

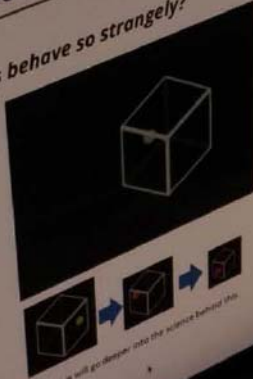
Size-Dependent Behavior

The question is...

Why do nanomaterials behave so strangely?

The answer:

- Electrons are squeezed into a space smaller than they prefer
- a phenomena known as quantum confinement



OMNI NANO

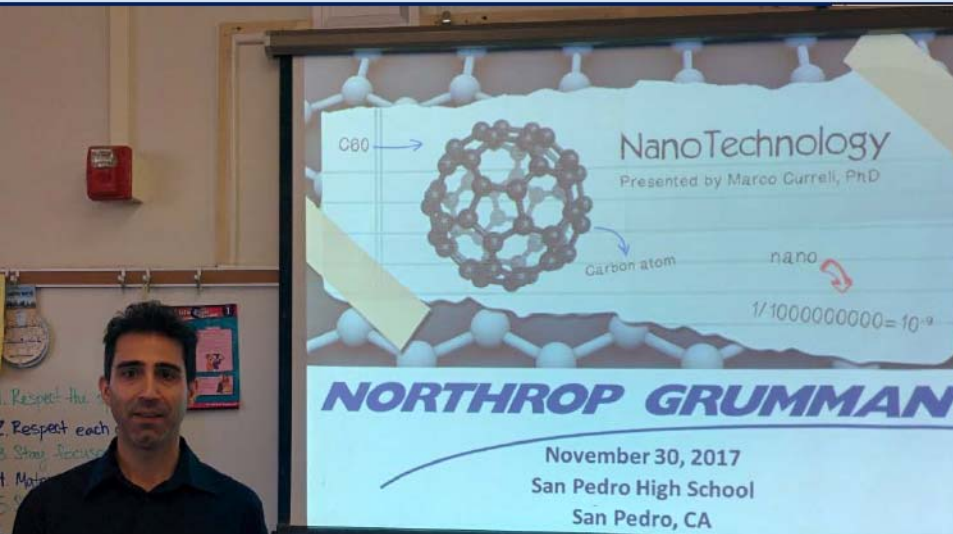
Presentation by
Dr. Marco Curreli

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?

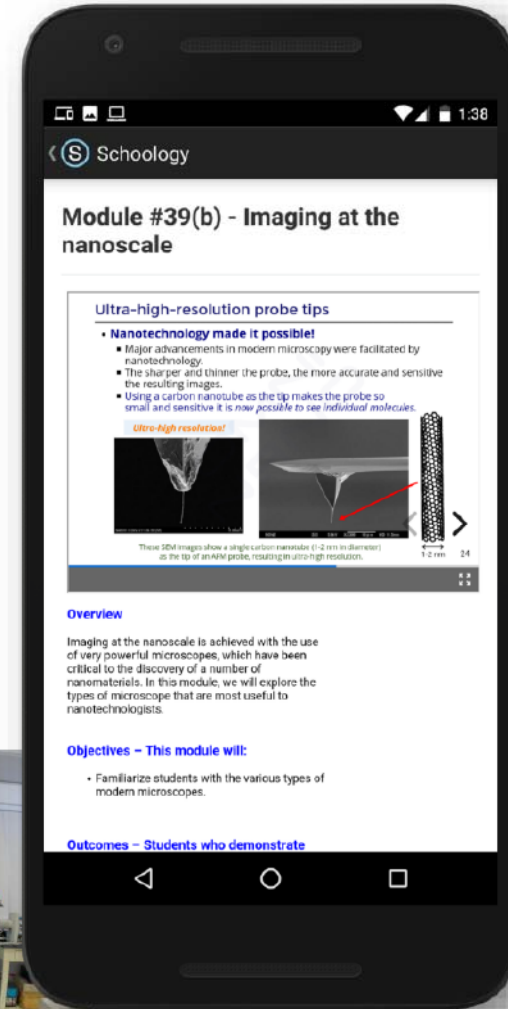


We teach students the science skills they need for the jobs of the future.



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.



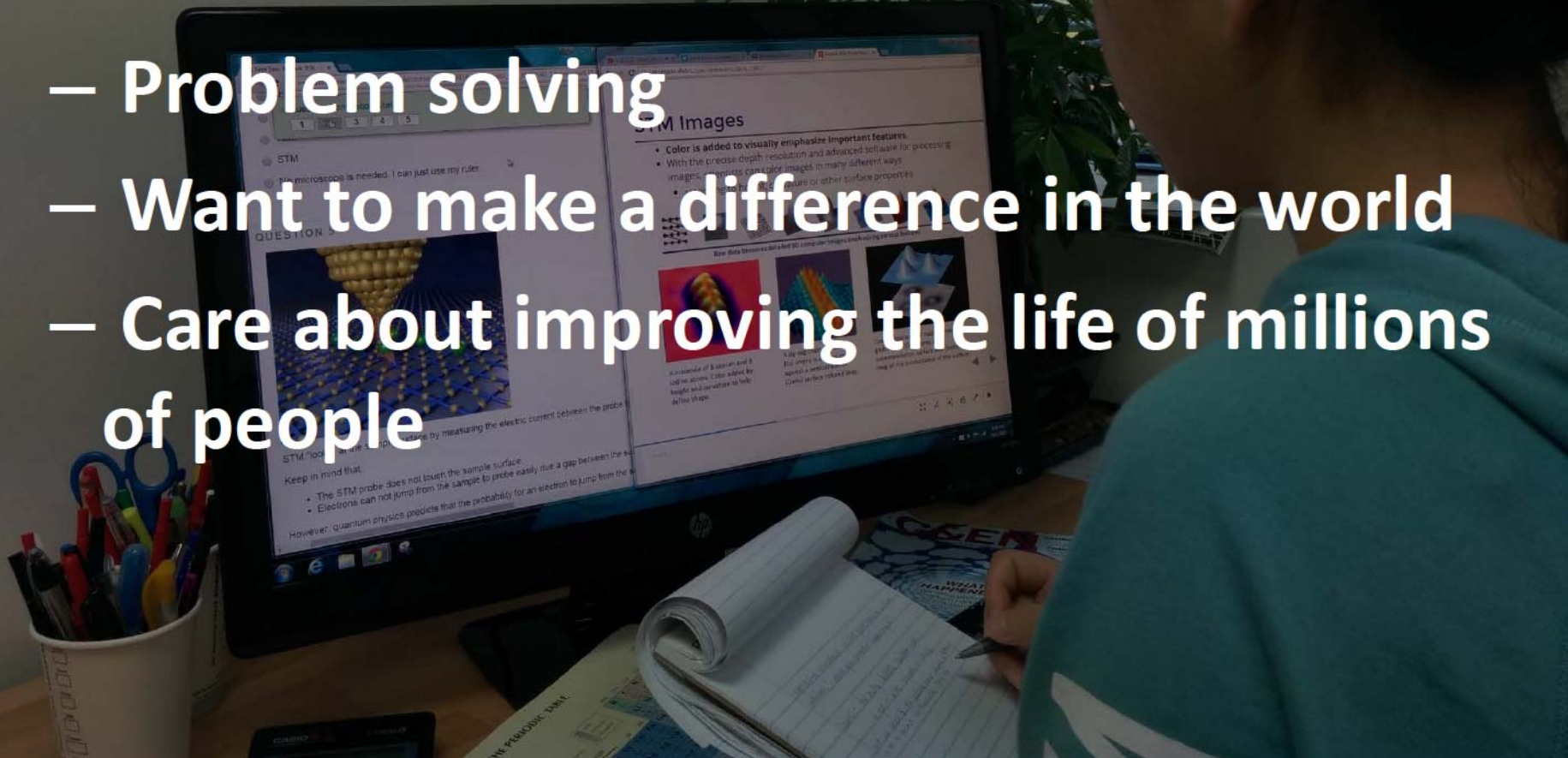
WE ENVISION giving every student in the world the opportunity to learn nanotechnology with a high-quality, curriculum.



