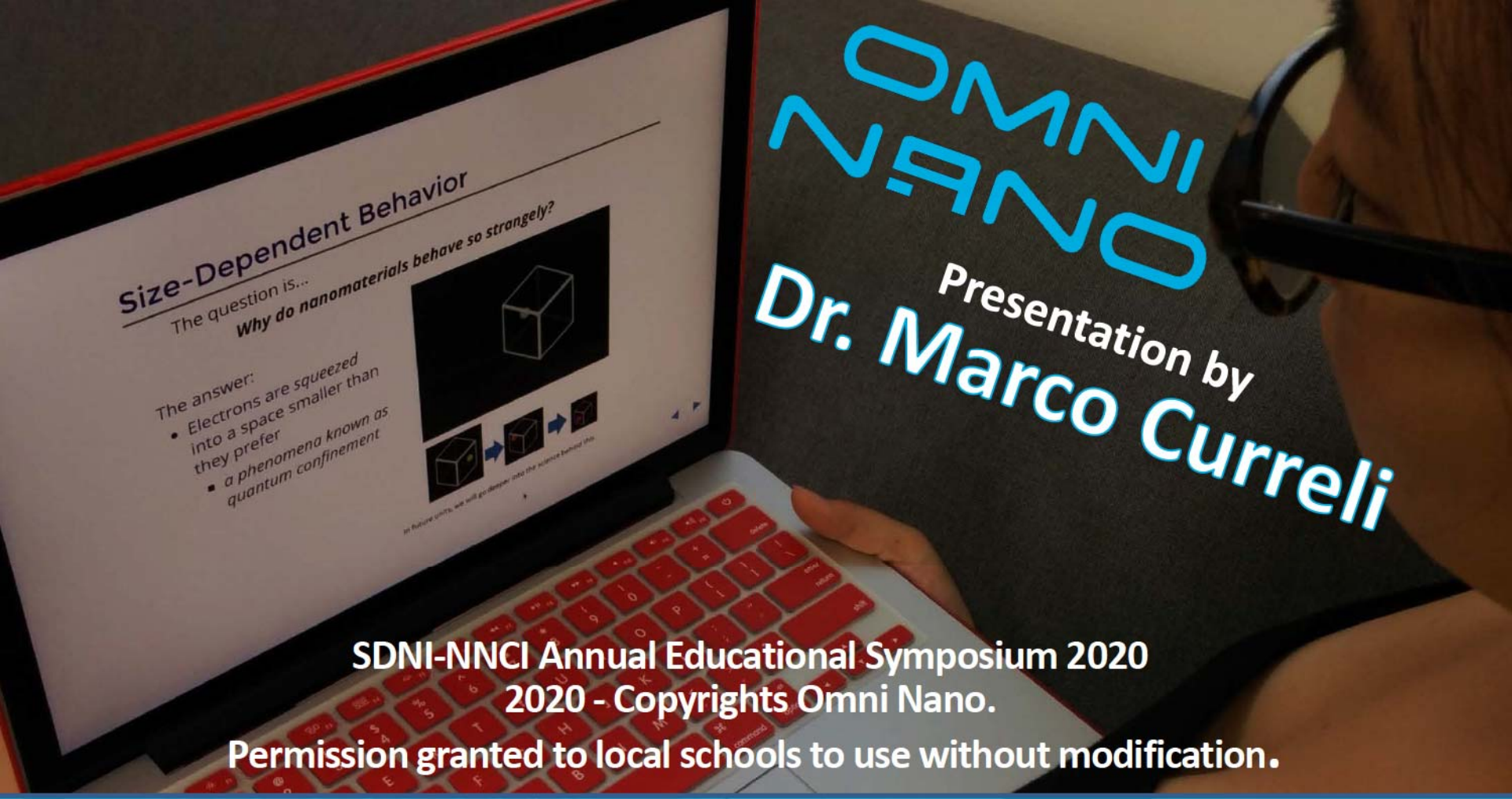


OMNI NANO

Presentation by

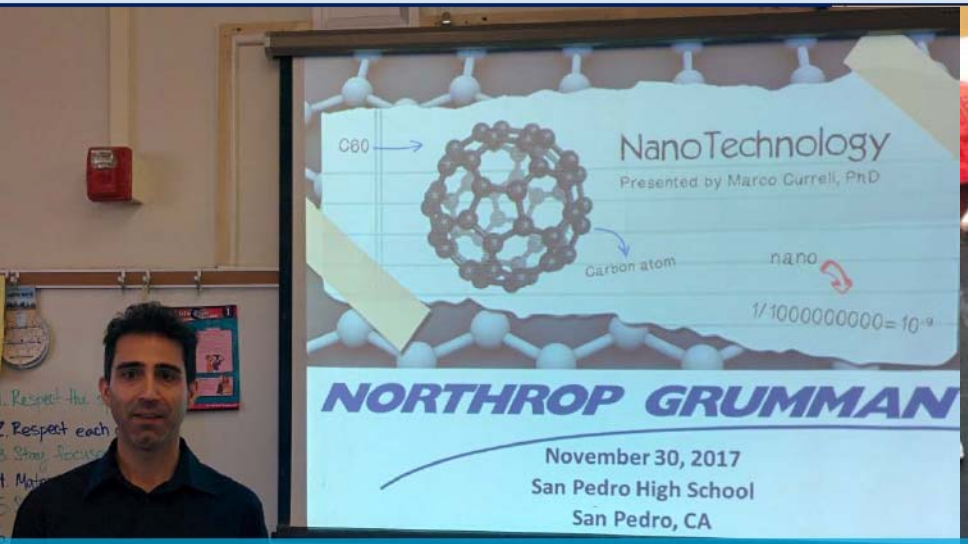
Dr. Marco Curreli

SDNI-NNCI Annual Educational Symposium 2020

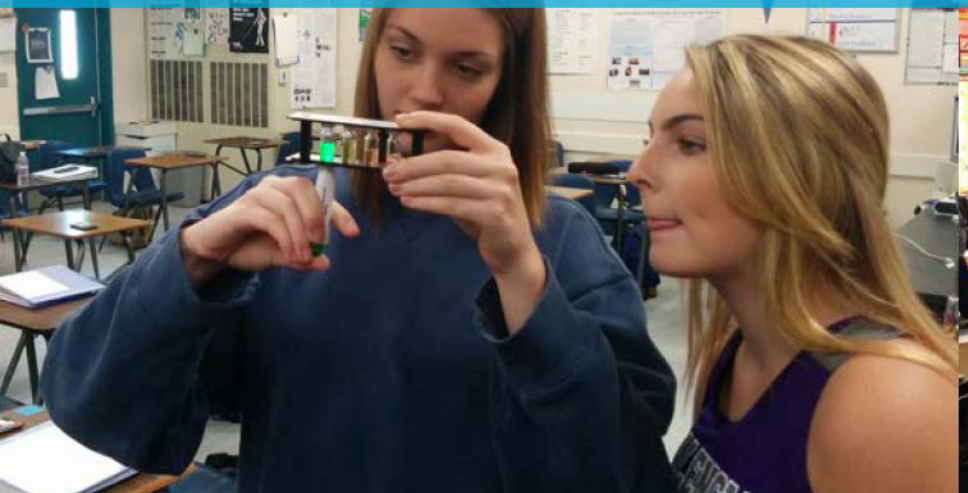
2020 - Copyrights Omni Nano.
Permission granted to local schools to use without modification.

A Digital Curriculum for Global Nanotechnology Education

What does Omni Nano do?

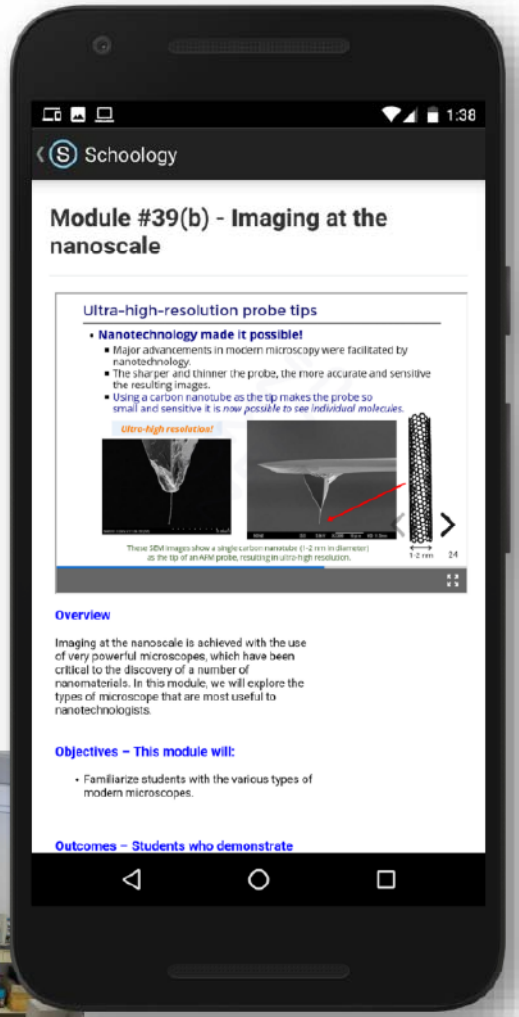


We teach students the science skills they need for the jobs of the future.



About us

- Omni Nano is in the education technology ("**EdTech**") space.
- Not-for-profit, 501(c)(3) organization.
- Developing **digital educational resources** to teach **nanotechnology** at the high school and college levels.



Today's students

Omni Nano's Programs & Resources

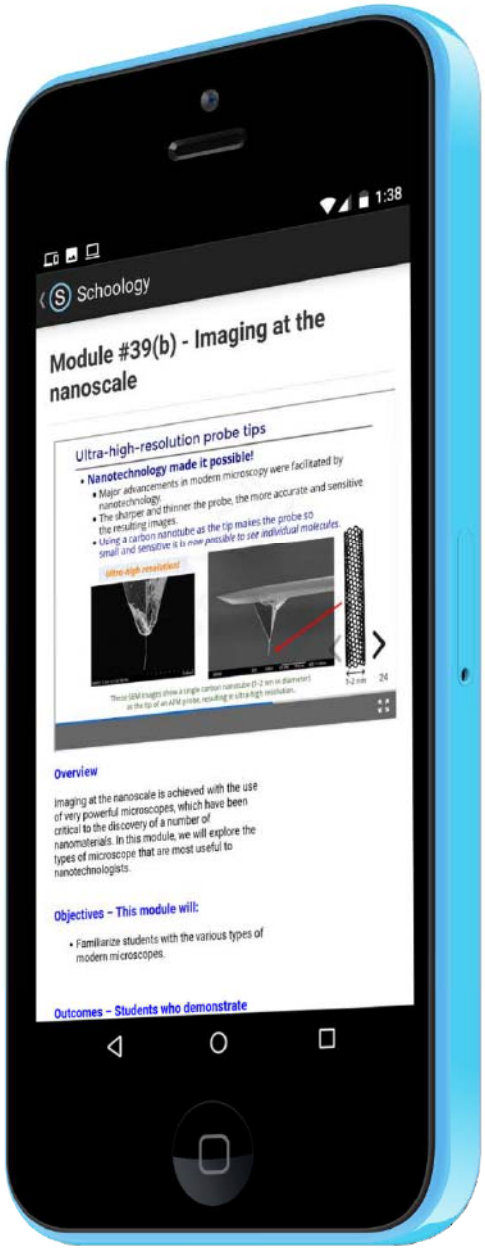
Tomorrow's STEM workforce

Today's students can become tomorrow's STEM workforce with Omni Nano's programs and resources.

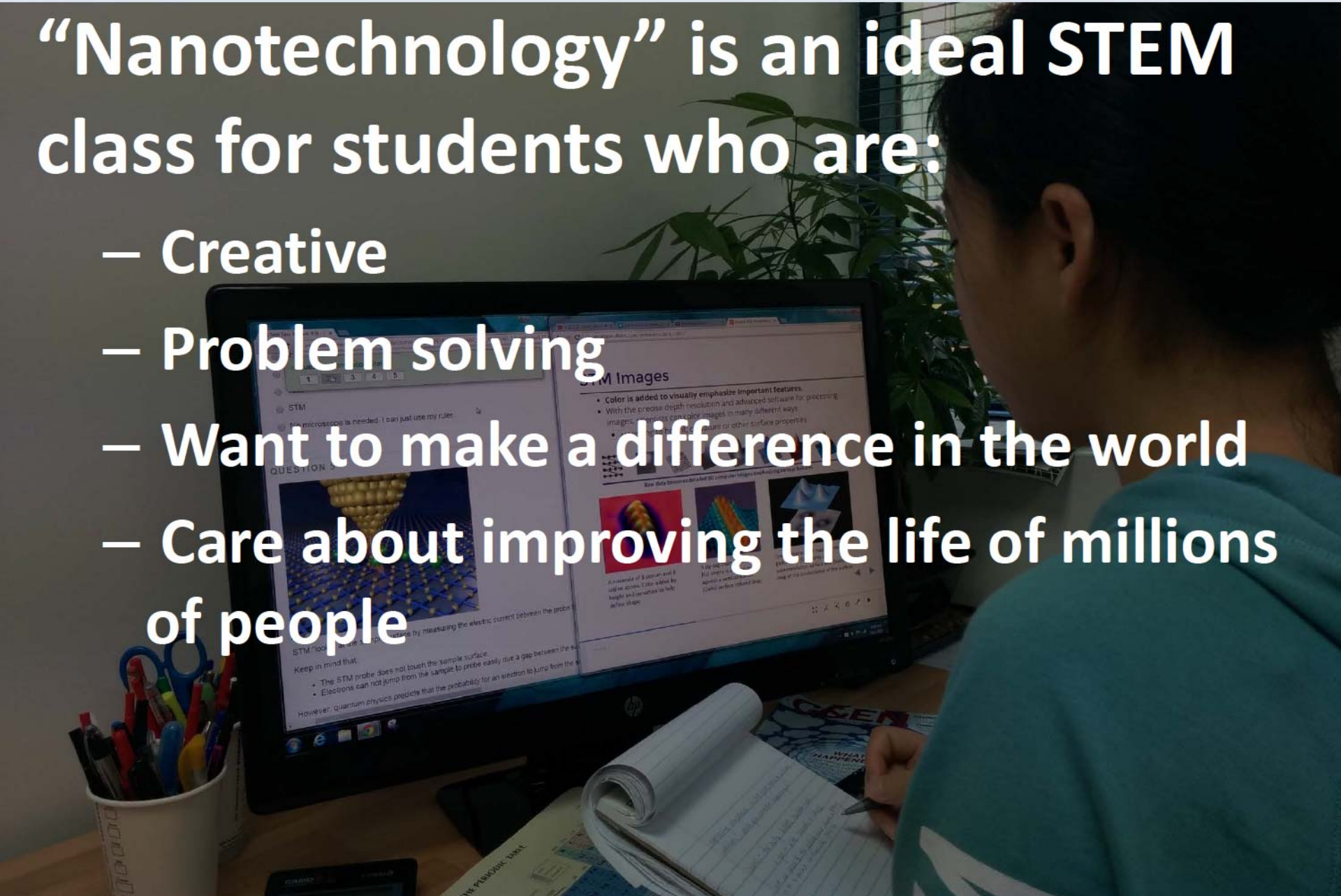
Mission and vision

OUR MISSION is to inspire today's students to become tomorrow's scientists, engineers, and entrepreneurs.

WE ENVISION giving every student in the world the opportunity to learn nanotechnology with a high-quality, curriculum.



