EDTECH SANDBOX

Universal Design for Learning (UDL): Enhancing Accessibility Across Disciplines with JoVE

Presenters

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Universal Design for Learning (UDL) in STEM and Beyond

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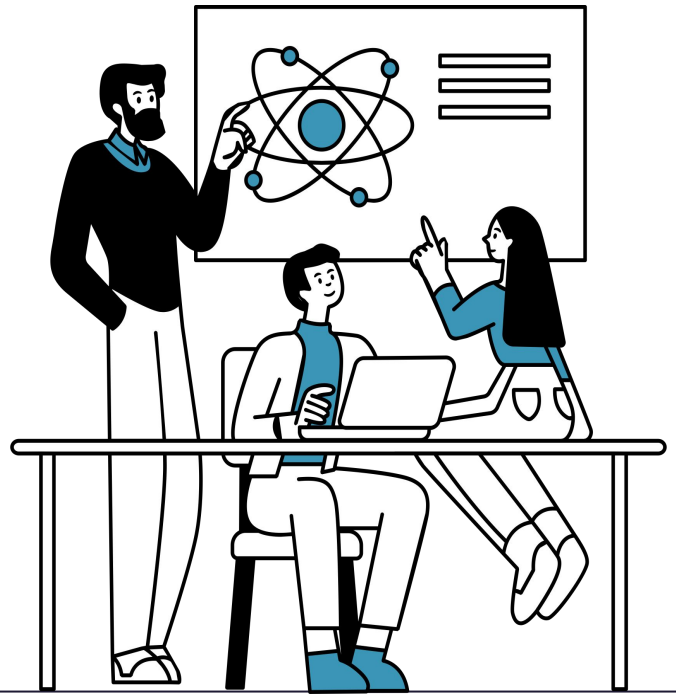
Challenges in STEM fields

- STEM courses often rely heavily on visual aids.
- Laboratory settings may not be designed to accommodate students with physical disabilities.
- Some STEM activities may not support assistive technologies.
- Traditional teaching methods.
- Symbols, acronyms and technical language.



Benefits of UDL

78%

Increase in student engagement

(Lombardi et al, 2021)

85%

Observed improvements in student learning outcomes

(Roberts et al ,2020)

74%

Reported increased job satisfaction

(CAST,2022)

Introduction to Universal Design for Learning

- Framework developed by the Center for Applied Special Technology (CAST) for designing educational materials and activities that are accessible to all learners.
- Emphasizes the need for flexible approaches that can be customized and adjusted for individual needs.
- Based on three core principles: multiple means of representation, multiple means of engagement, and multiple means of expression.

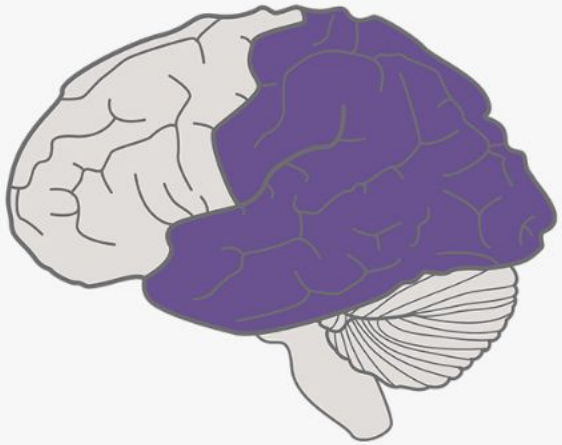
Three Principles of UDL

- Multiple means of representation: providing learners with various ways to access information and content.
- Multiple means of engagement: tapping into learners' interests, and challenging them appropriately.
- Multiple means of expression: offering learners different ways to demonstrate what they know.

Multiple Means of Representation

Multiple means of representation is the idea that learners should be provided with various ways to access information and content.

- Perception
  - Visual representations (graphs, equations, diagrams) accompanied by text description, audio and video explanations
- Language and Symbols
  - Plain language, consistent terminology, symbol glossary
- Building Knowledge
  - Hands-on experiments, interactive simulations, collaborative projects



Representation

Design options for perception, language and symbols, and building knowledge.