Ideal STEM class

“Nanotechnology” is an ideal STEM class for students who are:

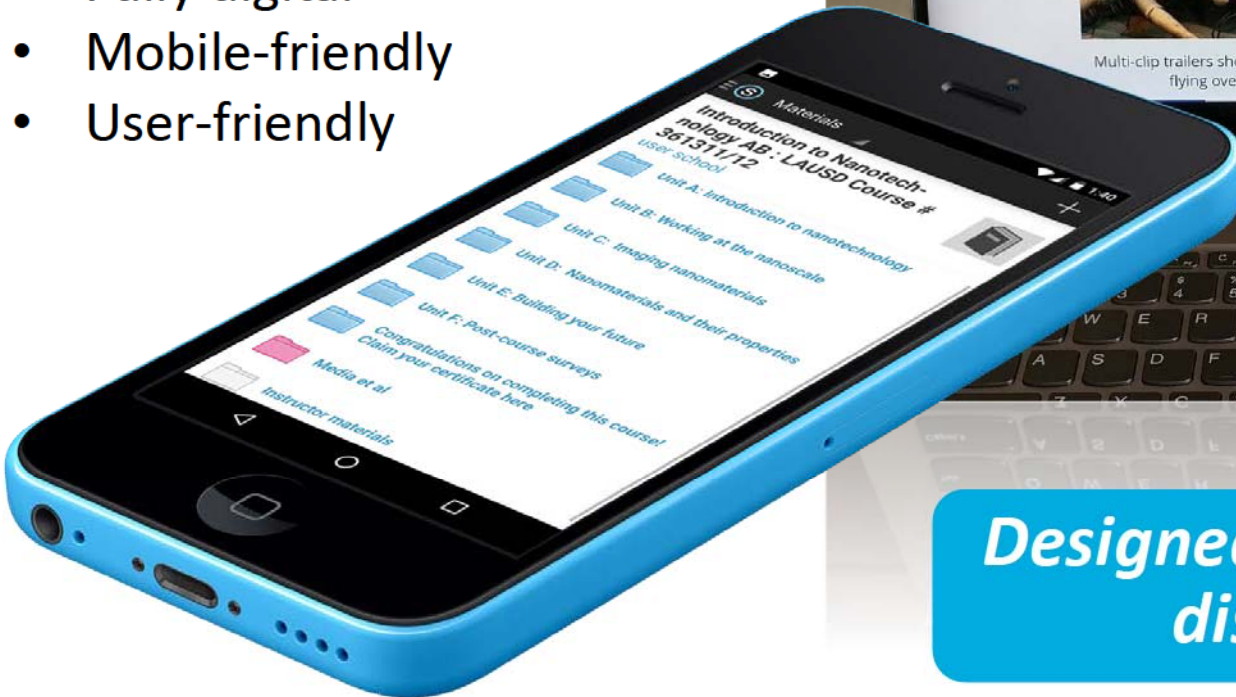
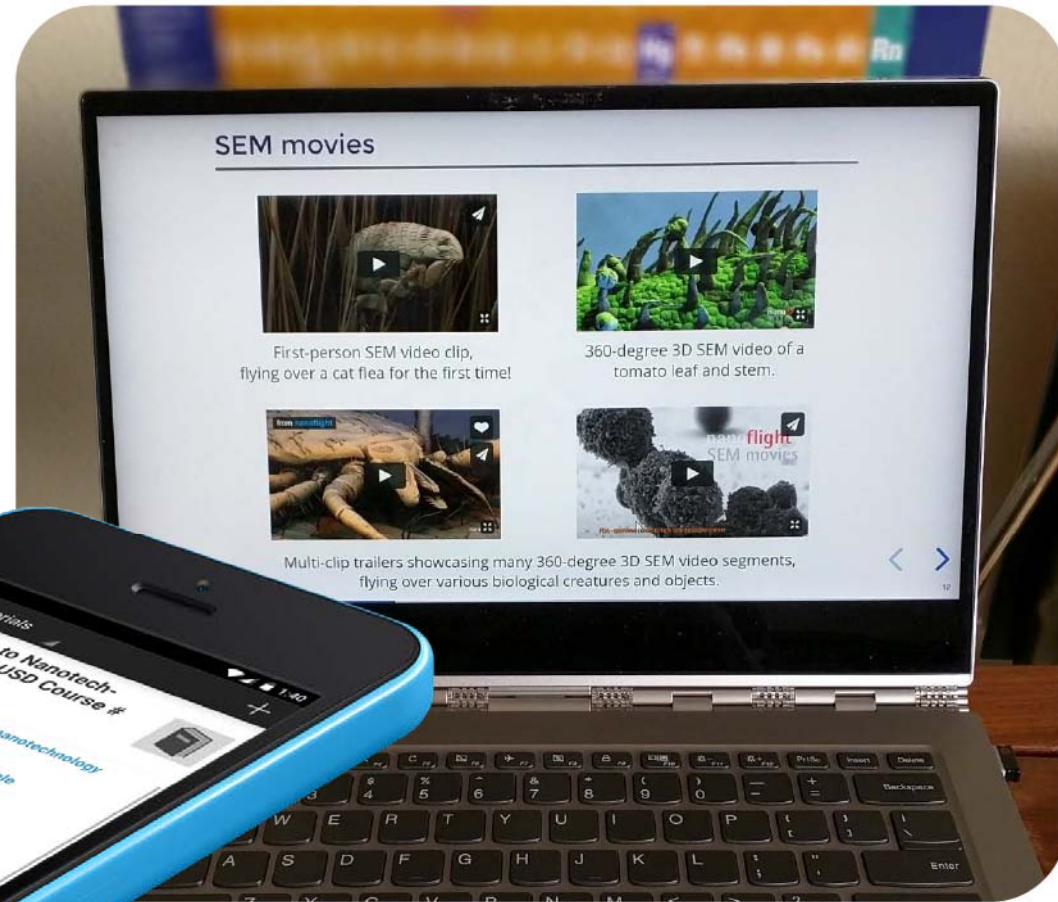
- Creative
- Problem solving
- Want to make a difference in the world
- Care about improving the life of millions of people



Curricula for teachers & students

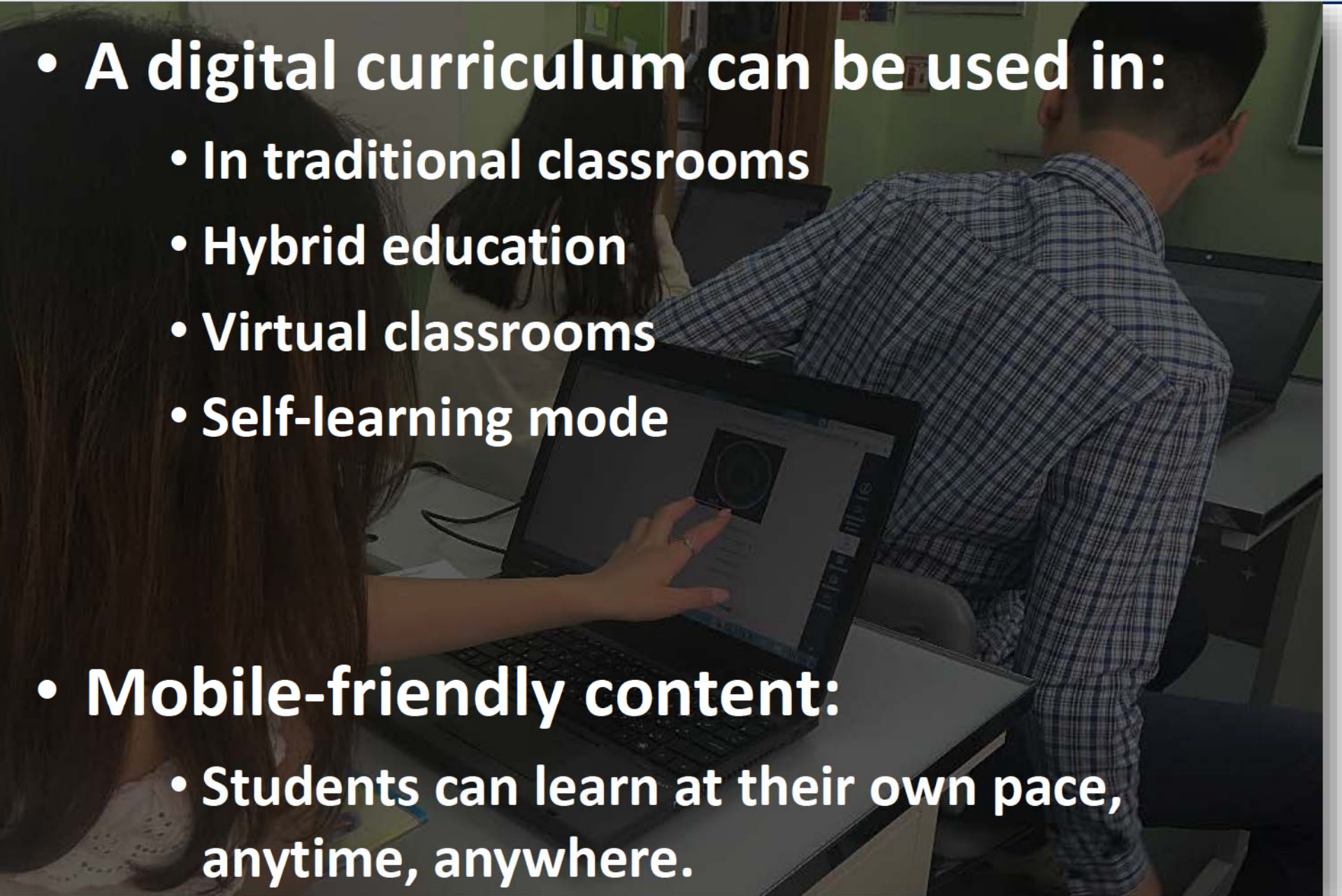
NEEDED **A NANOTECHNOLOGY CURRICULUM THAT IS:**