Ideal STEM class



"Nanotechnology" is an ideal STEM class for students who are:

- Creative
- Problem solving
- Want to make a difference in the world
- Care about improving the life of millions of people

Curricula for teachers & students

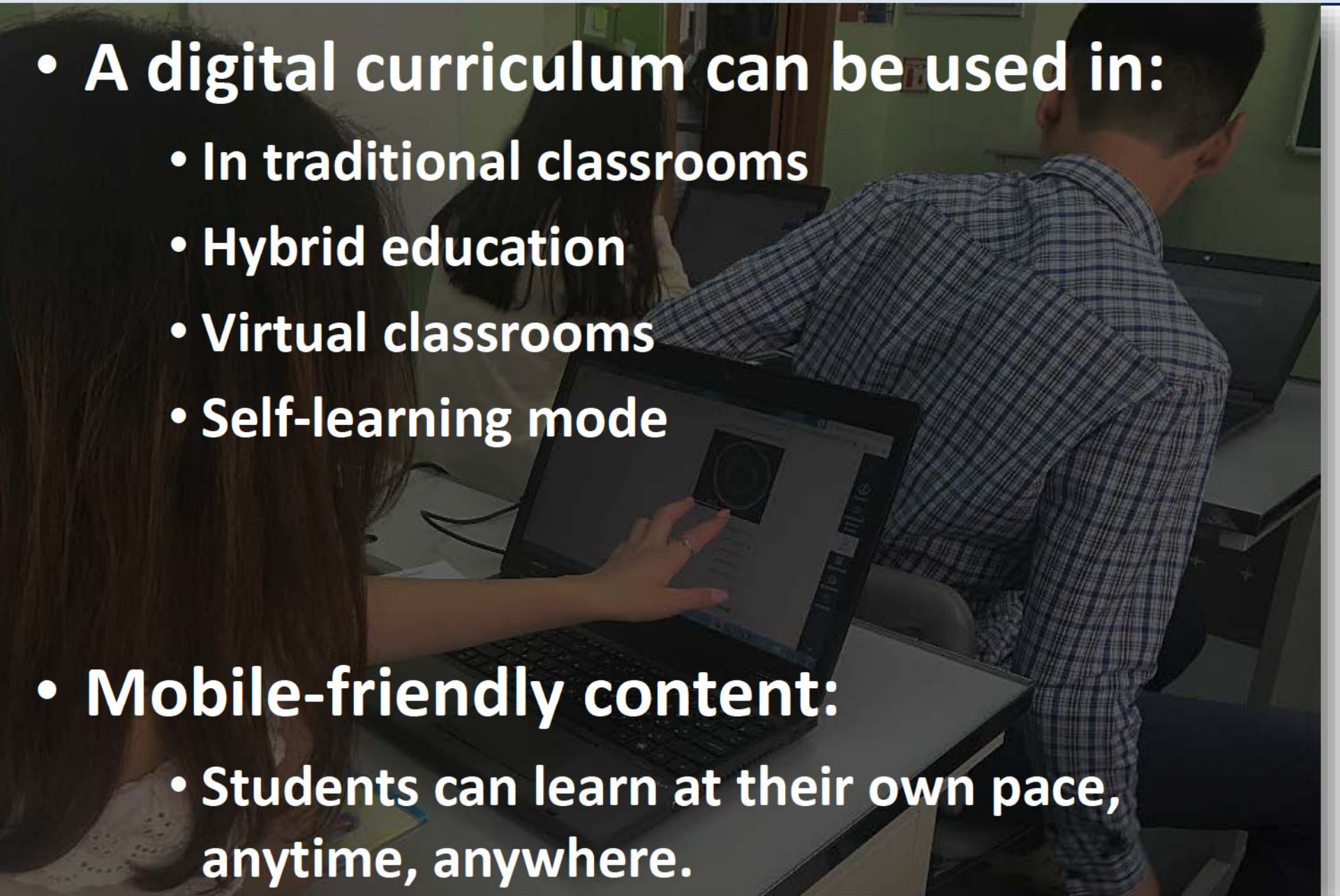
NEEDED

A NANOTECHNOLOGY CURRICULUM THAT IS:

- Comprehensive
- Student-centered
- Teacher-approved
- Fully digital
- Mobile-friendly
- User-friendly

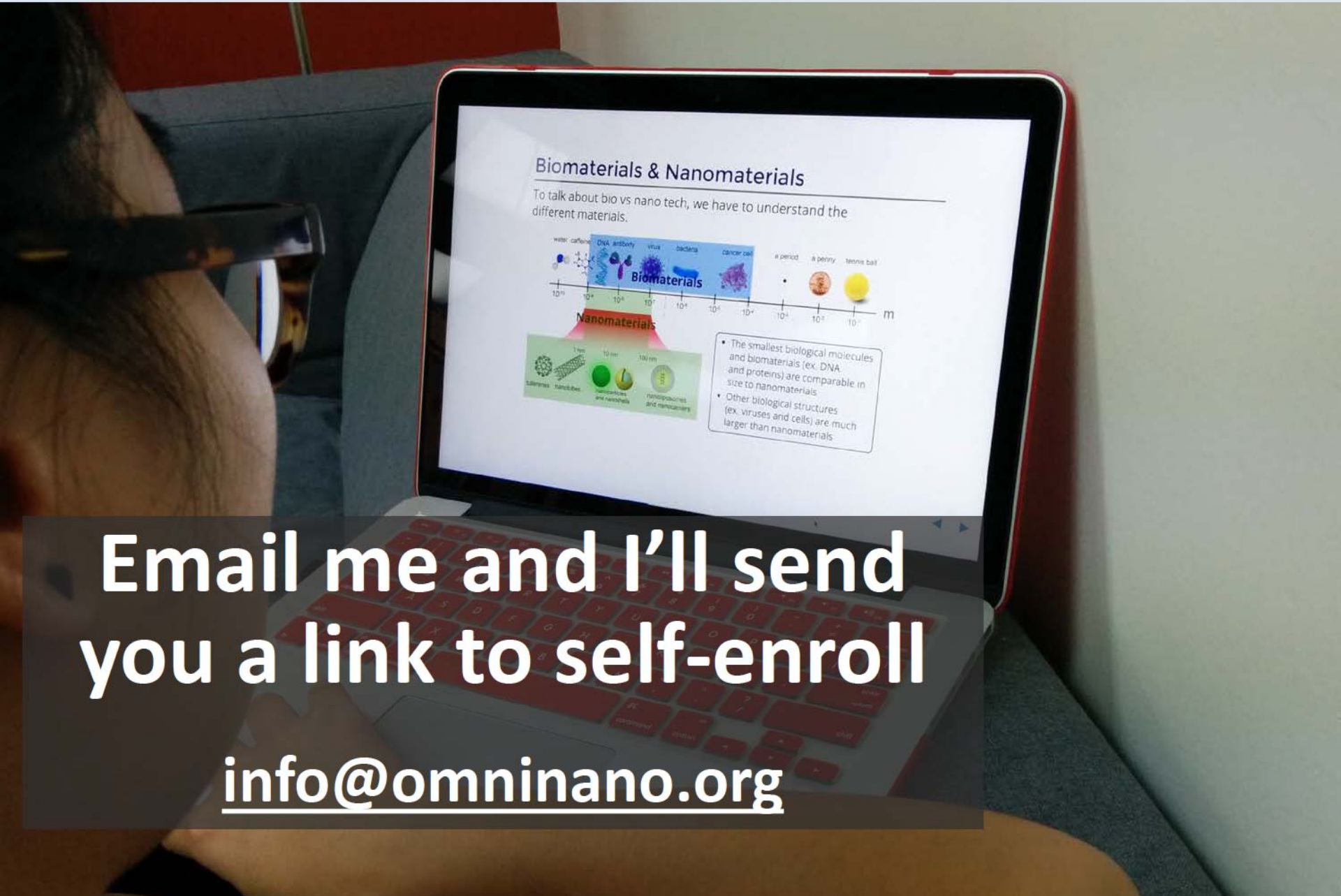
Designed for worldwide distribution

Versatile uses



- A digital curriculum can be used in:
  - In traditional classrooms
  - Hybrid education
  - Virtual classrooms
  - Self-learning mode
- Mobile-friendly content:
  - Students can learn at their own pace, anytime, anywhere.

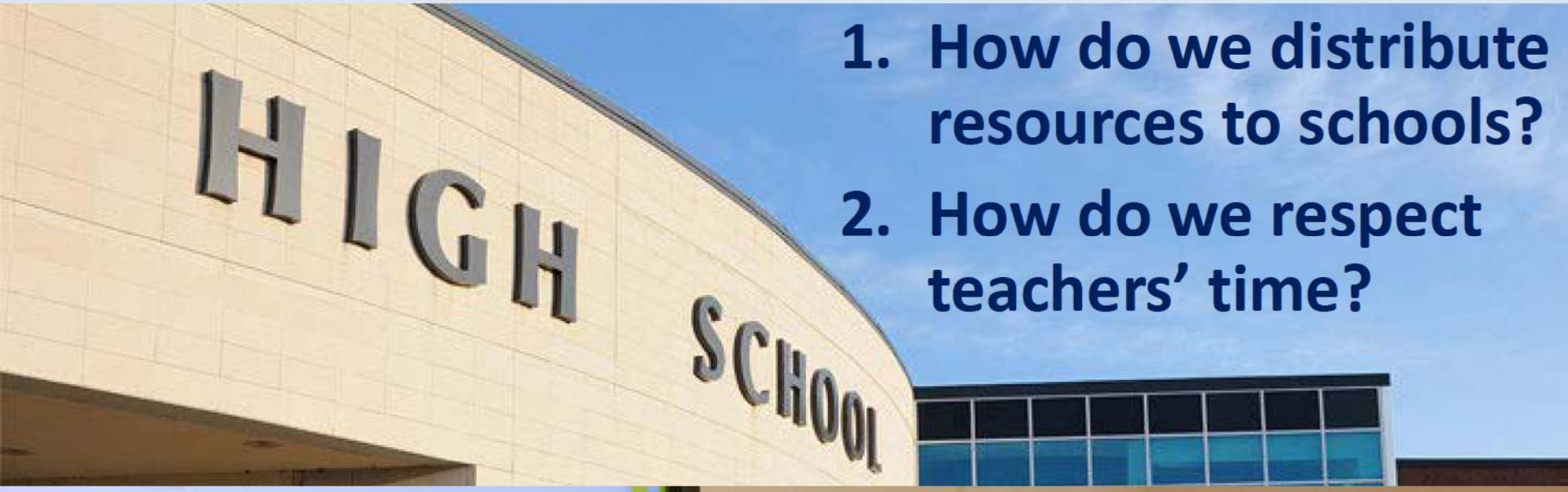
Preview of the digital textbook?



Email me and I'll send you a link to self-enroll

info@omninano.org

Questions that came up

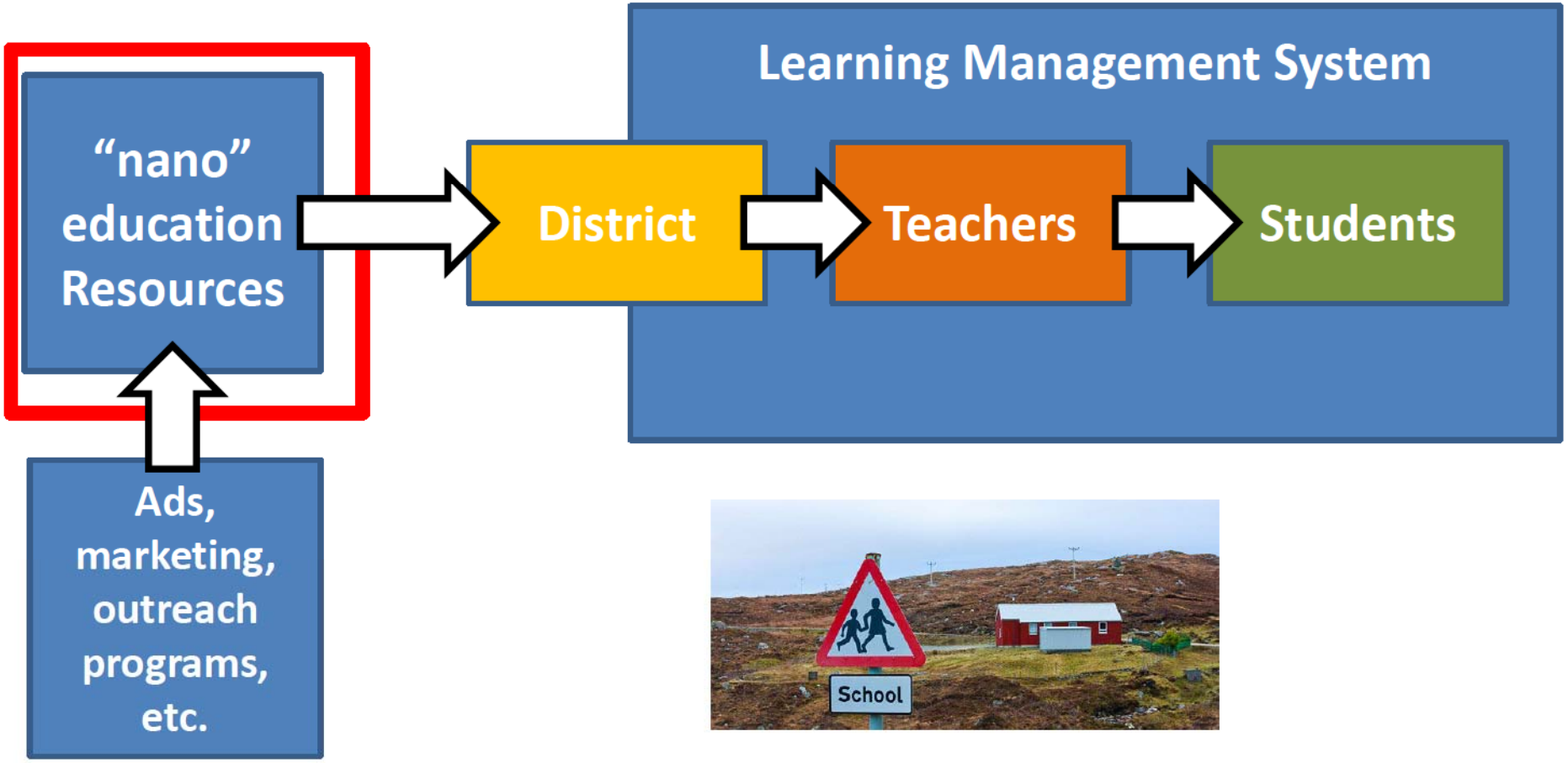


1. **How do we distribute resources to schools?**
2. **How do we respect teachers' time?**