Multiple Means of Engagement

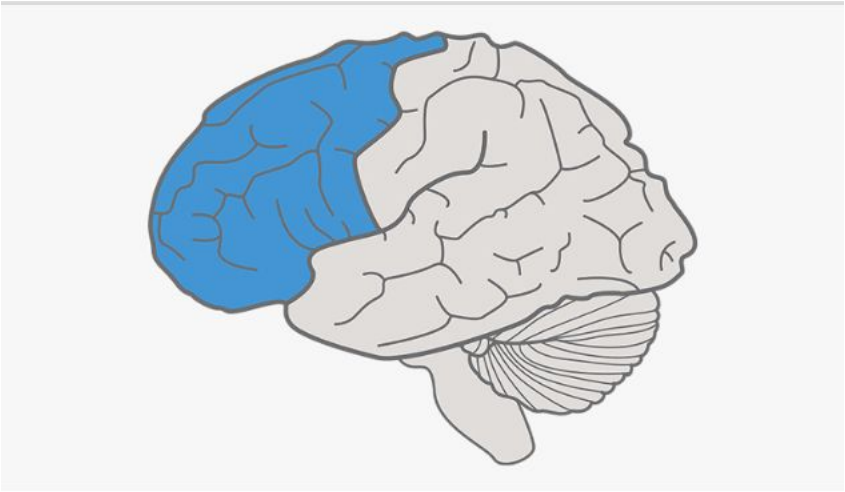
- Welcoming Interests and Identities
  - Recognize and integrate students' diverse interests and backgrounds into the curriculum.
  - Provide choices in topics and projects.
- Sustaining Effort and Persistence
  - Set clear, achievable goals to keep students motivated.
  - Use varied teaching methods
- Emotional Capacity
  - Foster a supportive atmosphere where students feel safe to express themselves and take risks.
  - Provide feedback that is constructive.

Engagement

Design options for welcoming interests and identities, effort and persistence, and emotional capacity.

Multiple Means of Expression

- Interaction
  - Encourage group projects and peer reviews.
  - Implement interactive simulations and virtual labs.
- Expression and Communication
  - Diverse modalities allow students to demonstrate their understanding.
- Strategy Development
  - Provide step-by-step instructions and support to help students develop complex problem-solving skills gradually.



Action & Expression

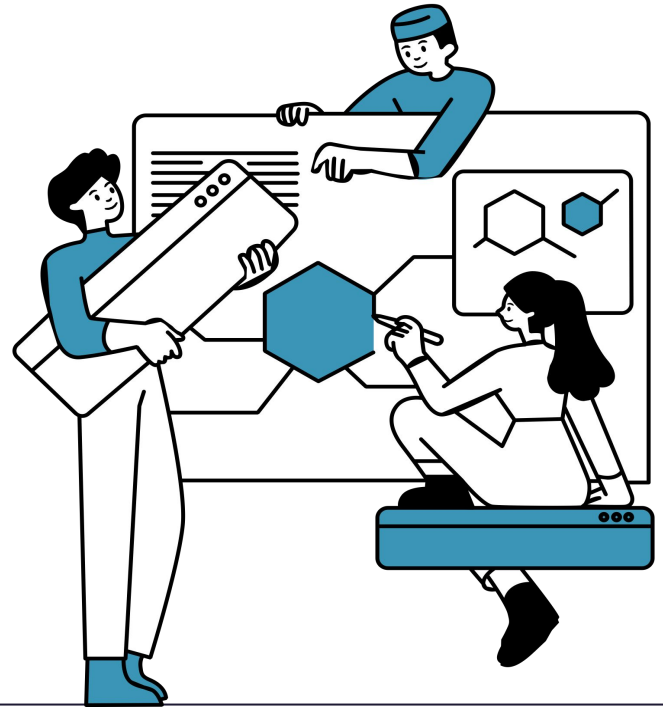
Design options for interaction, expression and communication, and strategy development.

Videos as Teaching Tools

- Can help students visualize complex subject matter in STEM courses
- Real-world applications of theoretical concepts.
- Used to demonstrate laboratory procedures and experiments in STEM fields
- Supplement to in-person lectures and classroom discussions in STEM education

Video Accessibility Considerations

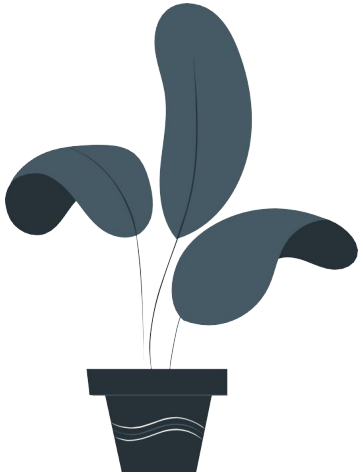
- Closed captioning and transcripts.
- Optimization for assistive technologies.
- Audio descriptions.
- Video pacing
- High-contrast visuals and readable text.



Universal Design for Learning (UDL): Enhancing Accessibility Across Disciplines with JoVE!

JoVE is the world-leading producer and provider of science videos with the mission to improve scientific research and education.