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



Designed for worldwide distribution

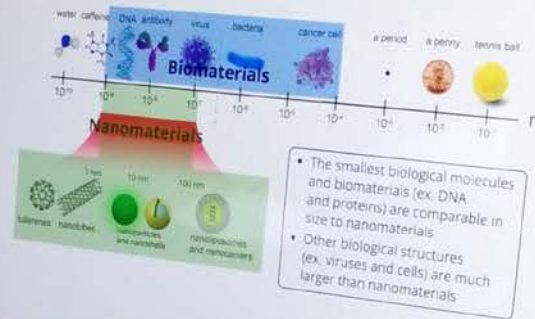
Versatile uses

- **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.
- 
- A photograph of a classroom setting. In the foreground, a student with long dark hair is seen from behind, looking at a laptop screen. The laptop displays a webpage with a circular graphic. In the background, another student is visible, and a male teacher or instructor in a plaid shirt is standing and looking at a laptop on a desk. The room has green walls and a window.

Preview of the digital textbook?

Biomaterials & Nanomaterials

To talk about bio vs nano tech, we have to understand the different materials.



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

info@omninano.org

Questions that came up

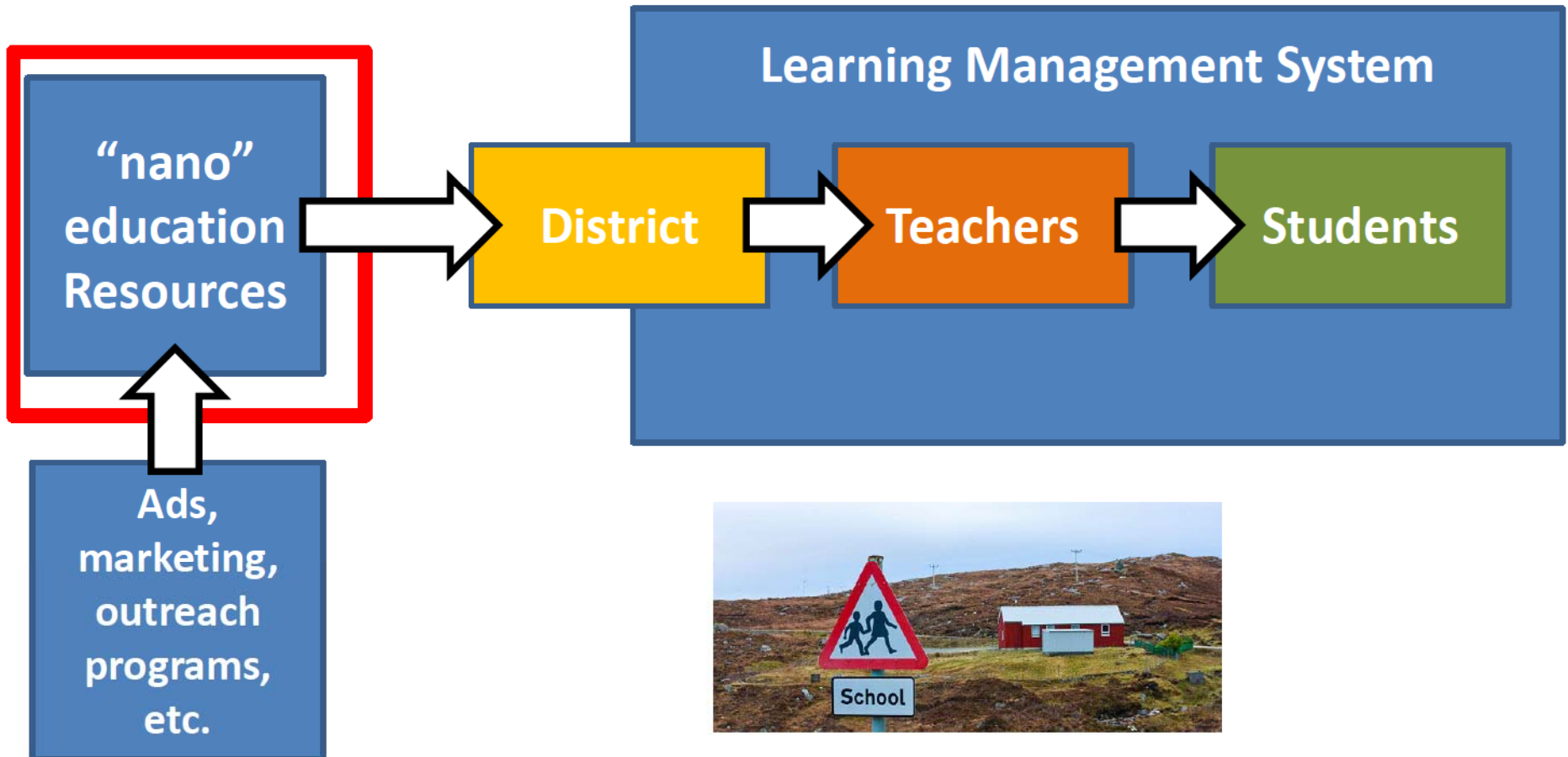
1. How do we distribute resources to schools?
2. How do we respect teachers' time?



Distribution

Solving the distribution problem

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



Google Ads & landing page

Free Online STEM Activity | LMS compatible | All Digital, Mobile Friendly

www.omninano.org/STEM/Activity

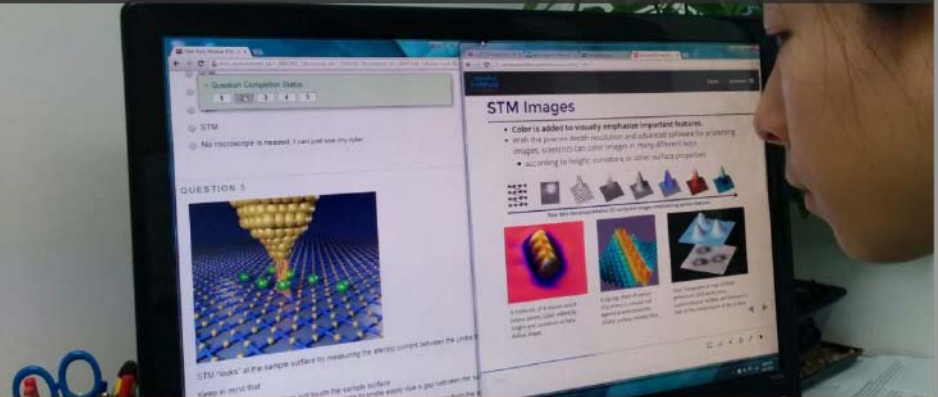
Free, fun, and inspiring STEM activity for high school students. Discover the tiny world of nanotechnology while having fun! Donate Online. Become A Volunteer. Sign Up For Newsletters. Need a customized image? Types: Carb...

[About our organization](#)

[About Omni Nano](#)

STEM Activity

How Mark Became a Nanotechnologist



Students and teachers love it!



"Now, we're looking into introducing a year-long course in nanotechnology!"

stem courses online nanotechnology

International Students: Extend Your HB1 Visa With **STEM**-certified Program. New Jan. Intake. Paid Internship Opportunities With Established Local & National Companies. Emerge Better. AACSB Accredited. SAS Approved. Curriculum · Business Analytics Master · GMAT waivers available · Expert Faculty

Ad · www.omninano.org/

Nanotechnology is the Future - A Growing STEM Field

What is **nanotechnology**? How will it affect your life in the near future? Find out here. Journey into **Nanotech** with our collection of quizzes, **free courses**, or TED talks. Learn About a New Career. Test your Knowledge. Learn **STEM Today**. Watch Videos.