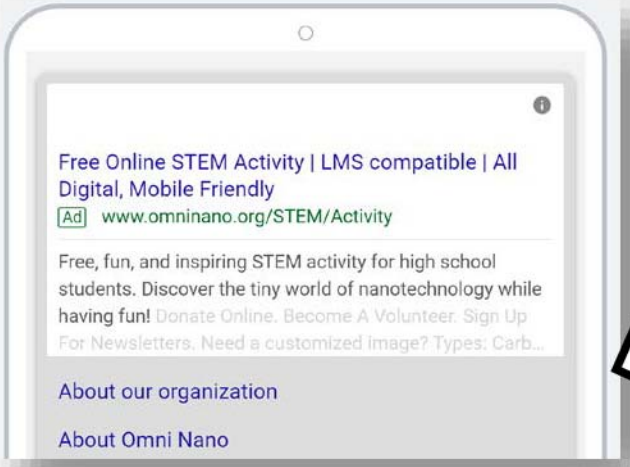
Distribution

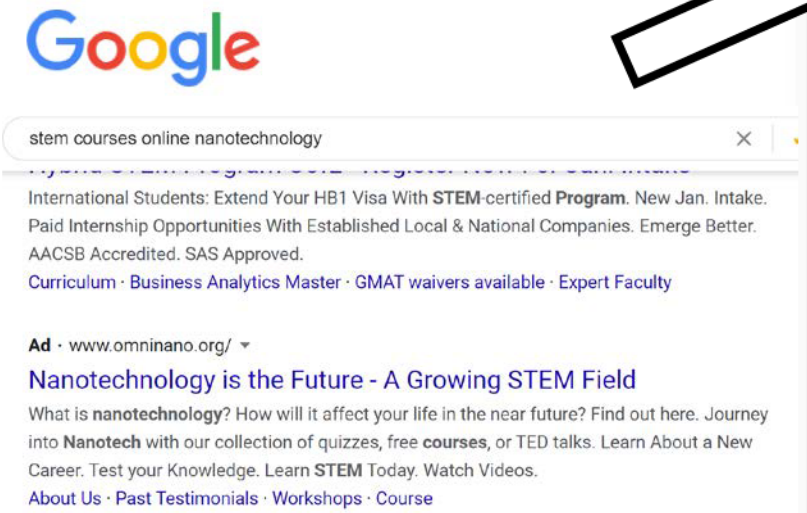
Solving the distribution problem

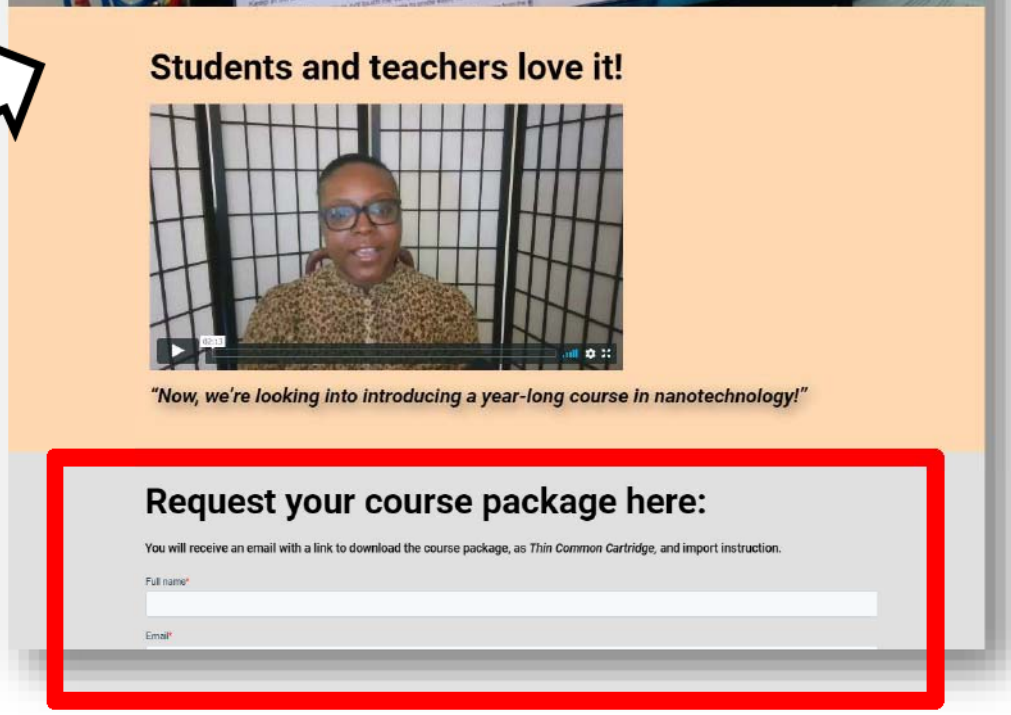
- How can we have “nano” activities or classes in 10,000 schools?



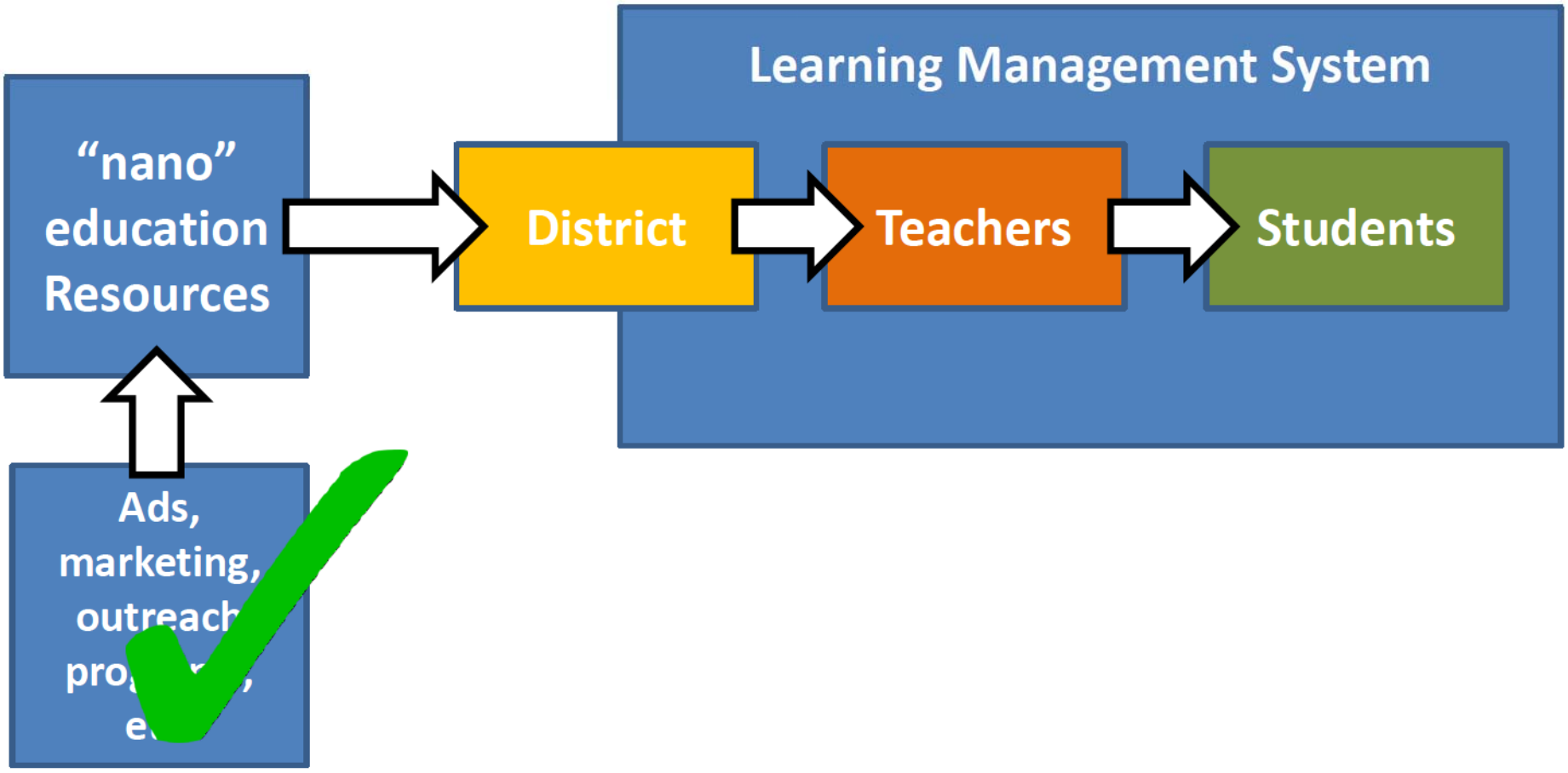
Google Ads & landing page







Solving the distribution problem



Request form

Request your course package here:

You will receive an email with a link to download the course package, as *Thin Common Cartridge,* and import instruction.

Full name*

Email*

".edu" or "business" emails only

Alternative email*

Do you have a "gmail" or a "yahoo" or another address?

What subject do you mainly teach and where?*

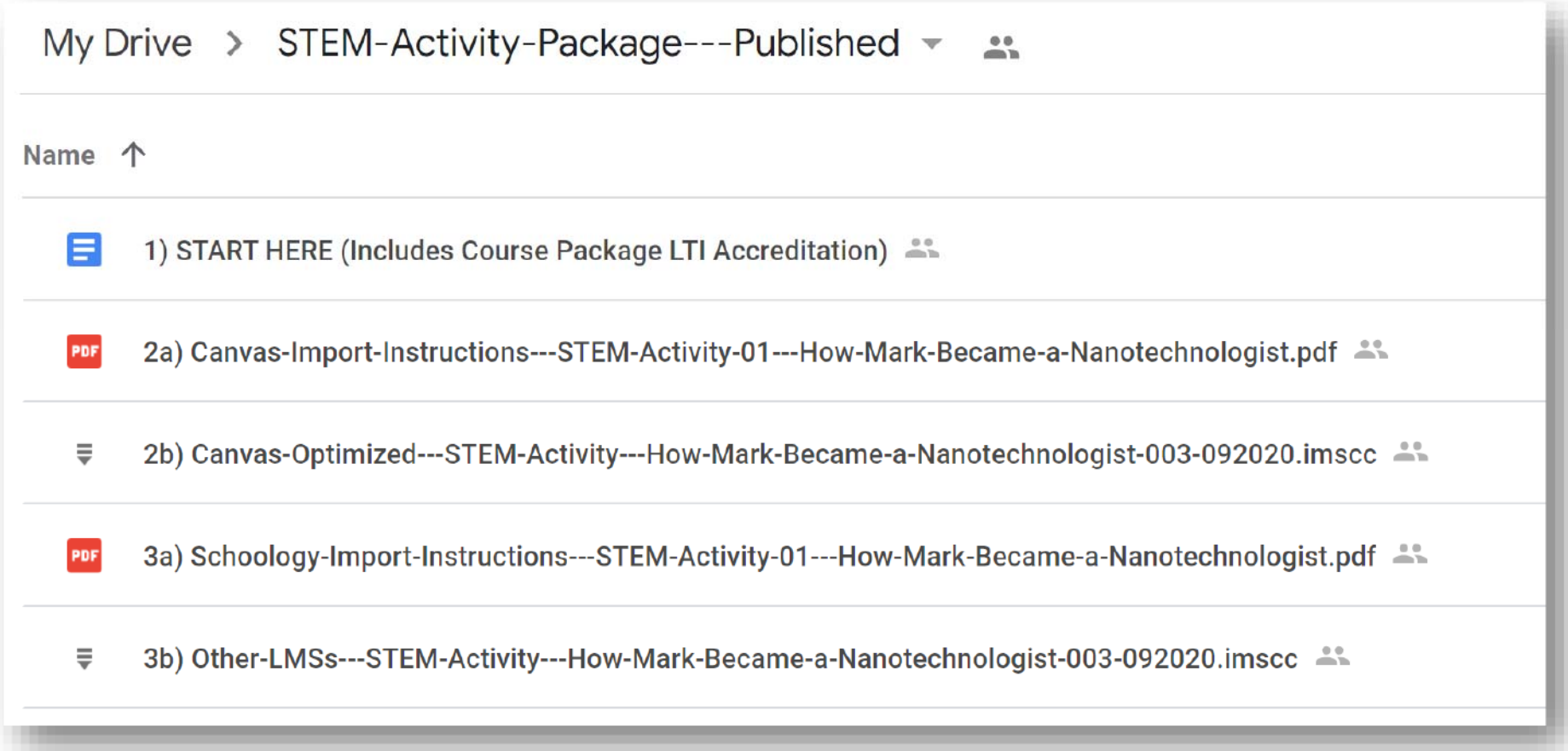
Do you teach chemistry or biology or...? -- What is the name of your institution?

Anything you want to tell us?

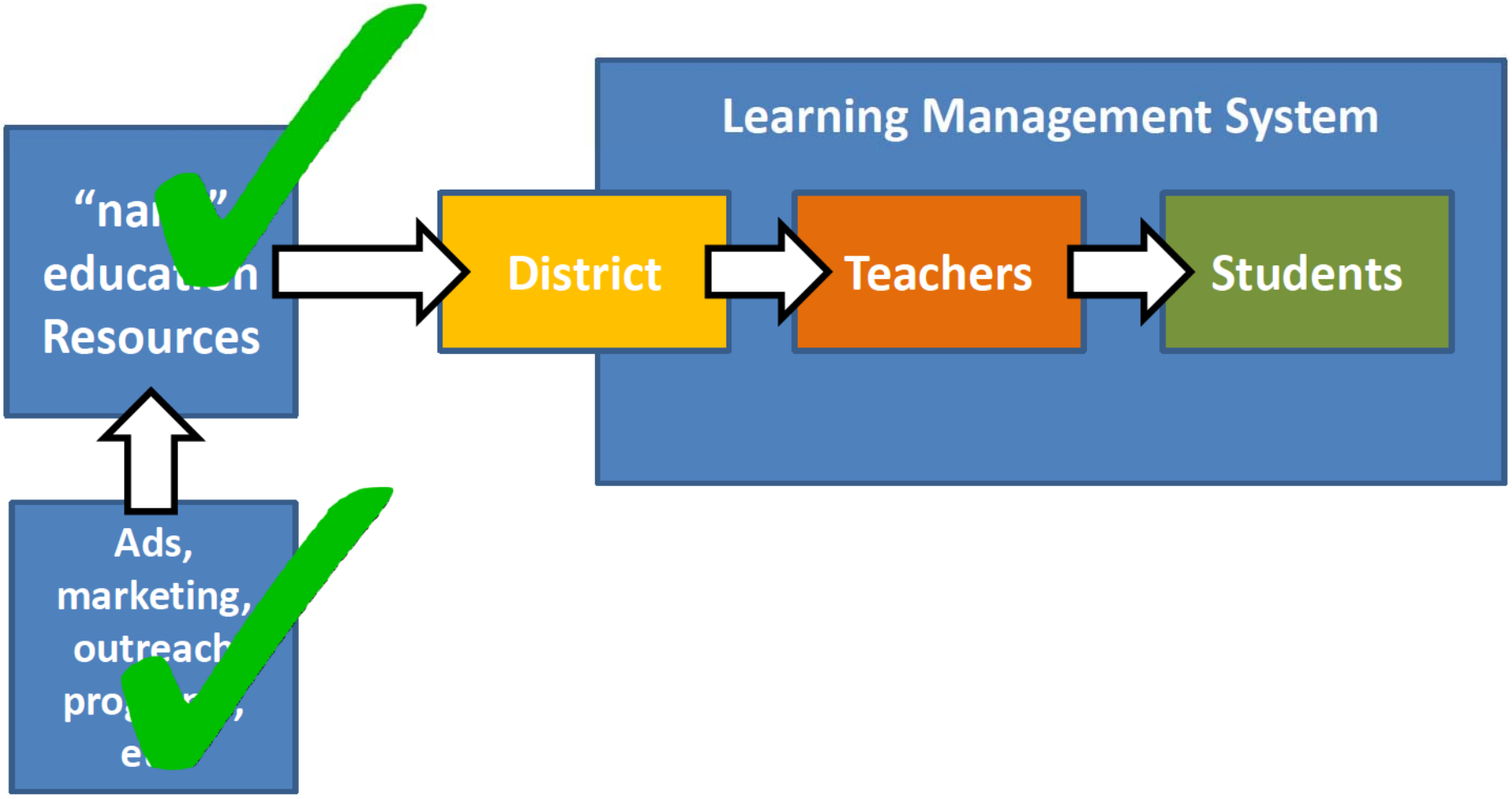
protected by reCAPTCHA
Privacy - Terms

Request your course package (check your Spam Folder!)

