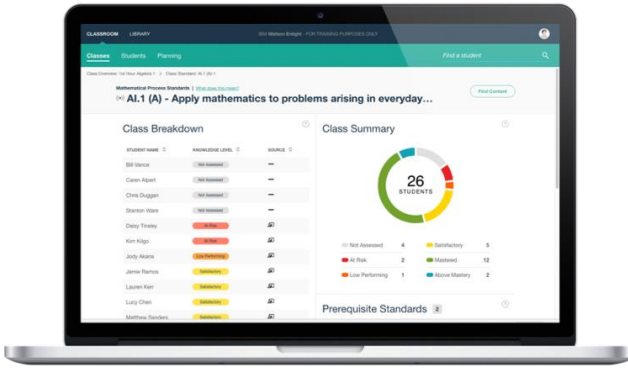
- Integrates key source systems data.
- Provides teachers with a simple easy view of the data in the way they want to see it and can use it. Providing insights that are directly pertinent to the teachers needs for both students and the classroom.
- Incorporates state learning standards and district learning progressions to provide specific, real-time information on individual student achievement and gaps.
- Integration of state-aligned learning content and recommendations for content specifically applicable to the individual student's gaps, learning styles and interests.
- Support for creating units aligned to objectives and for gathering evidence of learning for those units and objectives.
- Documenting the structure of the curriculum — courses, instructional units and learning standards

IBM Watson Classroom **Enlight** and **Element**

Element - An **in-class** tool for educators:

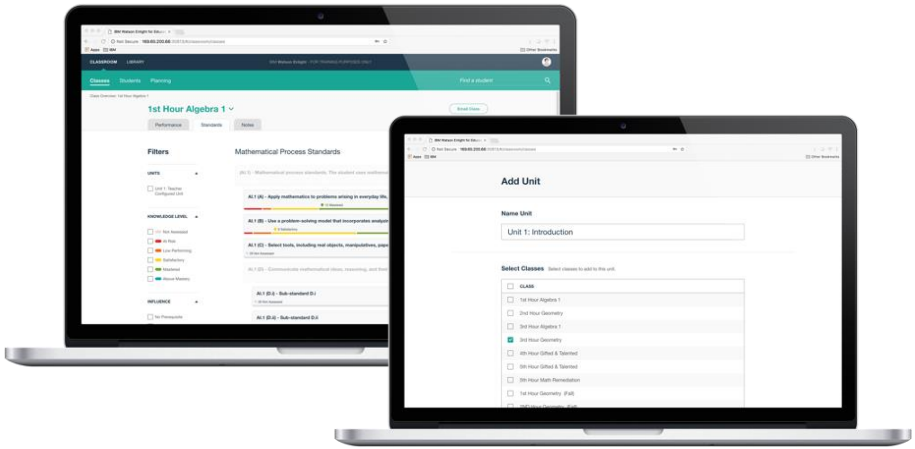
- Integrates multiple source systems (SIS, Gradebook and others)
- through a simple interface,
- providing 360 degree insights for each individual student and
- helps the educator to quickly document observations and evidence of learning and
- easily share that information with the student's other teachers and the parents





Enlight - An educator planning tool:

- Uses deep analytics to understand class and individual student progress.
- Allows you to review and plan instruction tailored to individual student needs.
- Helps align content to learning progressions.
- Gives you the tools to communicate with other teachers, staff and parents**.**