[About Us](#) · [Past Testimonials](#) · [Workshops](#) · [Course](#)

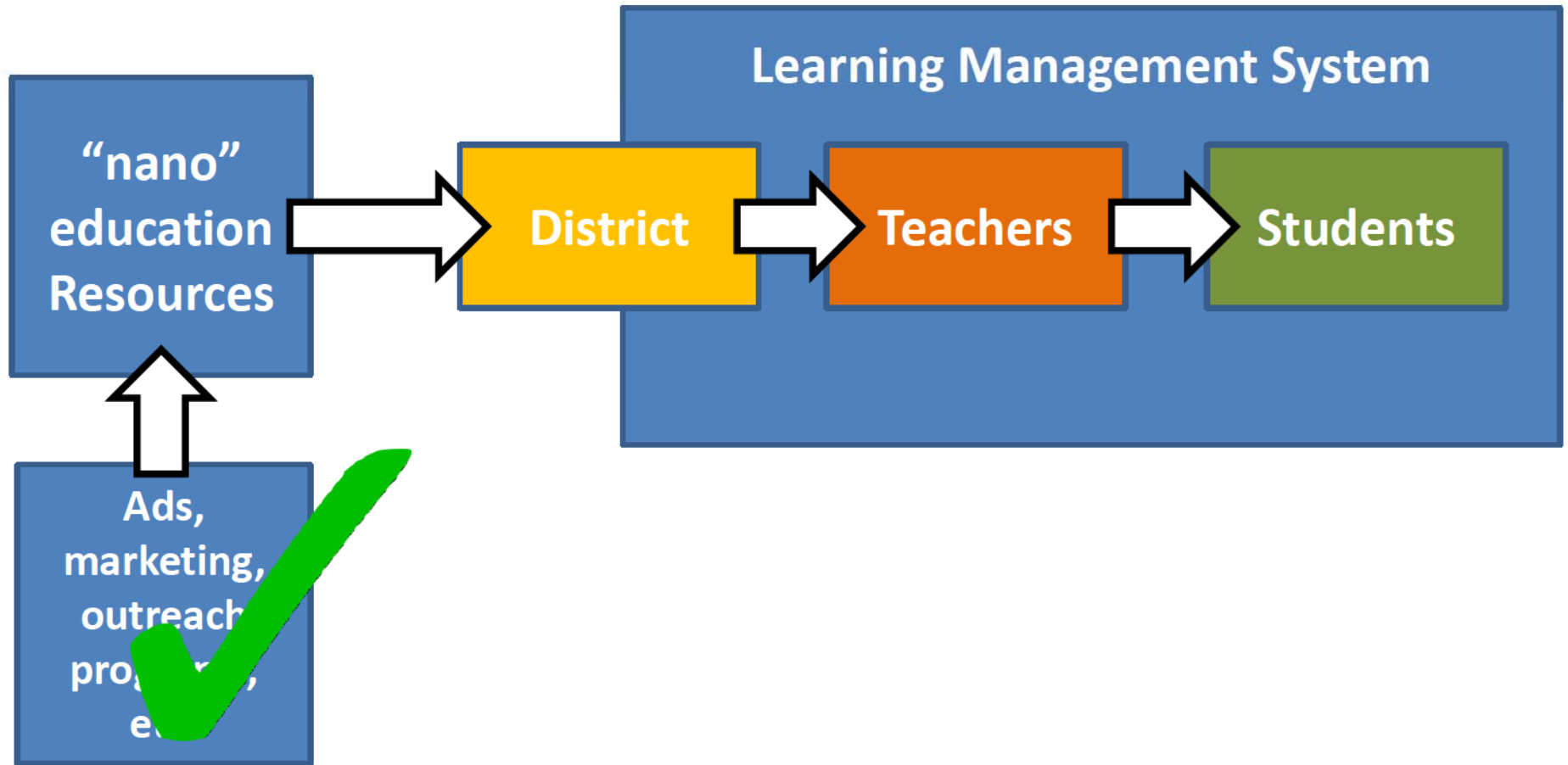
Request your course package here:

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

Full name*

Email*

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 \(check your Spam Folder!\)](#)

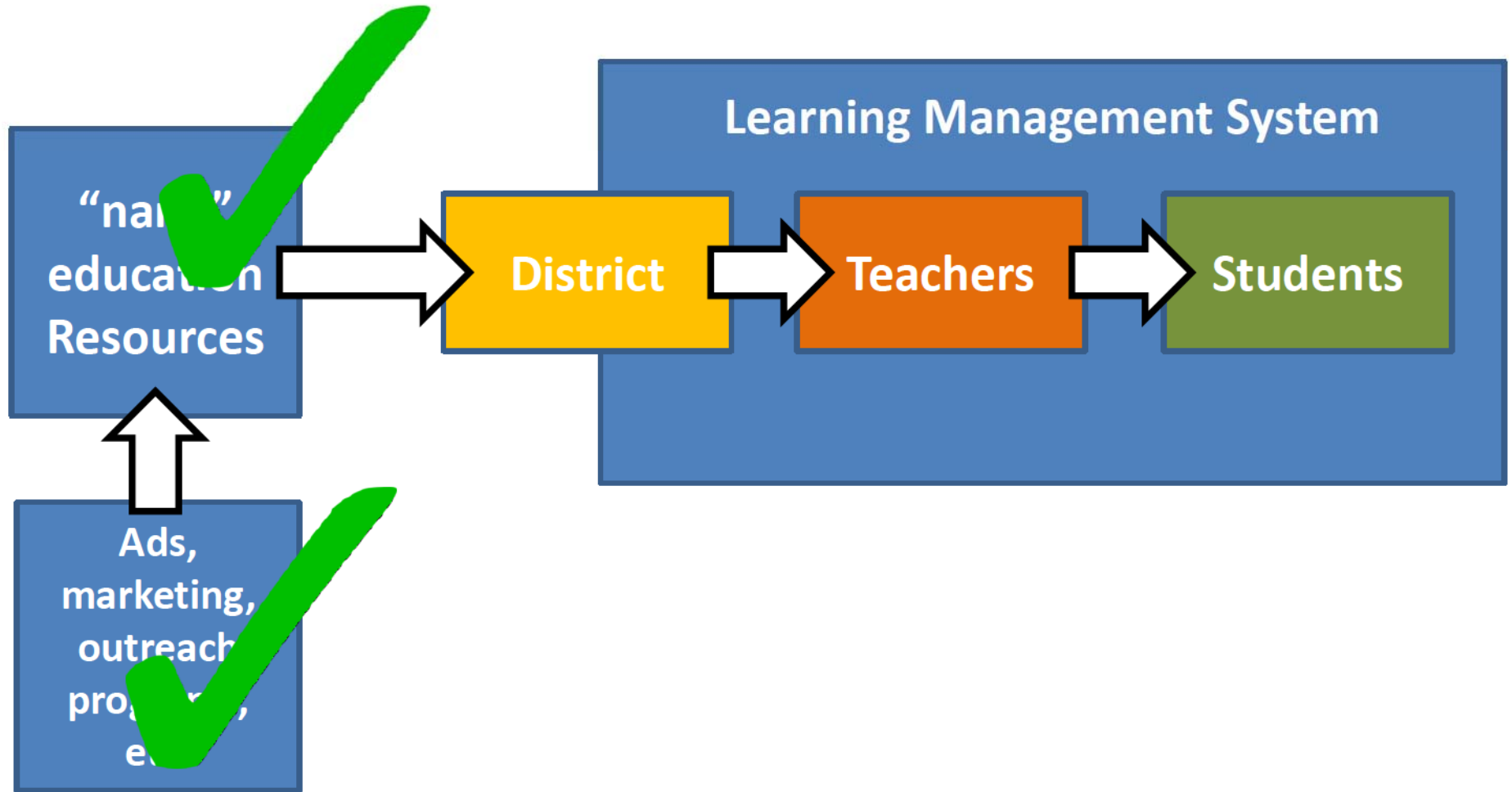
Course package – LMS compatible

My Drive > STEM-Activity-Package---Published 

Name ↑

-  1) START HERE (Includes Course Package LTI Accreditation) 
-  2a) Canvas-Import-Instructions---STEM-Activity-01---How-Mark-Became-a-Nanotechnologist.pdf 
-  2b) Canvas-Optimized---STEM-Activity---How-Mark-Became-a-Nanotechnologist-003-092020.imsc 
-  3a) Schoology-Import-Instructions---STEM-Activity-01---How-Mark-Became-a-Nanotechnologist.pdf 
-  3b) Other-LMSs---STEM-Activity---How-Mark-Became-a-Nanotechnologist-003-092020.imsc 