Course package – LMS compatible

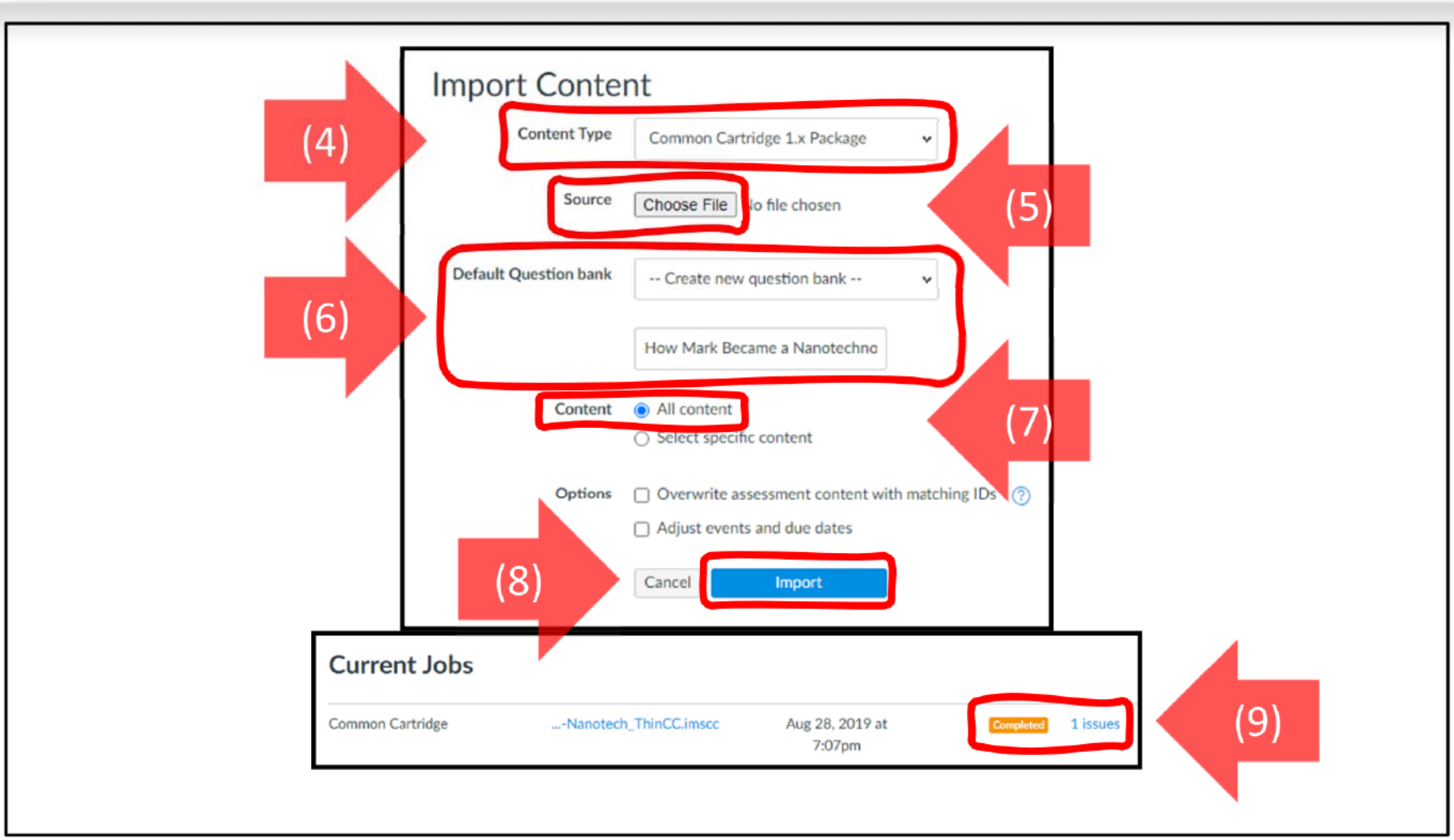


Solving the distribution problem



Import into the LMS

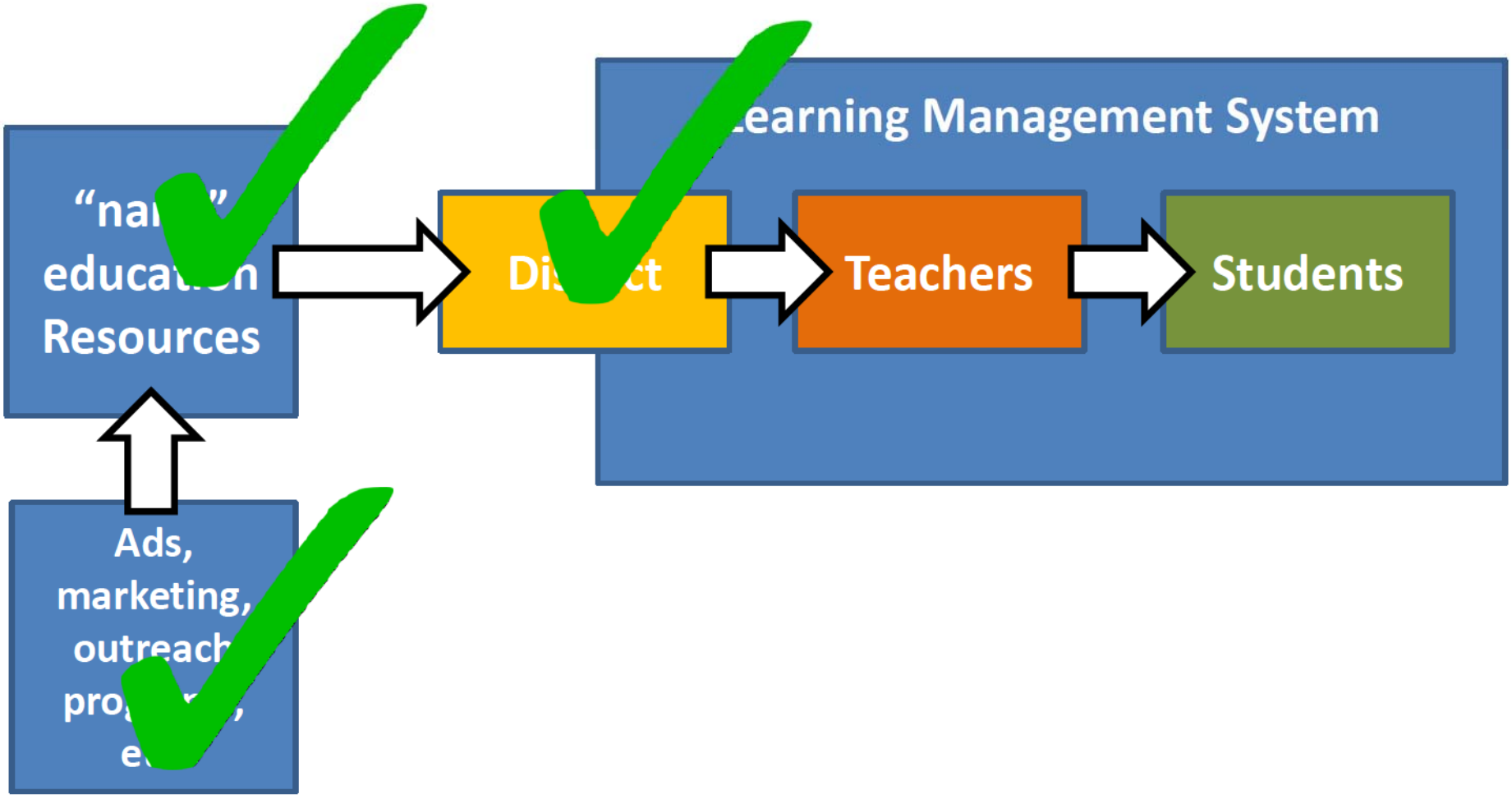
- Typically handled by the District LMS specialist