Changing the way educators engage with their students

District email, chat, video

Social inventory

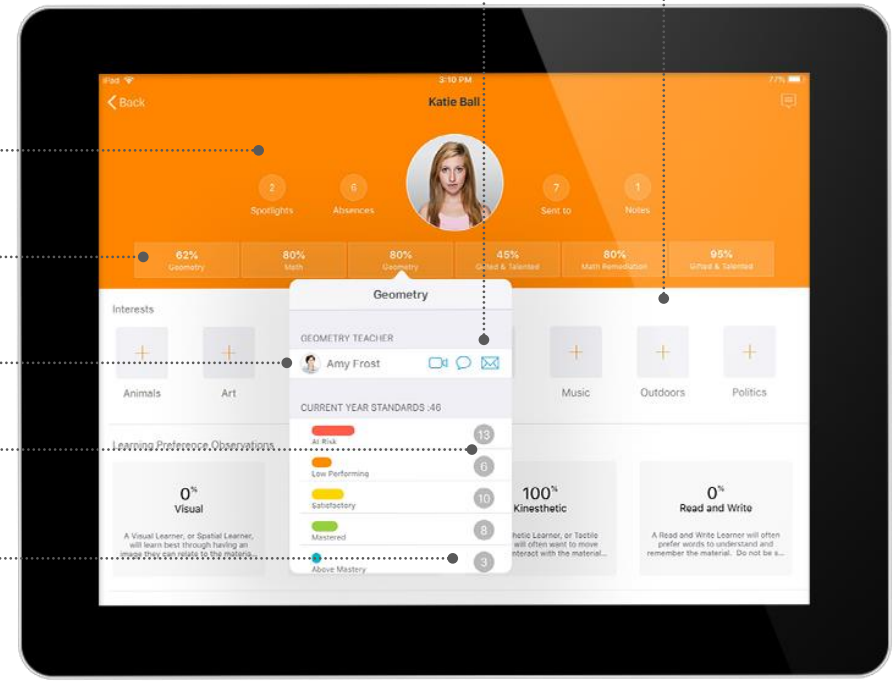
Student information / roster systems

Gradebook system

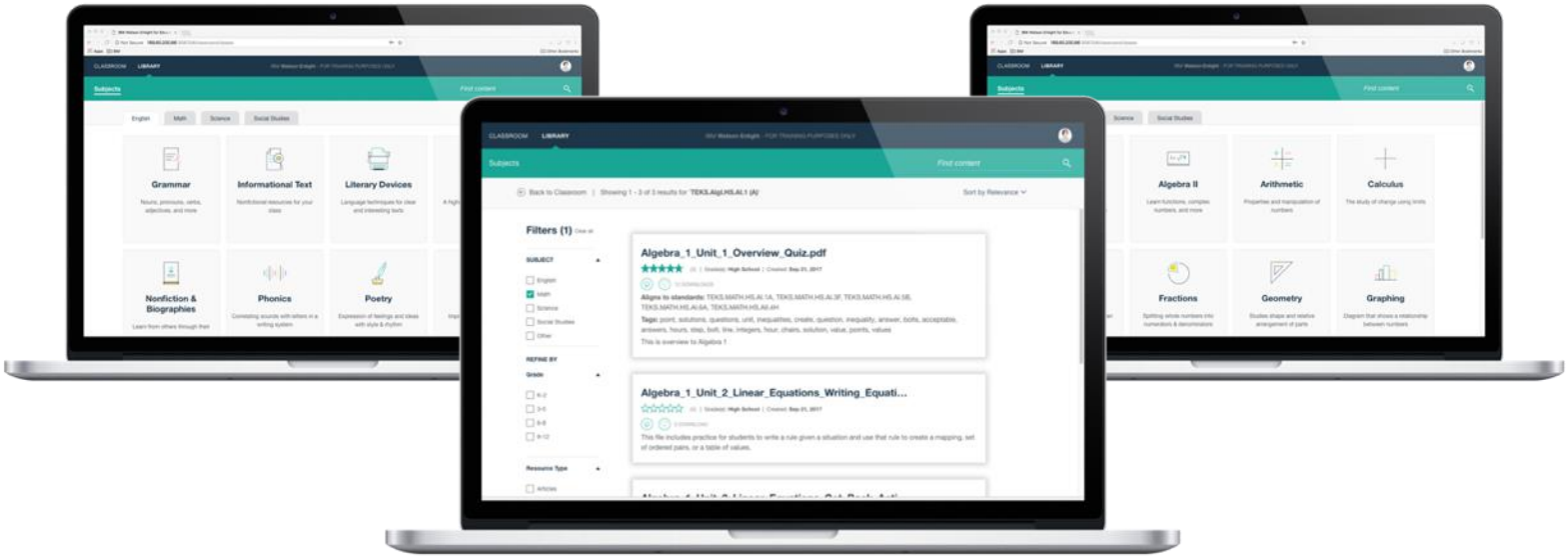
District HR staff system

Assessment system

Learning progressions systems



Aligning learning content to standards and providing personalized recommendations



A Demonstration of Watson Classroom Edition

Watson Education Videos

- IBM Watson Element tool for K12 teachers (5 minutes)
- IBM Watson Intelligent Tutor Sesame Workshop (X minutes)
- IBM Watson Classroom – Element at Coppell ISD in Texas (X minutes)
- IBM Watson – Personalizing Teaching
- Watson Teacher Advisor (3 minutes)
- IBM Watson – Pearson Tutor
- IBM Watson In Education 5 in 5

Questions?