Solving the distribution problem



Import into the LMS

- Typically handled by the District LMS specialist

The screenshot displays the 'Import Content' interface. Red arrows and boxes highlight the following elements:

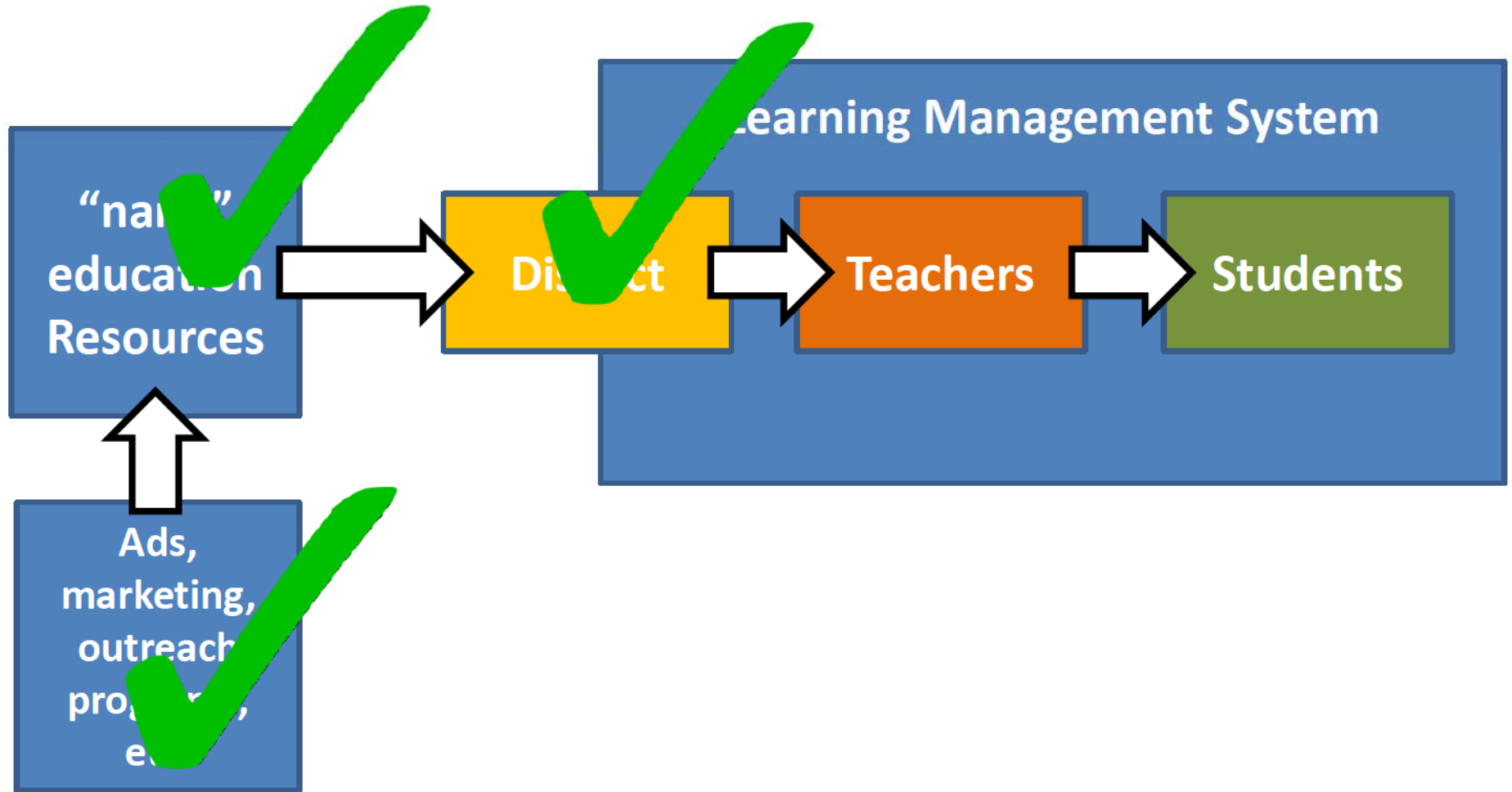
- (4) Points to the 'Content Type' dropdown menu, which is set to 'Common Cartridge 1.x Package'.
- (5) Points to the 'Source' section, which includes a 'Choose File' button and the text 'No file chosen'.
- (6) Points to the 'Default Question bank' dropdown menu, which is set to '-- Create new question bank --'. Below it is a text input field containing 'How Mark Became a Nanotechno'.
- (7) Points to the 'Content' section, where the 'All content' radio button is selected.
- (8) Points to the 'Options' section, which includes checkboxes for 'Overwrite assessment content with matching IDs' and 'Adjust events and due dates'. Below these is a 'Cancel' button and a blue 'Import' button.
- (9) Points to the 'Current Jobs' table, specifically to the 'Completed' status and '1 issues' count in the final row.

Current Jobs			
Common Cartridge	...-Nanotech_ThinCC.imssc	Aug 28, 2019 at 7:07pm	Completed 1 issues

LAUSD & Schoology

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

Solving the distribution problem



Imported & ready

Dashboard



FREE FOR TEACHER



Account



Dashboard



Courses



Calendar



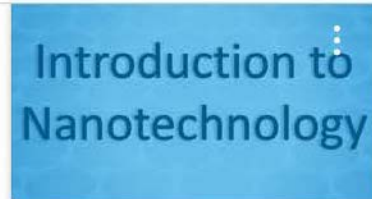
Inbox



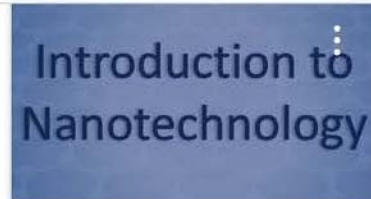
Commons



Help



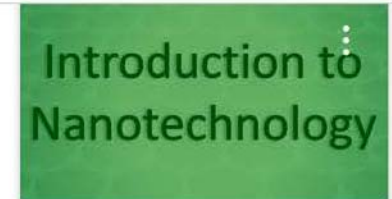
Introduction to Nanotechnology
Torrance HS Denisiu 19-20



Introduction to Nanotechnology
Valencia HS Nanochemistry 1...



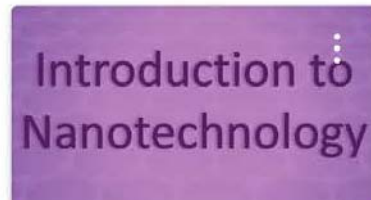
纳米技术基础 (PREVIEW: Introduc...
Chinese PREVIEW



PREVIEW: Introduction to Nanote...
OmniCoLab PREVIEW



PREVIEW: Introduction to Nanote...
Nazarbayev Uralsk PREVIEW



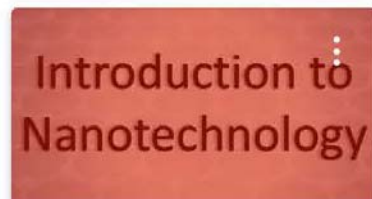
Granada Hills Charter
GHC-Nano-01



How-Mark-Became-a-Nanotechn...
Nano-Activity-01



Introduction to Nanotechnology
Nano-01 - ISRAEL SCI-TECH



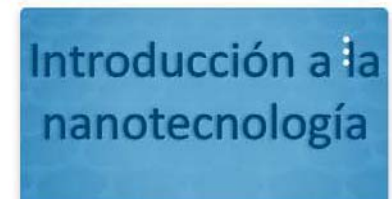
Introduction to Nanotechnology ---...
MOOC-001