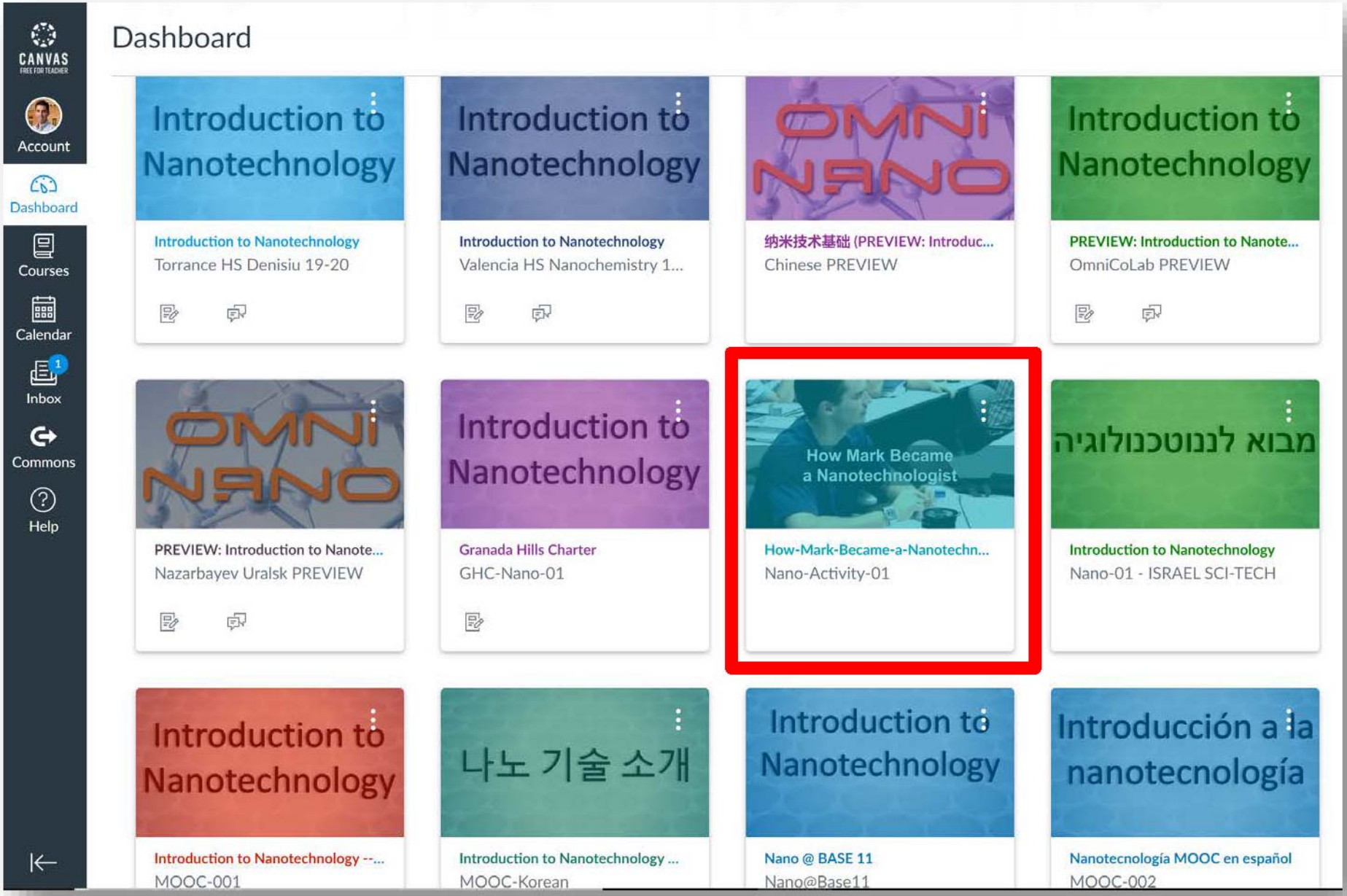
LAUSD & Schoology

https://lausd.wistia.com/medias/tgiasfvvab

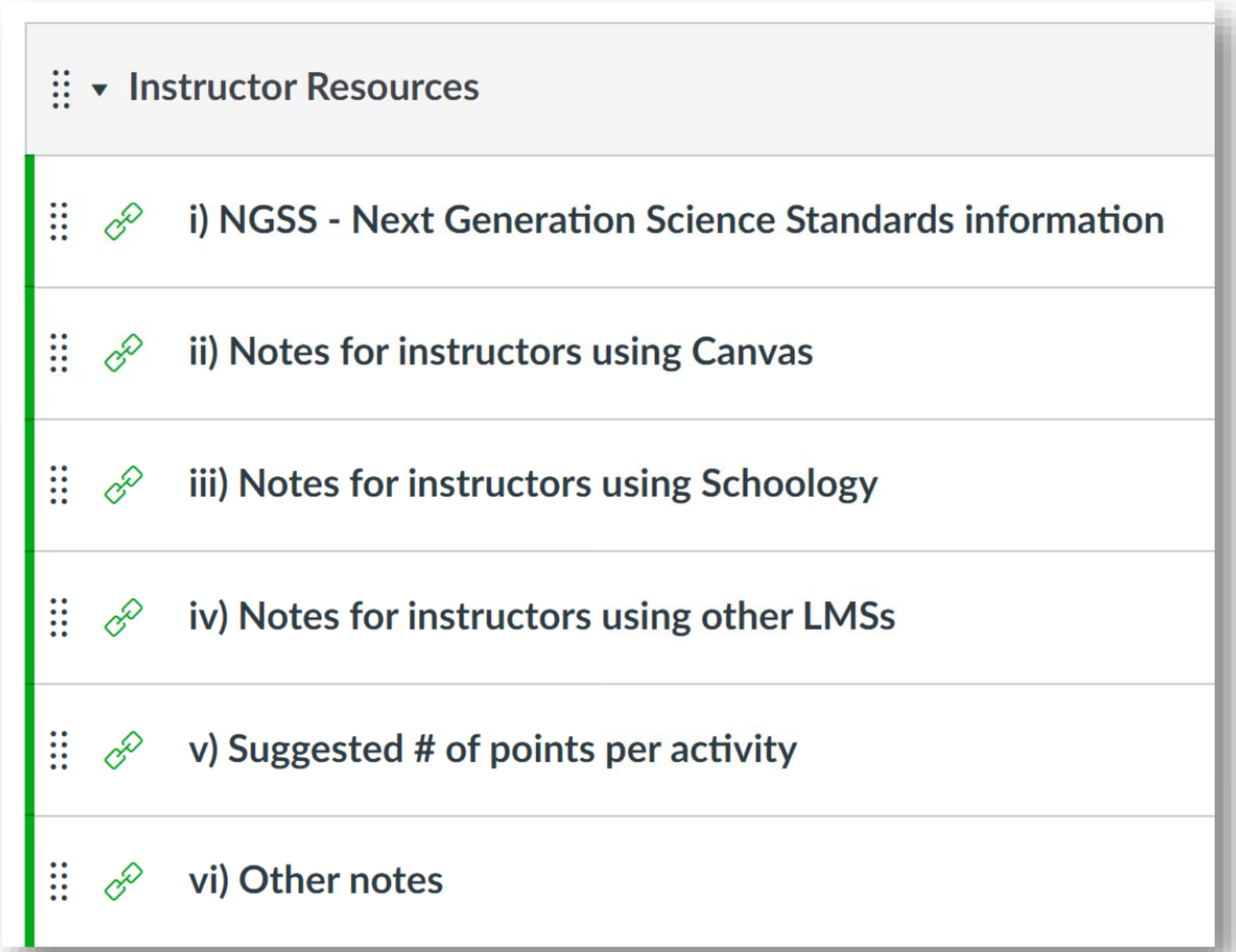
Solving the distribution problem



Imported & ready



Instructions for teachers

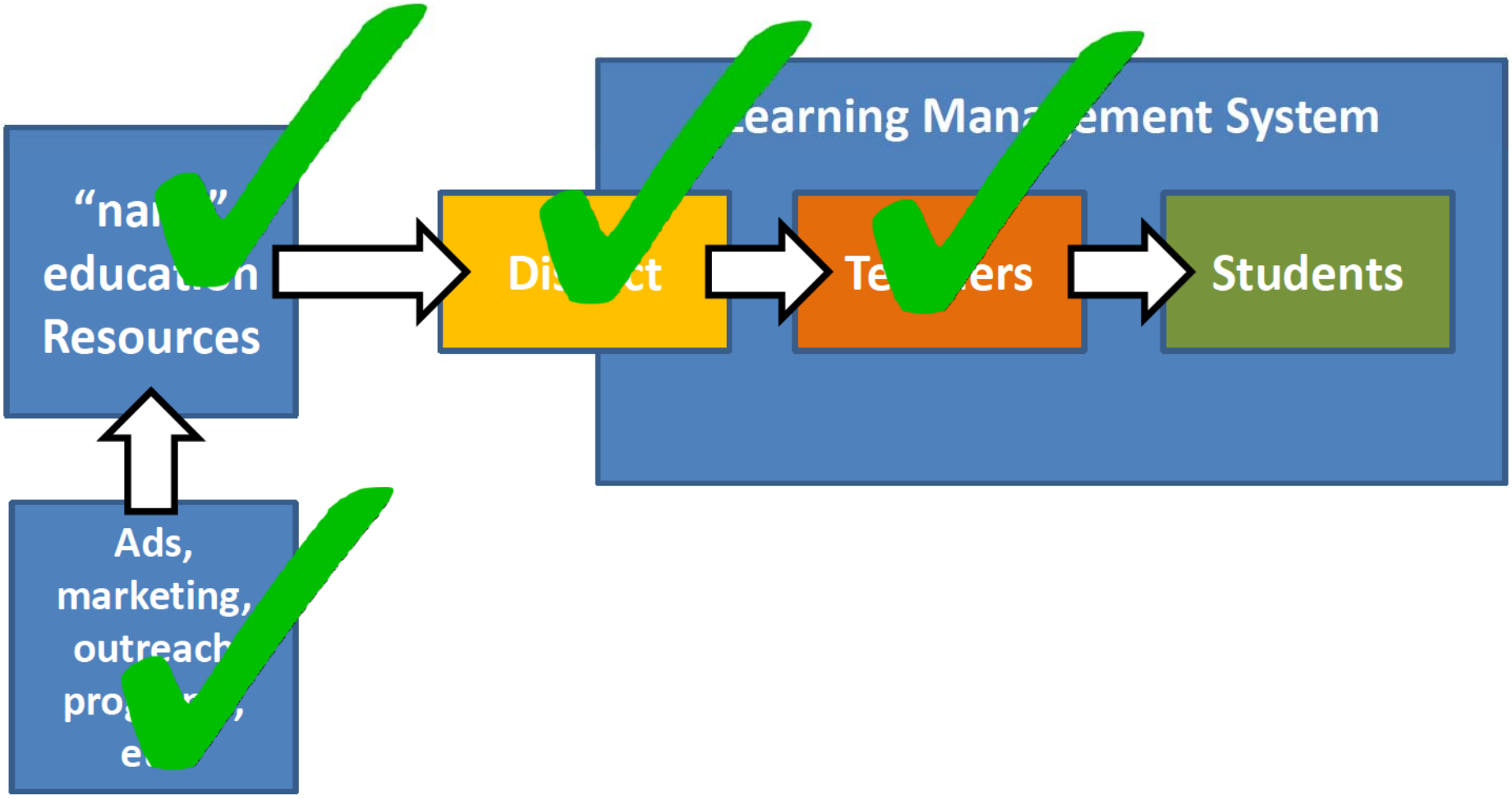


All students are enrolled

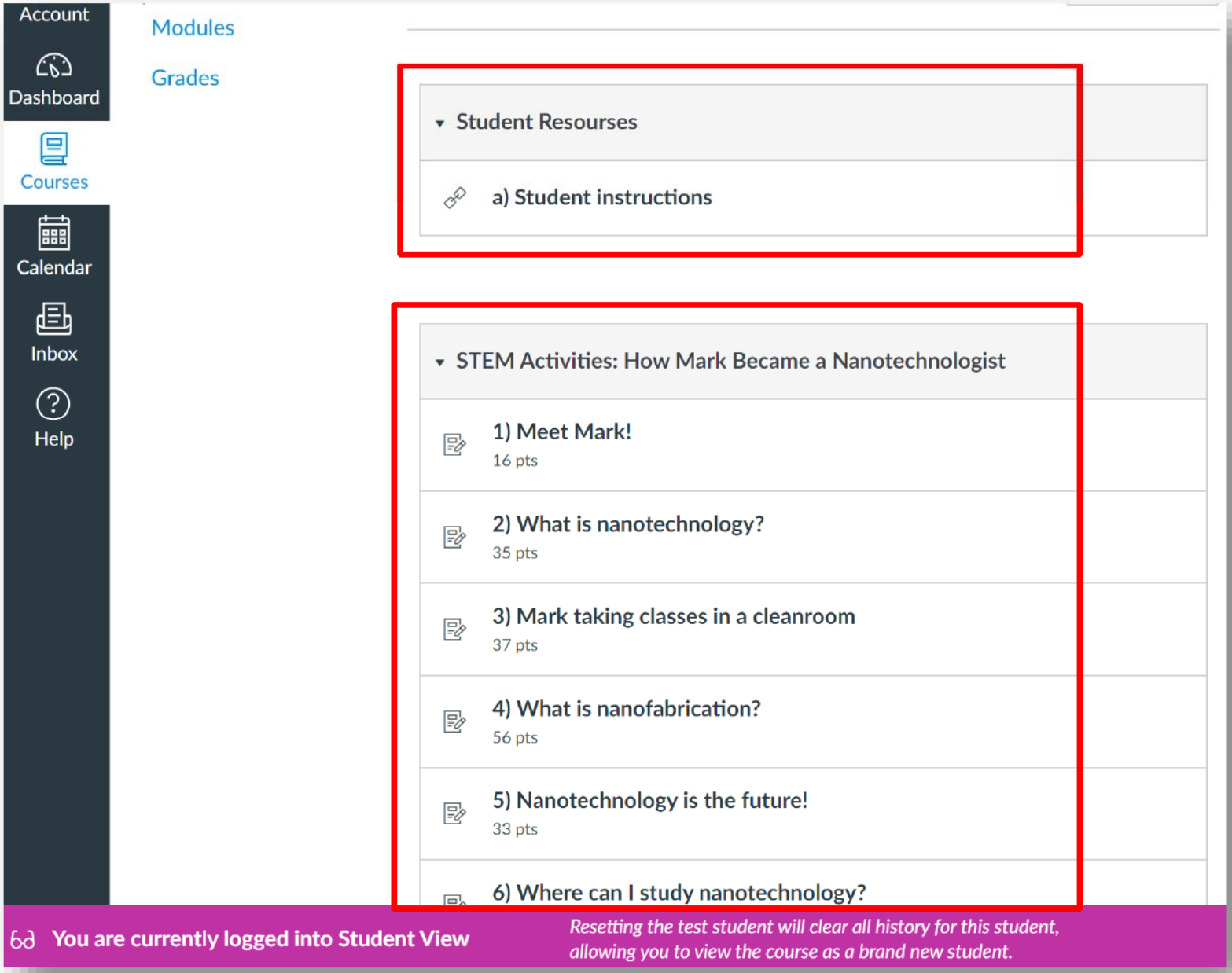
Gradebook ▾ View ▾ Actions ▾

Student Name	#11 - Assignment Out of 43	#12 - Assignment Out of 25	#13 - Assignment Out of 38	#14 - Assignment Out of 44	#15 - Assignment Out of 24
[redacted]	43	25	38	44	24
[redacted]	43	25	38	44	24
[redacted]	43	25	38	44	24
[redacted]	43	25	38	44	24
[redacted]	43	25	-	-	-
[redacted]	43	25	38	44	-
[redacted]	43	25	38	44	24
[redacted]	43	25	38	44	24
[redacted]	43	25	38	44	24
[redacted]	43	25	38	44	24
[redacted]	43	25	38	44	24
[redacted]	43	25	38	44	24
[redacted]	43	-	-	-	-
[redacted]	43	25	27.33	-	-
[redacted]	43	25	38	44	24
[redacted]	43	25	33.33	-	-
[redacted]	43	25	38	44	-
[redacted]	43	25	38	44	24

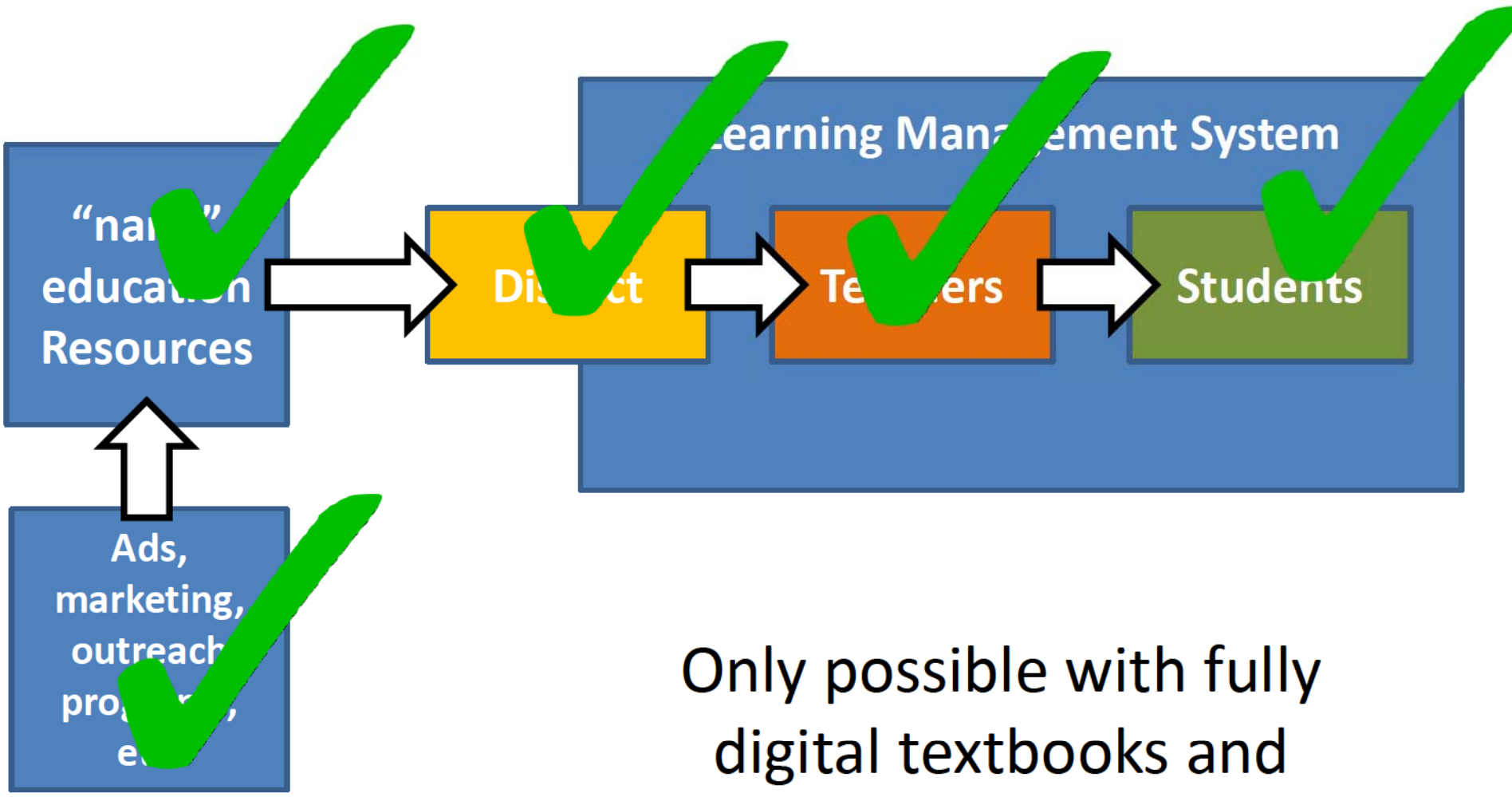
Solving the distribution problem



Accessible to students



Solving the distribution problem



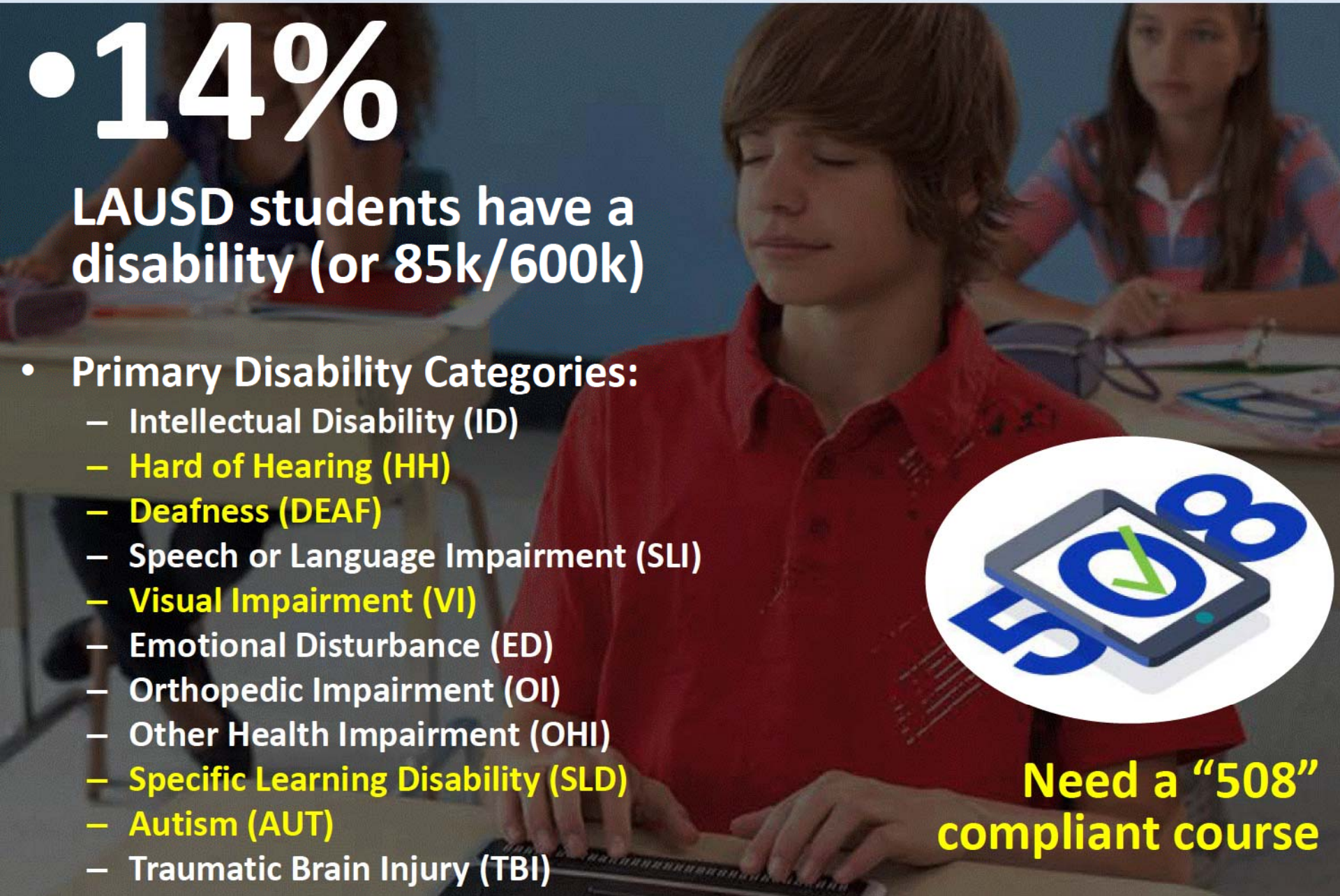
Only possible with fully digital textbooks and curricula!

Some Requirements of Digital Textbooks

Requirements: “508” compliance

- **Accessibility requirements** for information and communication technology (ICT)
- Section **508** of the Rehabilitation Act
- Section 255 of the Communications Act.

LAUSD students with disabilities



- **14%**

LAUSD students have a disability (or 85k/600k)

- **Primary Disability Categories:**
  - Intellectual Disability (ID)
  - Hard of Hearing (HH)
  - Deafness (DEAF)
  - Speech or Language Impairment (SLI)
  - Visual Impairment (VI)
  - Emotional Disturbance (ED)
  - Orthopedic Impairment (OI)
  - Other Health Impairment (OHI)
  - Specific Learning Disability (SLD)
  - Autism (AUT)
  - Traumatic Brain Injury (TBI)

Need a "508" compliant course

LACCD just lost a lawsuit

Los Angeles Community College District (LACCD)

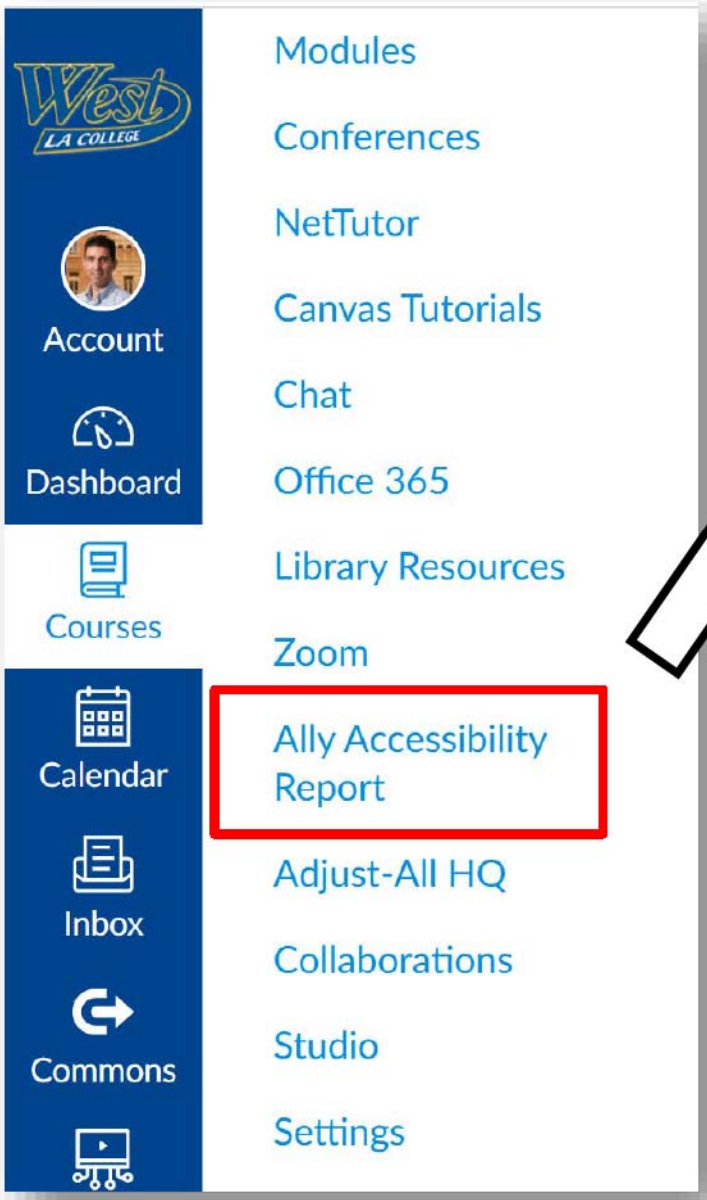
- **Complaint filed by:** National Federation of the Blind and two students who are blind
- **Year:** March 3, 2107
- **Complaint:** Violation of the ADA and Section 508

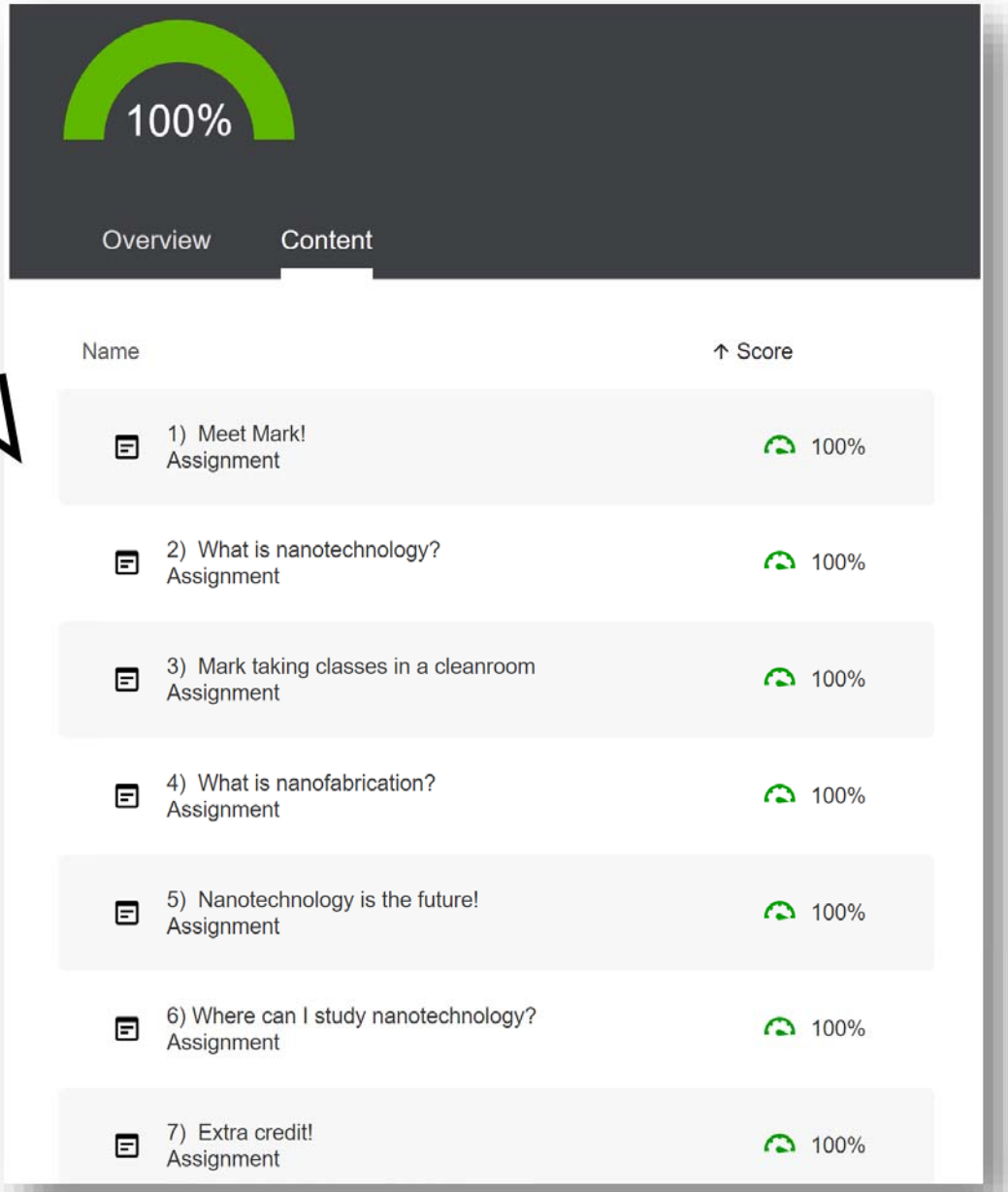
Federal Court Rules in Favor of Blind Students

August 21, 2019 | Source: National Federation of the Blind

The National Federation of the Blind, its California affiliate, and two blind students, Roy Payan and Portia Mason, have won their disability discrimination lawsuit against the Los Angeles Community College District (LACCD). The Federal District Court for the Central District of California Found that LACCD violated the students' rights under Title II of the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973 by, among other things, failing to provide them with accessible documents and course materials, failing to provide equal access to library resources...

Ally accessibility report



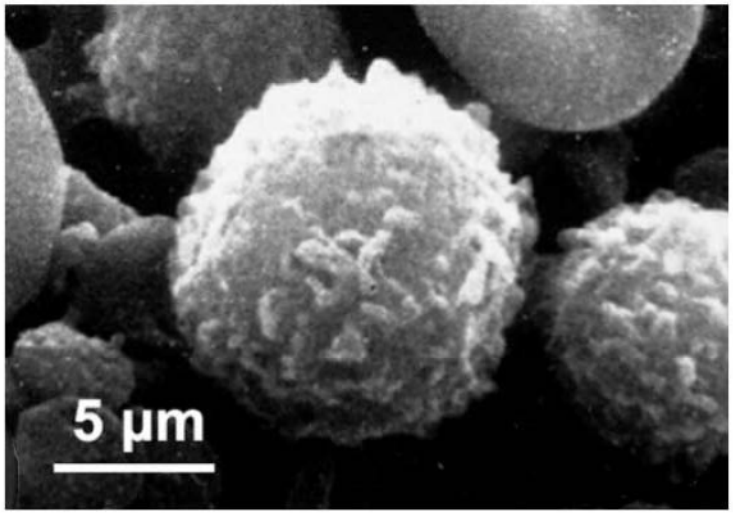


How did we pass the accessibility check?

“Alt text”

3) ***Beyond the video*** – The microscopy image below shows a human white blood cell. What is its approximate diameter?

- *Hint:* Use the scale bar at the bottom.



3	10-11 micrometers
0	7-8 micrometers
0	10-11 nanometers
0	4-5 micrometers
0	0.05 millimeters
0	50-100 nanometers

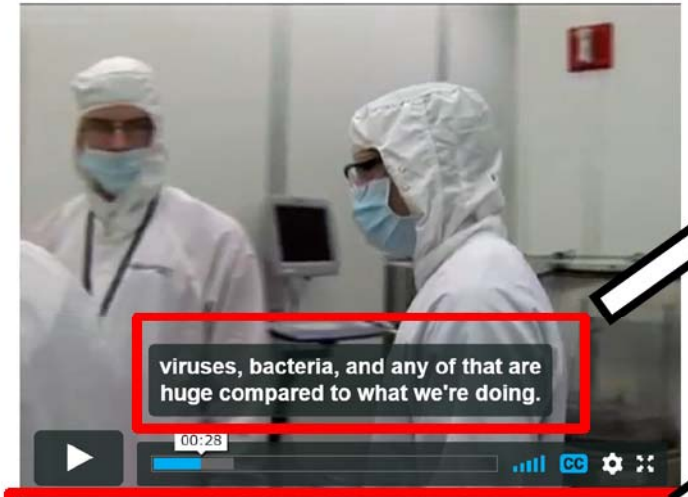
“alt text” describe images for students with visual impairments.

```
Type: MC
Score: 3, Partial
3) [HTML]<div style="font-size:1.5em; color:#1E1658;"><span style="co :#0080ff;"><em><strong>Beyond the
video</strong></em></span> – The microscopy image below shows a huma hite blood cell. What is its
approximate diameter? <span style="font-size:0.75em;"><ul><li><em><s n style="text-decoration:
underline;">Hint:</span></em> Use the scale bar at the bottom.</li ul></span><img
src="https://live.staticflickr.com/65535/49958098283_d429c0f5fc.jp width="500" style="max-width:90%;"
alt="This image is critical to answering this question. The image shows a white blood cell as an apparently
sphere-shaped object. The scale bar reads 5 micrometers. The width of the white blood cell appears to be
roughly twice that of the scale bar."></div>[/HTML]
@[Always] The scale bar reads 5 micrometers, and the white blood cell shown here appears to be roughly twice
that of the scale bar. Thus, we can deduce that the diameter of this white blood cell is approximately 10-11
micrometers.
[1]a. 10-11 micrometers
b. 7-8 micrometers
c. 10-11 nanometers
d. 4-5 micrometers
e. 0.05 millimeters
f. 50-100 nanometers
```

Screen reader software reads HTML code

Video caption and description

1. Which of the following statements about the video below seem correct? Select all that apply.



Courtesy of the Nanotechnology Applications and Career Knowledge (NACK) Network.
Click here to view the transcript of this video.

Captions for students with hearing impairments.

Description for students with visual impairments.

- [ ] The reason why Mark's class requires a bunny suit is to prevent people from introducing contaminants into the ultra-clean working environment of the Nanofabrication Lab.
- [ ] Mark and the other students get trained to operate the same type of equipment used in the semiconductor industry to make the electronics that power your smartphone.
- [ ] Fabricating nanoscale devices and systems requires an understanding of design, chemistry, physics, biology, and engineering. Nanotechnology is truly STEM!
- [ ] Nowadays, students like Mark might have multiple careers in very different fields. A strong background in nanotechnology prepares these students for rewarding professional careers.
- [ ] Learning nanofabrication gave Mark superpowers, similar to the superheroes in Marvel movies. Mark is now unstoppable.

NGSS & other standars

STEM ACTIVITY

"How Mark Became a Nanotechnologist"

Next Generation Science Standards (NGSS)

Grade Levels:

- 9th - 12th (but also OK for grades 8-16)

Duration:

1-2 class periods

Topic/Theme:

This STEM activity introduces the subject of nanotechnology, a new field of science and engineering, through the story of a college student named Mark. This story shows that many students like him are willing to undergo rigorous training to acquire the skills needed to develop transformative technologies at high-tech companies. In fact, nanotechnology applications promise to find solutions to many real-world concerns affecting human lives and the environment at large – such as water purification, clean energy production, energy storage, effective medical treatments, accurate disease diagnostics, and safe food storage, just to name a few. By learning more about nanotechnology, today's high school students will become tomorrow's STEM workforce for the greater good of the world.