Introduction to Nanotechnology ...
MOOC-Korean



Nano @ BASE 11
Nano@Base11




Nanotecnología MOOC en español
MOOC-002

Instructions for teachers

☰ ▼ Instructor Resources

☰  i) NGSS - Next Generation Science Standards information

☰  ii) Notes for instructors using Canvas

☰  iii) Notes for instructors using Schoology

☰  iv) Notes for instructors using other LMSs

☰  v) Suggested # of points per activity

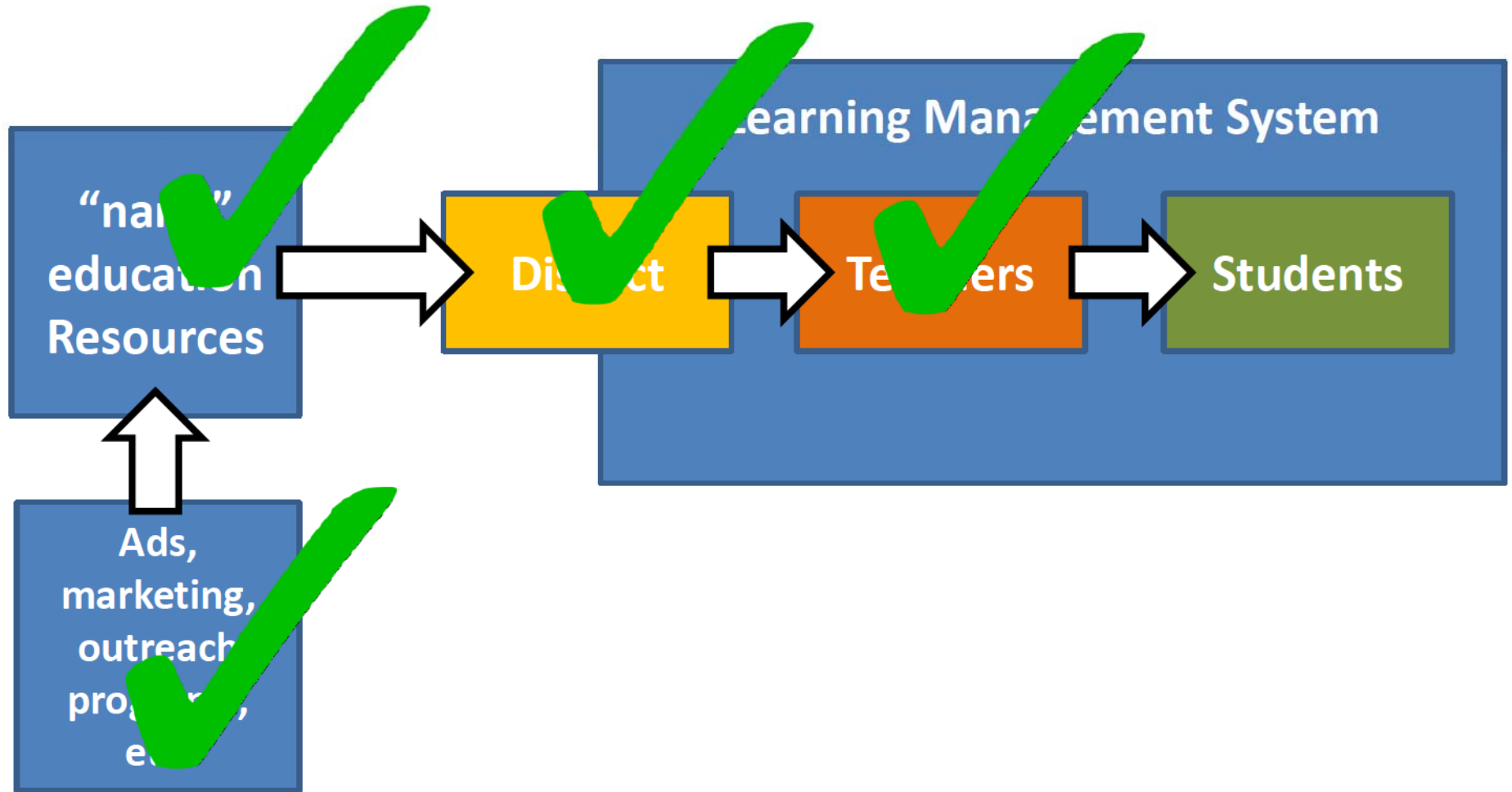
☰  vi) Other notes

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

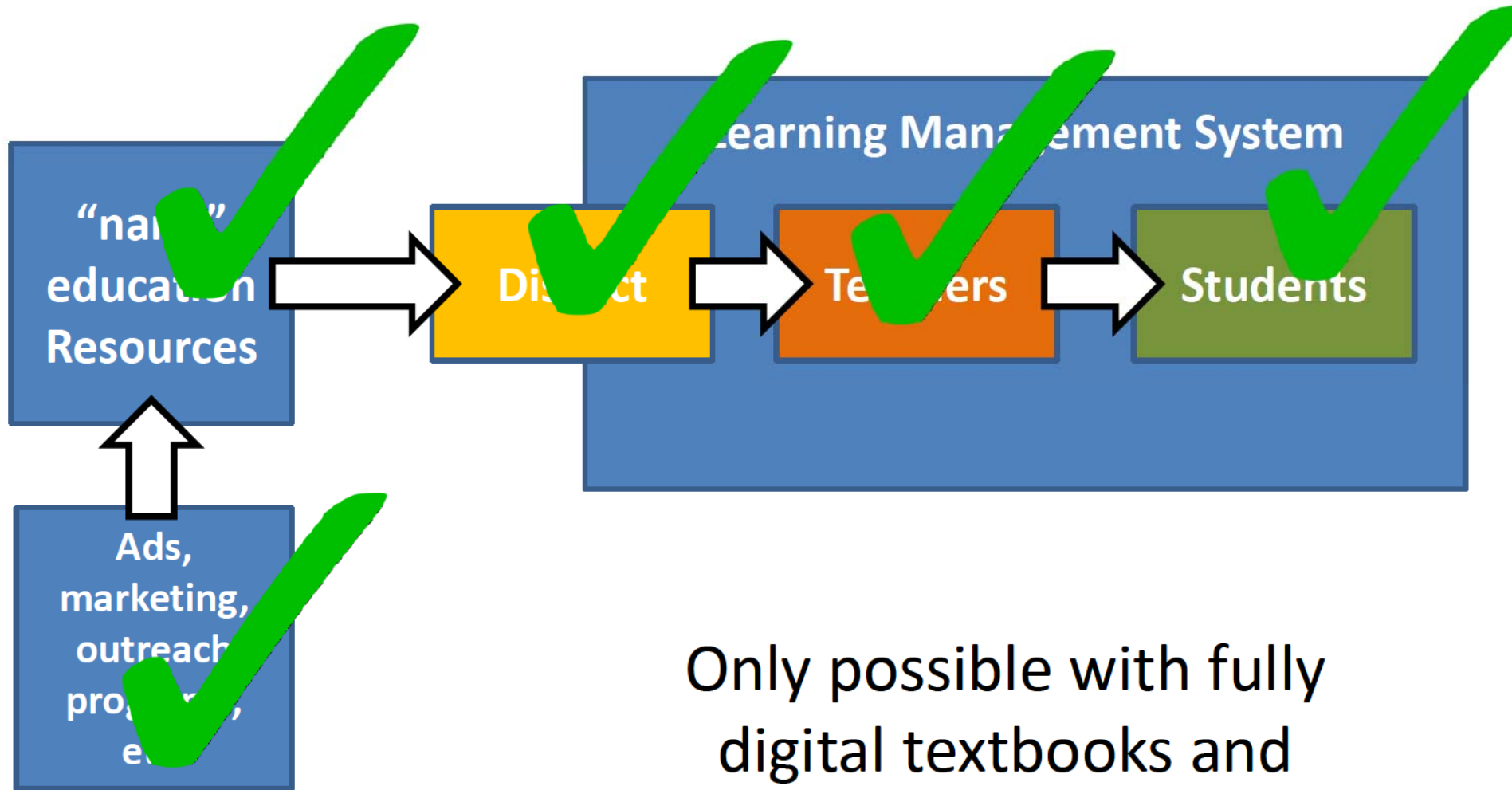


Accessible to students

The screenshot displays a learning management system interface. On the left is a dark sidebar with navigation icons and labels: Account, Dashboard, Courses, Calendar, Inbox, and Help. The main content area is titled 'Modules' and 'Grades'. It features a list of resources:

- Student Resources**
 - a) Student instructions
- STEM Activities: How Mark Became a Nanotechnologist**
 - 1) Meet Mark! (16 pts)
 - 2) What is nanotechnology? (35 pts)
 - 3) Mark taking classes in a cleanroom (37 pts)
 - 4) What is nanofabrication? (56 pts)
 - 5) Nanotechnology is the future! (33 pts)
 - 6) Where can I study nanotechnology?