NGSS Performance Expectations

Glossary:

- PE = Performance Expectation
- SPE = Science and Engineering Practices
- DCI = Disciplinary Core Ideas
- CCC = CrossCutting Concepts

HS-PS2 Motion and Stability: Forces and Interactions

HS-PS2-6

HS-PS2-6 -- General Statement:

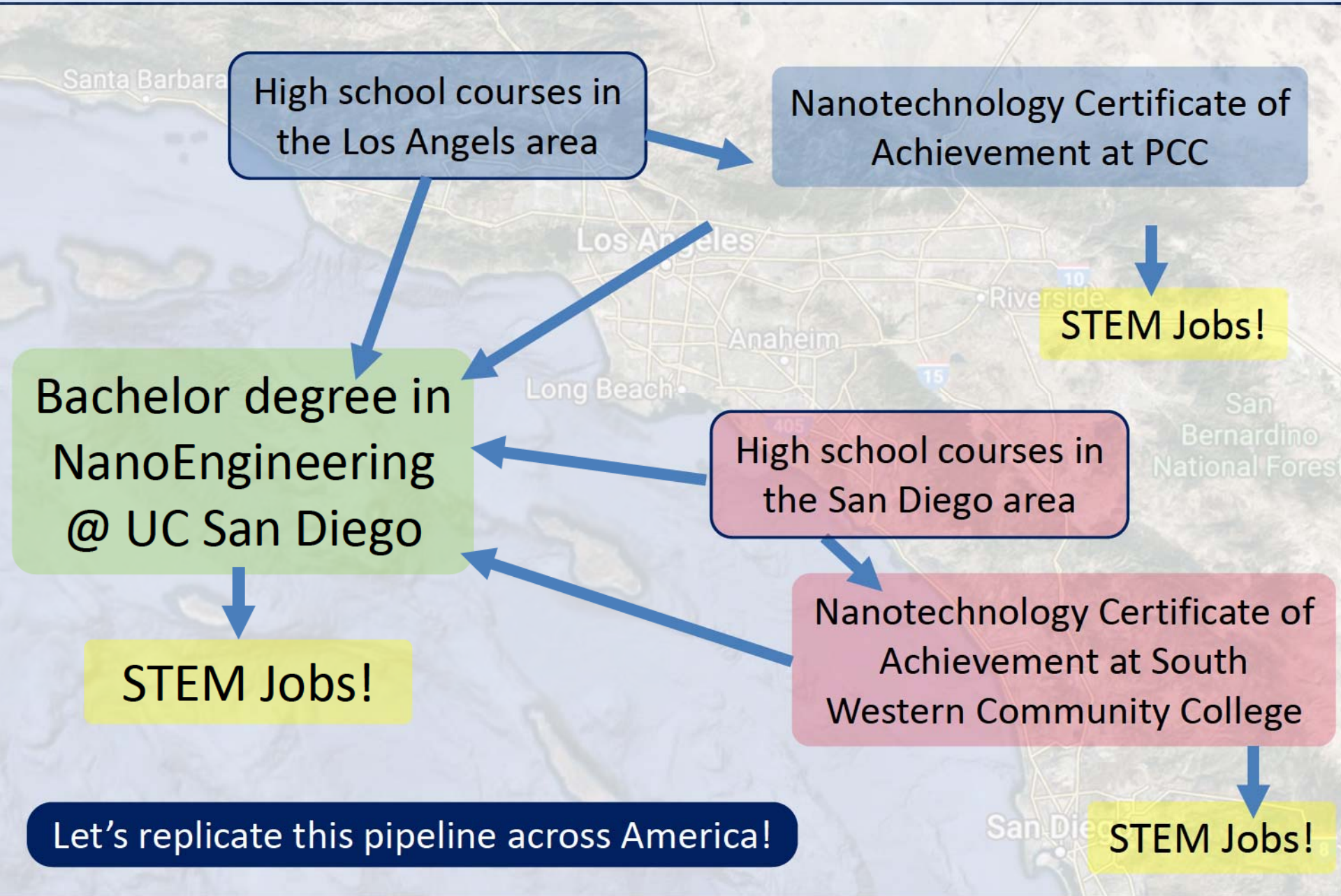
- **PE:** Students who demonstrate understanding can communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
  - NGSS Document Link: https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/HS-PS2-6%20Evidence%20Statements%20June%202015%20asterisks_0.pdf

HS-PS2-6 -- Specific to this Activity:

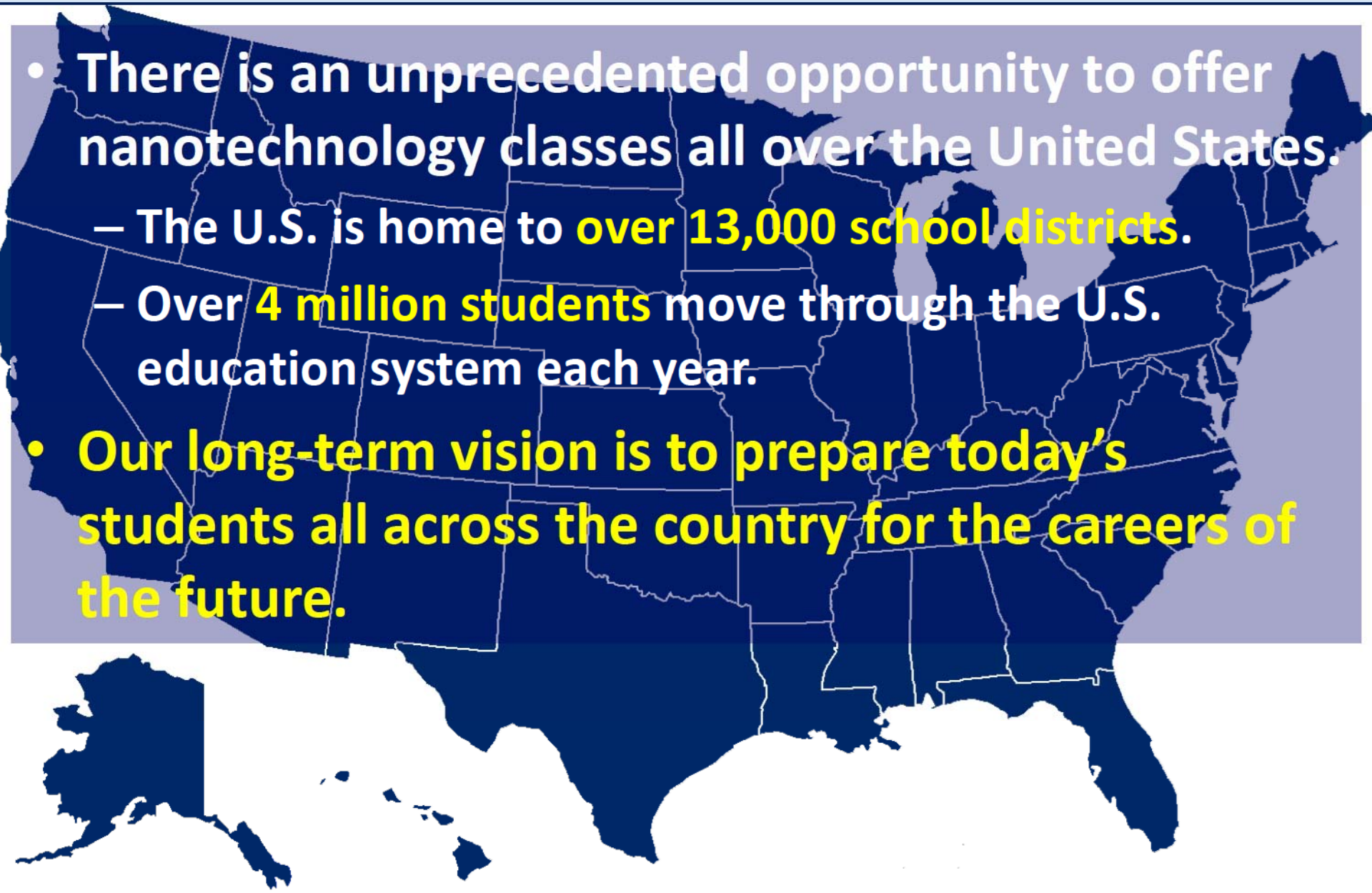
- **PE:** Students who demonstrate understanding can communicate the development of this new field of science and engineering, nanotechnology, wherein a unique arrangement of atoms constrained to nanoscale dimensions results in novel material properties, which can be utilized to design and manufacture new technological devices and systems.
- **SPE:** To show proficiency, students must be able to communicate scientific and technical information about novel materials and structures with nanoscale dimensions. These materials/structures, even if have the same formula/composition, behave completely differently than bulk forms. This discovery brought on changes and enabled this new field of science and engineering known as nanotechnology, which ultimately is leading towards new products, processes, and industries.Students must also be able to communicate scientific and technical information about how nanotechnology is expected to bloom in a new Industrial Revolution by changing the way objects and materials are manufactured, resulting in significant social and economic changes.
- **DCI:** The structure and dimension of materials are important for their properties and function. In fact, (PS1.A) scientists and engineers can design, create, and study materials and structures with precise nanoscale dimensions (less than 100 nm). The unique properties of nanoscale materials are derived from their tiny size. Moreover, (PS2.B) nanoscale materials and structures display novel chemical and physical properties, unachievable with the corresponding bulk material, enabling applications previously unimaginable.
- **CCC:** Nanoscale materials and structures can be manufactured with precise dimensions so they display certain desired properties. There are two main manufacturing methods: "top-down" and "bottom-up" manufacturing. At the research level, these materials/structures must be investigated to gain a full understanding of their properties. At the production level, they must be examined to ensure proper quality control. Special instrumentation has been developed to study matter at these tiny dimensions.

Show students the path!

“Nano” education pathway in SoCal

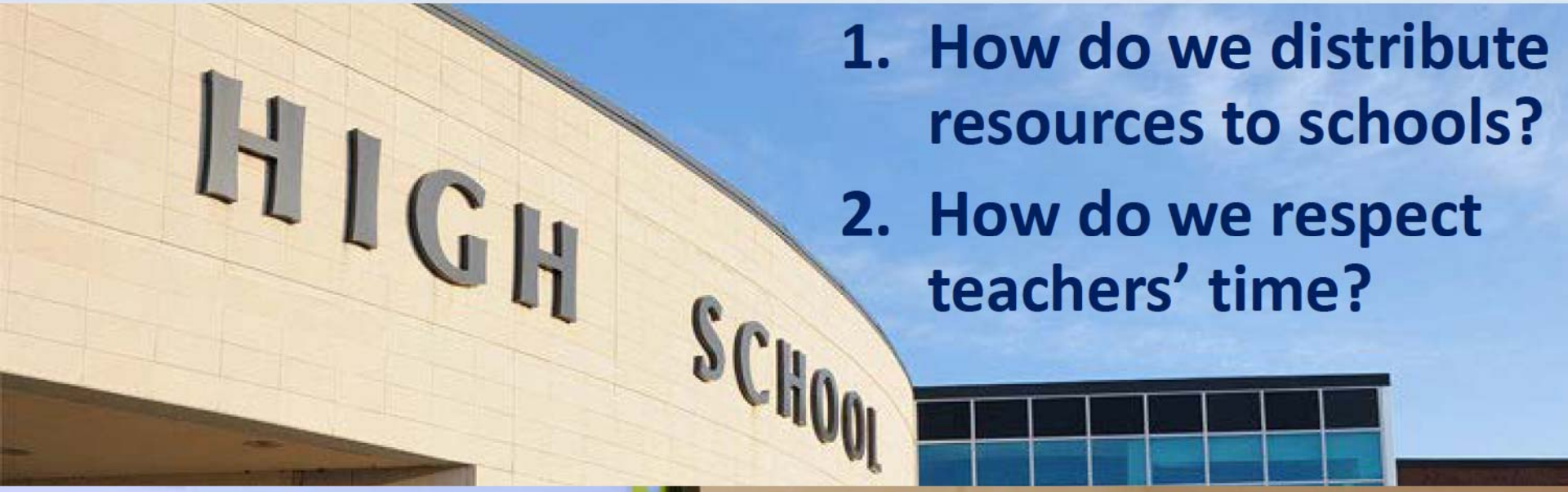


Nanotech classes across America



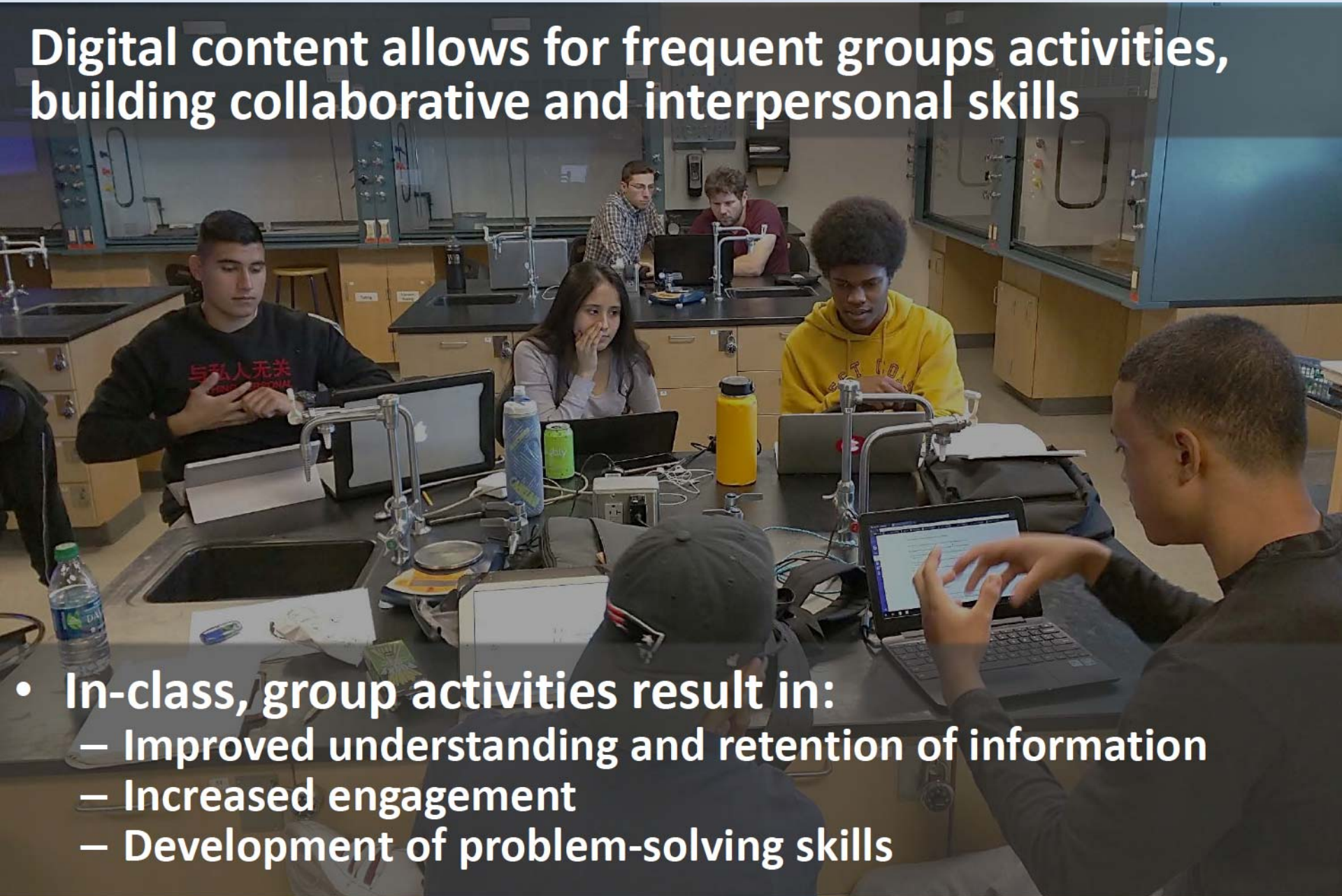
- There is an unprecedented opportunity to offer nanotechnology classes all over the United States.
  - The U.S. is home to over 13,000 school districts.
  - Over 4 million students move through the U.S. education system each year.
- Our long-term vision is to prepare today's students all across the country for the careers of the future.

Questions that came up



1. **How do we distribute resources to schools?**
2. **How do we respect teachers' time?**

Promote collaborative learning

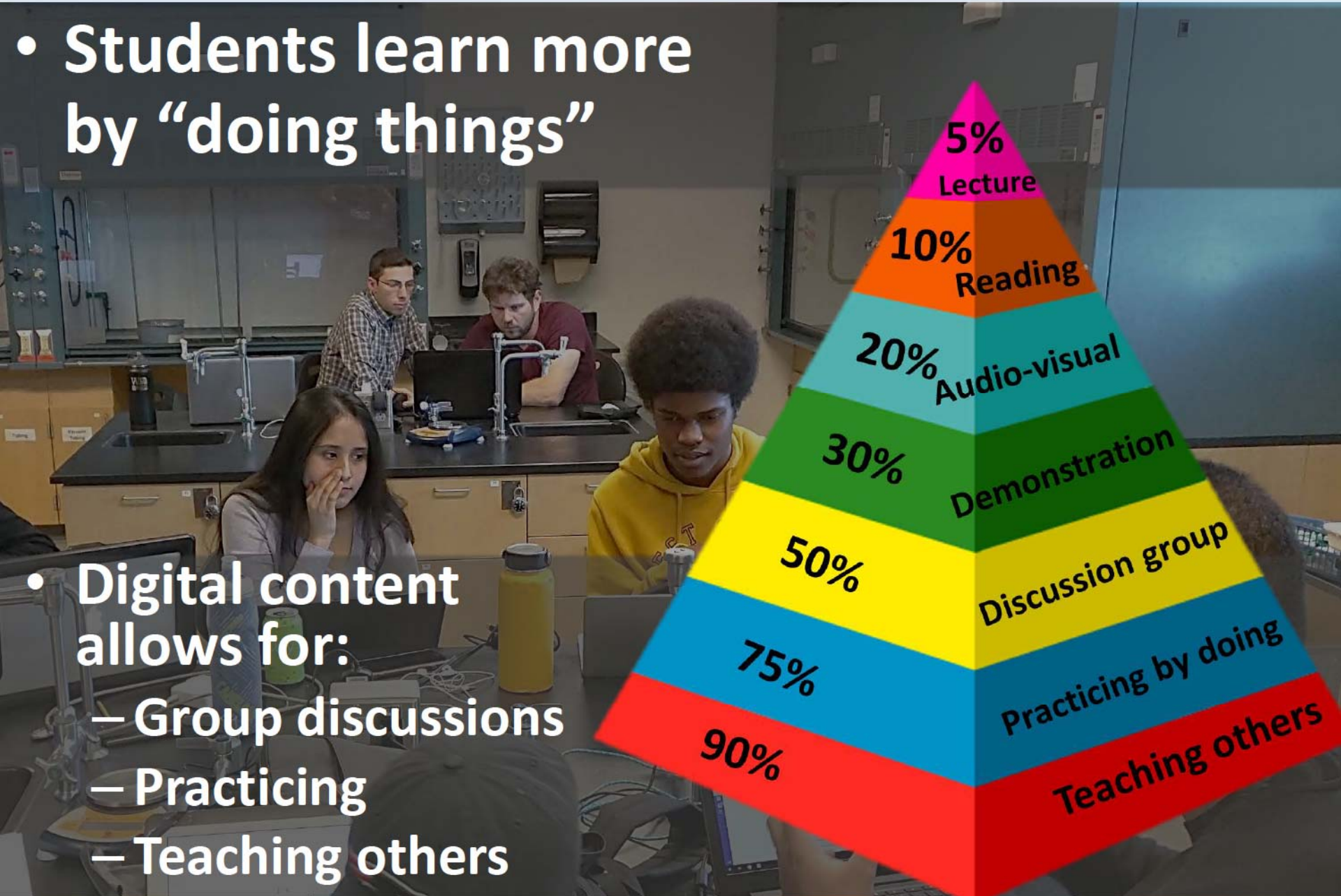


Digital content allows for frequent groups activities, building collaborative and interpersonal skills

- **In-class, group activities result in:**
  - **Improved understanding and retention of information**
  - **Increased engagement**
  - **Development of problem-solving skills**

Improve learning retention

- Students learn more by "doing things"

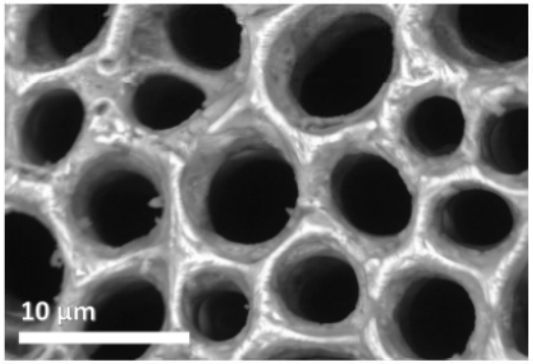


- Digital content allows for:
  - Group discussions
  - Practicing
  - Teaching others

Sneak peek: assessments

Question 8 3.67 / 11 pts

With regards to the image below of a sea urchin shell, which of the following statements are most likely to be correct?



Correct!

☑ This micrograph is a good example of the charge-up phenomenon occurring on a non-conductive biological sample.

This is correct! Sea urchin shells are composed of minerals, which are non-conductive biological materials. As is typical for biological and other non-conductive samples, the abnormal contrast that is characteristic of the charge-up phenomenon is visible in this micrograph. For more details, review the slides about the charging effect.

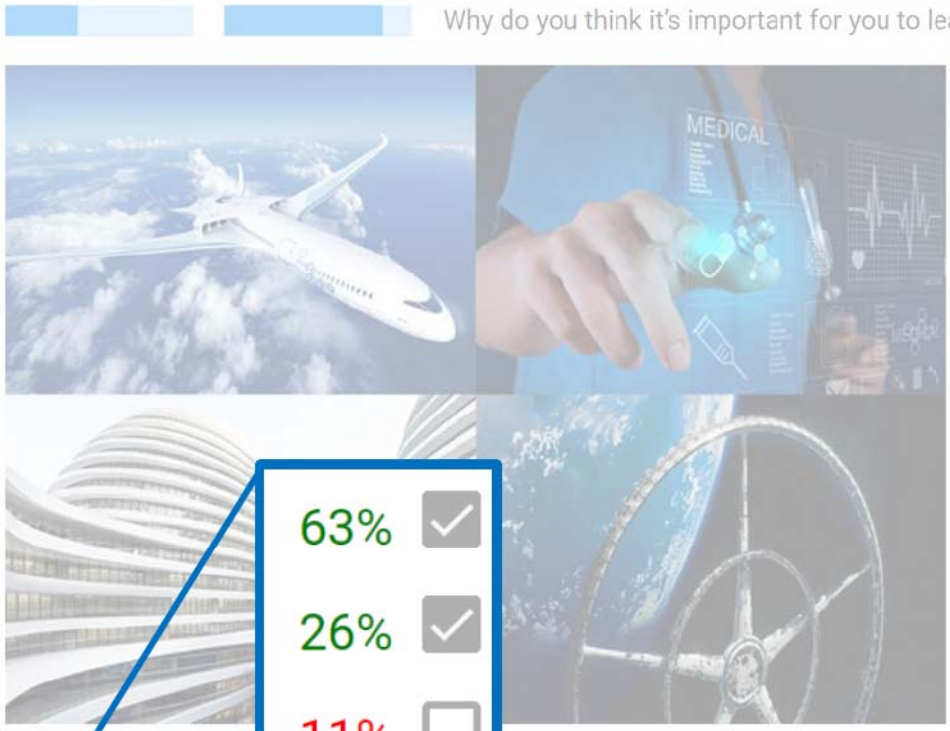
You Answered

☑ This image must be have been acquired in BSE-SEM mode because the heavier elements that sea urchins selectively position on the surface of their shells are clearly seen as bright bumps.

This is incorrect. Although heavier elements do appear brighter in BSE-SEM micrographs, sea urchin shells are typically homogeneous in composition throughout. Furthermore, animals do not selectively position elements in this way. For more details, search the web.

- **Our curriculum includes hundreds of automatically-graded assessment questions with detailed feedback immediately available to students**.
  - Grades are automatically recorded, and grading settings are fully customizable at both the course and quiz levels.
  - This significantly lowers the instructors' workloads.

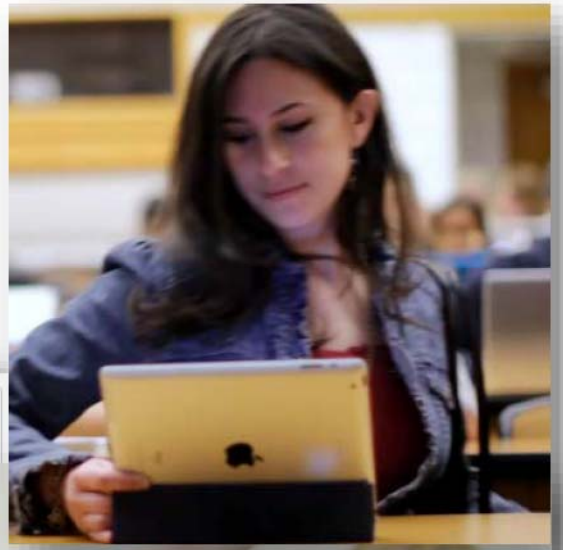
Real-time analytics



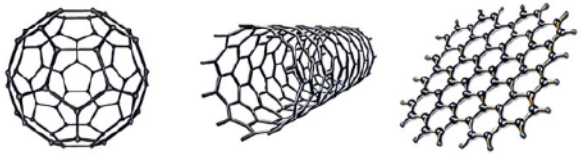
- Analytics of students' performance allow teachers to:
  - Teachers can evaluate the results online.
  - Offer in-depth guidance.
  - Offer personalized feedback.

Sneak peek: assessments

- **Our educational resources support all types of learning environments including in-class (traditional), virtual, hybrid, and flipped classroom models.**
- Instructors have immediate access to assessment statistics for a quantitative, visual representation of their students' strengths and areas of need.



Attempts: 259 out of 259



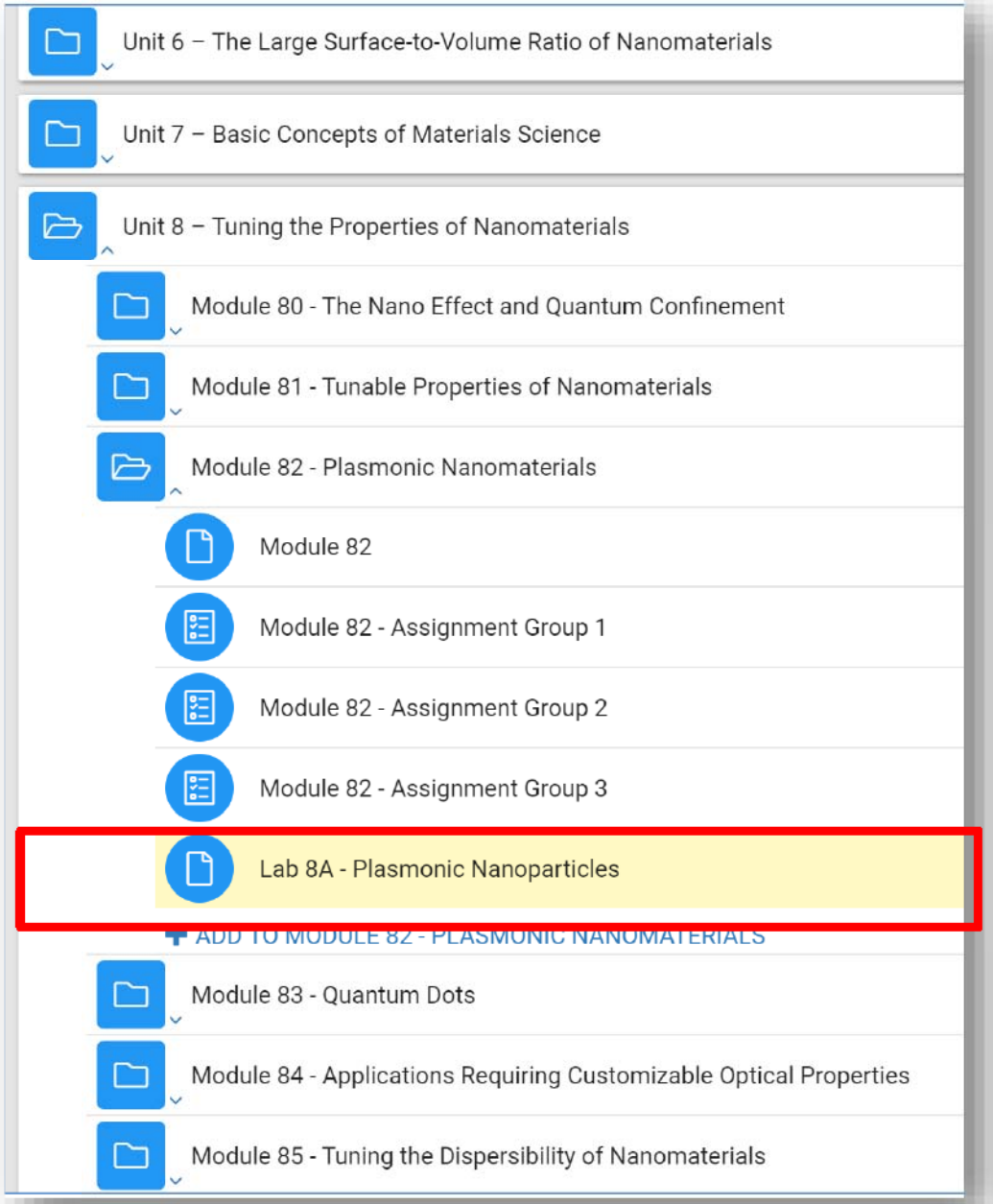
As an example, instructors can use select assessment questions for in-class quizzes and use the detailed statistics available in order to better tailor their lessons to their students.

Which of the following are types of carbon-based nanomaterials?

Graphene	252 respondents	97 % ✓
Carbon fibers	11 respondents	4 %
Carbon nanotubes	255 respondents	98 % ✓
Buckyballs	247 respondents	95 % ✓
Buckminster Fuller	9 respondents	3 %
Graphite	11 respondents	4 %

Labs within in the curriculum

- "Hands-on" activities are critical to learn science.
- Teachers need to know where to place these "nano labs" in their lesson plans.
- We suggest an appropriate place across the curriculum
  - All the prerequisite concepts have been discussed.



Nanotech labs

- How to include labs?
  - Dry and wet labs
- Three examples:
  1. Virtual/videotaped
  2. NanoSchoolBox
  3. Customized lab (ex: UCLA-CNSI “teach the teachers” program)

What are the advantages and disadvantages?

Virtual labs

- Videotaped labs with (translatable) caption explanation the procedure step by step.
- At each critical step, pop up questions related to the technique used, instruments used, good practice, and other science questions.
  - **No additional cost (included in the curriculum package).**
  - **Rapid worldwide distribution**
  - **Not really “hands-on”**

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Thank You!

Let's inspire a new generation of scientists and engineers!

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