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




Account




Dashboard




Courses




Calendar



Inbox



Commons



Settings

Modules

Conferences

NetTutor

Canvas Tutorials

Chat

Office 365

Library Resources

Zoom


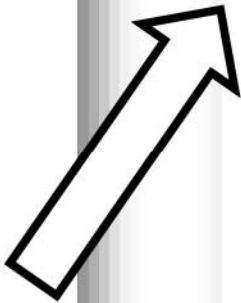
Ally Accessibility Report

Adjust-All HQ

Collaborations

Studio

Settings



100%

Overview Content

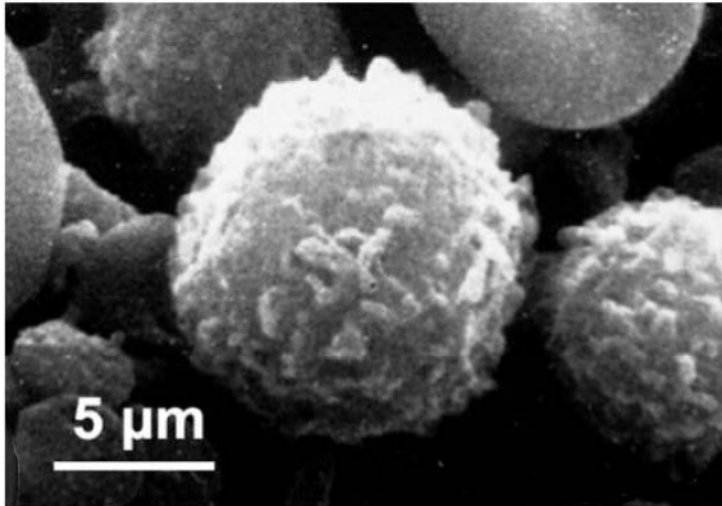
Name	Score
1) Meet Mark! Assignment	100%
2) What is nanotechnology? Assignment	100%
3) Mark taking classes in a cleanroom Assignment	100%
4) What is nanofabrication? Assignment	100%
5) Nanotechnology is the future! Assignment	100%
6) Where can I study nanotechnology? Assignment	100%
7) Extra credit! Assignment	100%

**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.



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

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

```
Type: MC
Score: 3, Partial
3) [HTML]<div style="font-size:1.5em; color:#1E1658;"><span style="color:#0080ff;"><em><strong>Beyond the
video</strong></em></span> – The microscopy image below shows a human white blood cell. What is its
approximate diameter? <span style="font-size:0.75em;"><ul><li><em><span style="text-decoration:
underline;">Hint:</span></em> Use the scale bar at the bottom.</li></ul></span></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.



Captions for students with hearing impairments.

Description for students with visual impairments.

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

- 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 standards

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

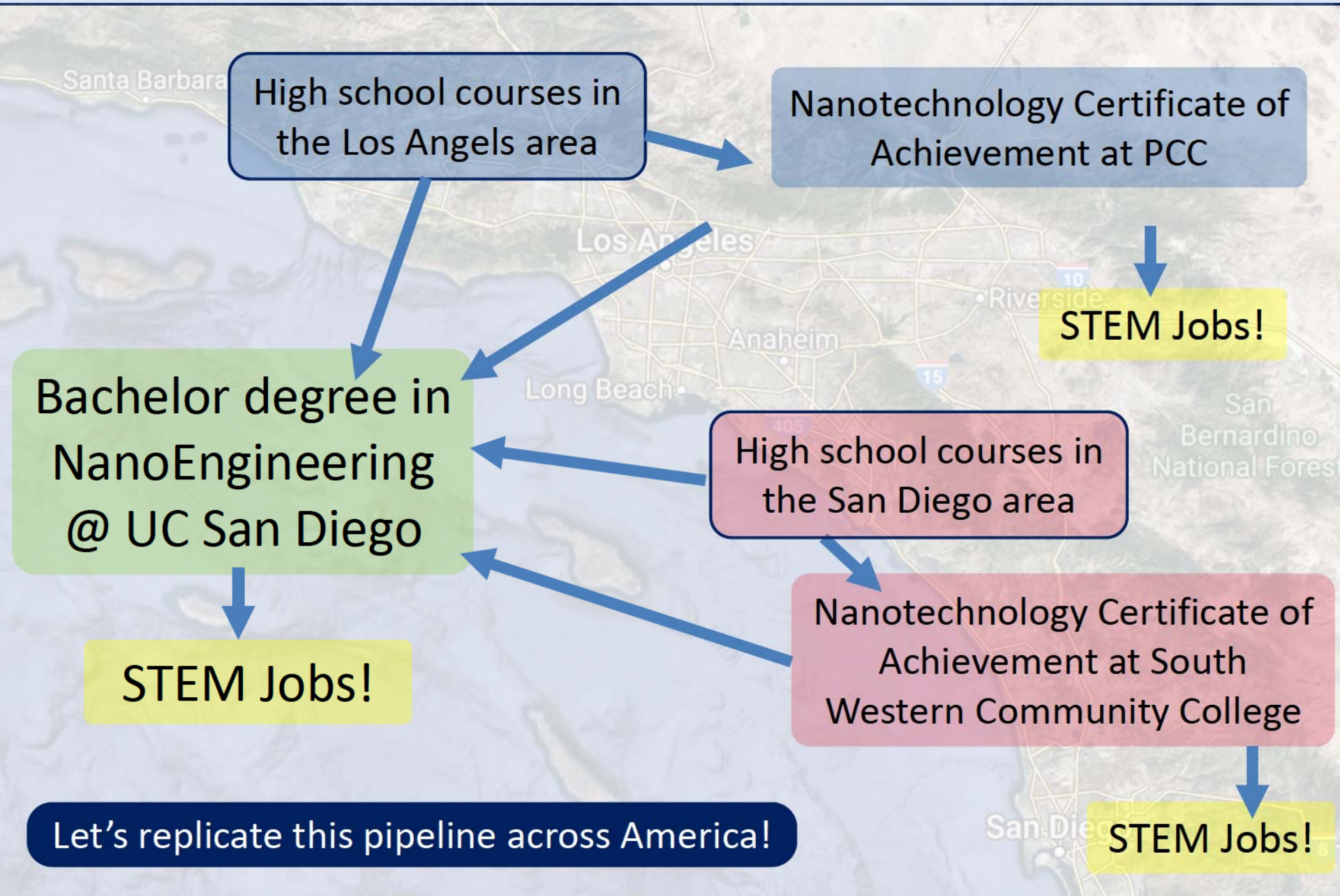
HS-PS2-6 -- Specific to this Activity:

- **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!

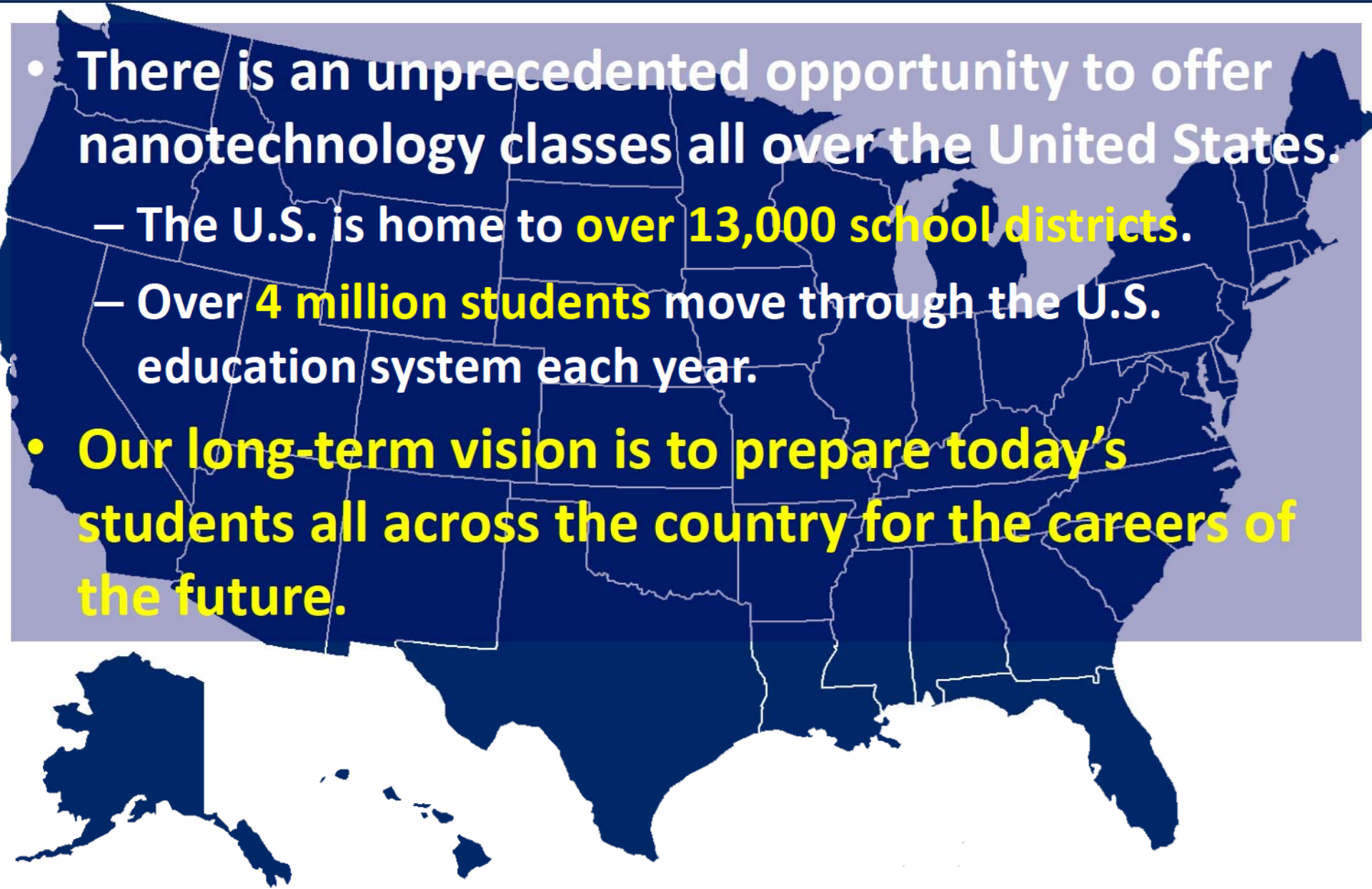


“Nano” education pathway in SoCal



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

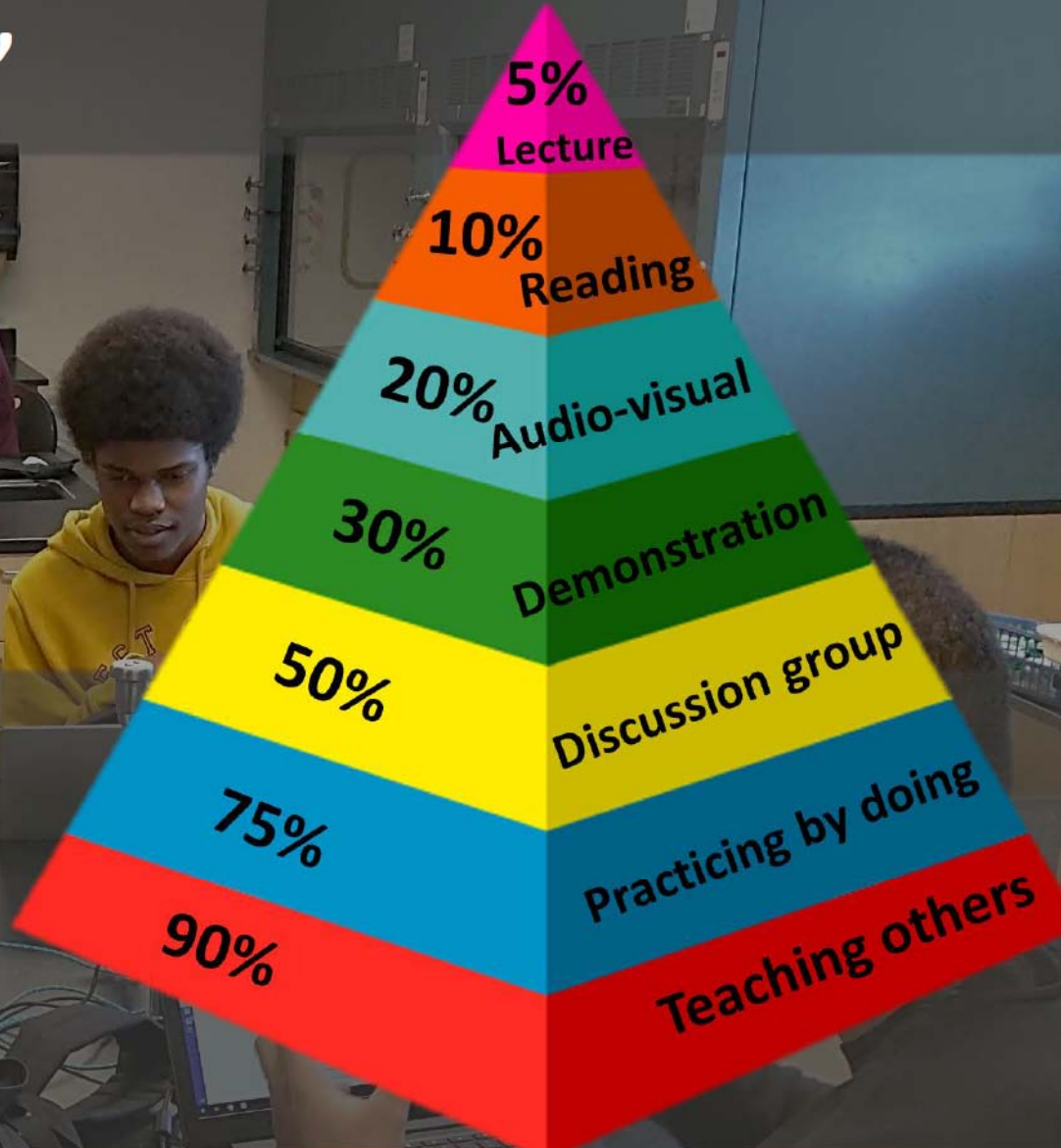
Digital content allows for frequent groups activities, building collaborative and interpersonal skills

- 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

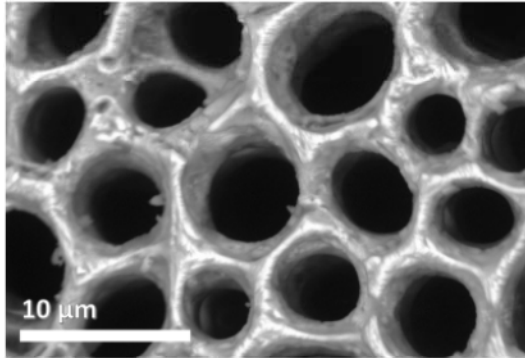


Sneak peek: assessments

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 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

Why do you think it's important for you to learn nanotechnology?



63%

26%

11%

47%

26%

16%

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

Why do you think it's important for you to learn nanotechnology?

• *Hint:* Think about the future of nanotechnology is headed, including future job opportunities.

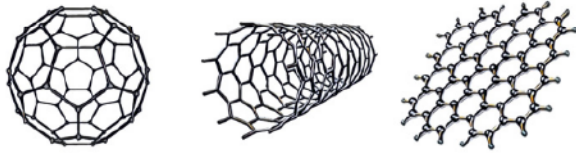
- 63% It has been predicted that nanotechnology will be at the core of many jobs related to science, technology, and engineering.
- 26% It can provide a way to keep our items/objects free of bacteria.
- 11% There is so much nanotechnology in our smartphones that we must know all of the details, even to make a simple phone call.
- 47% We want to live in a better place, and nanotech is at the core of green energy and environmental remediation.
- 26% We can choose better materials and devices to make our houses "smart" and well-insulated.
- 16% No answer

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%	<div style="width: 97%;"></div> ✓
Carbon fibers	11 respondents	4%	<div style="width: 4%;"></div>
Carbon nanotubes	255 respondents	98%	<div style="width: 98%;"></div> ✓
Buckyballs	247 respondents	95%	<div style="width: 95%;"></div> ✓
Buckminster Fuller	9 respondents	3%	<div style="width: 3%;"></div>
Graphite	11 respondents	4%	<div style="width: 4%;"></div>



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.

The image shows a vertical list of curriculum units and modules. The items are: Unit 6 – The Large Surface-to-Volume Ratio of Nanomaterials; Unit 7 – Basic Concepts of Materials Science; Unit 8 – Tuning the Properties of Nanomaterials; Module 80 - The Nano Effect and Quantum Confinement; Module 81 - Tunable Properties of Nanomaterials; Module 82 - Plasmonic Nanomaterials; Module 82; Module 82 - Assignment Group 1; Module 82 - Assignment Group 2; Module 82 - Assignment Group 3; Lab 8A - Plasmonic Nanoparticles (highlighted with a red box); ADD TO MODULE 82 - PLASMONIC NANOMATERIALS; Module 83 - Quantum Dots; Module 84 - Applications Requiring Customizable Optical Properties; Module 85 - Tuning the Dispersibility of Nanomaterials.

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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**For more, contact:
Dr. Marco Curreli
info@omnino.org**