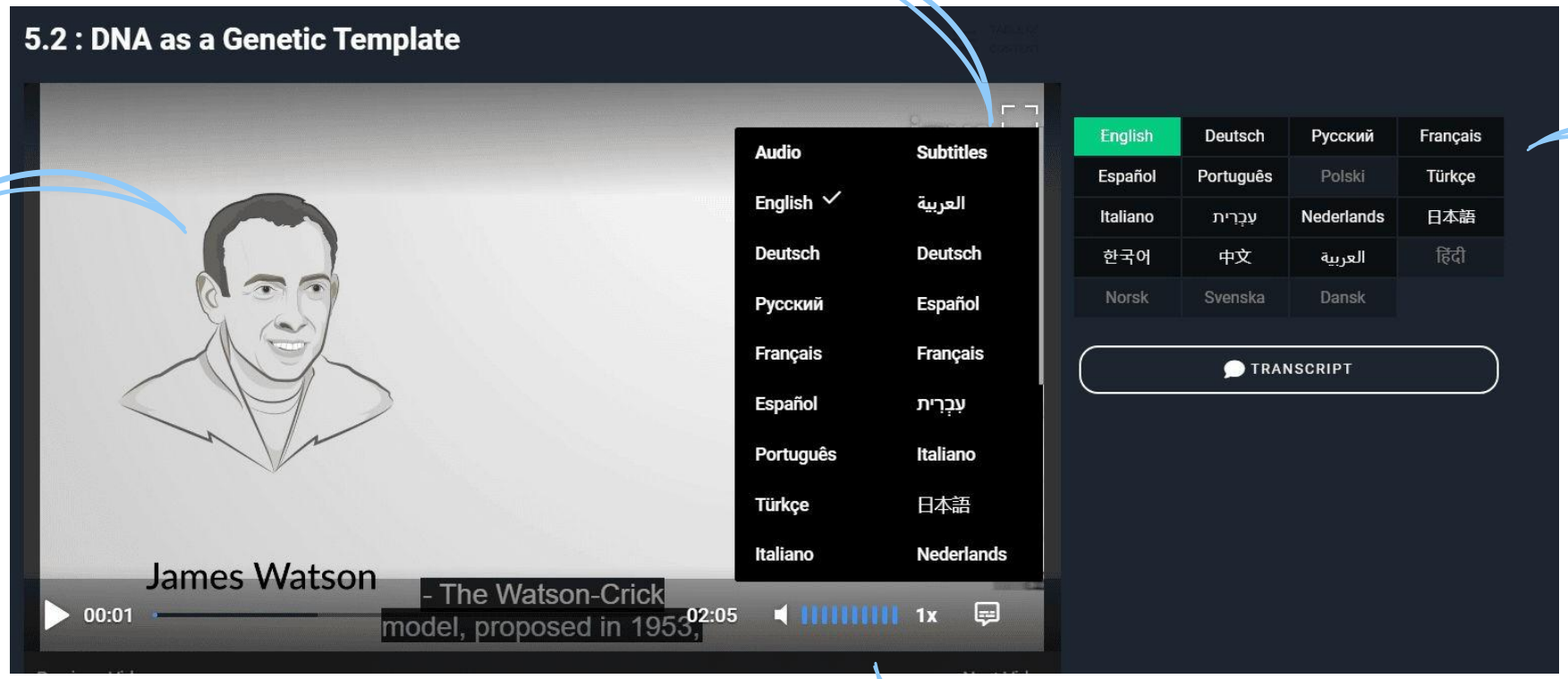
- 18,000+ Videos on Science Experiments and Concepts
- 1200+ subscribing institutions
- 66 million unique visits per year
- 343 million days spent on www.JoVE.com in 2023
- Almost 1 million years!



Building accessibility

Subtitles

Highly-descriptive audio



Multiple languages

Playback speed

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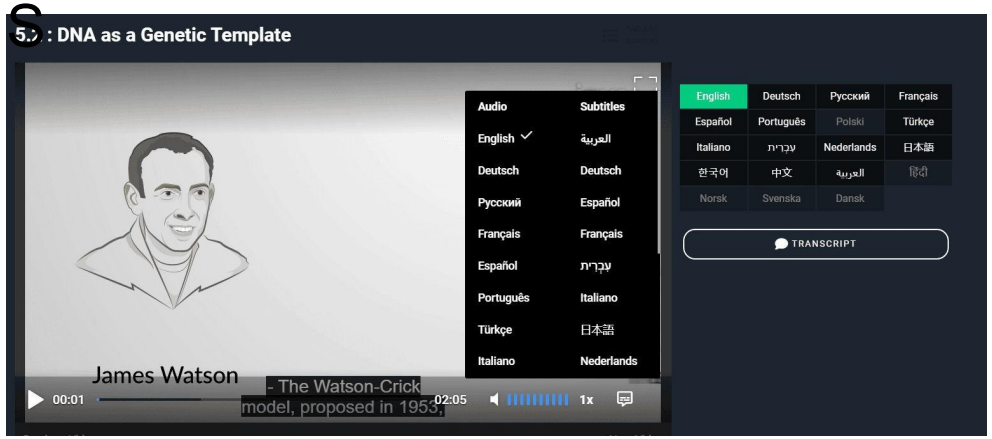
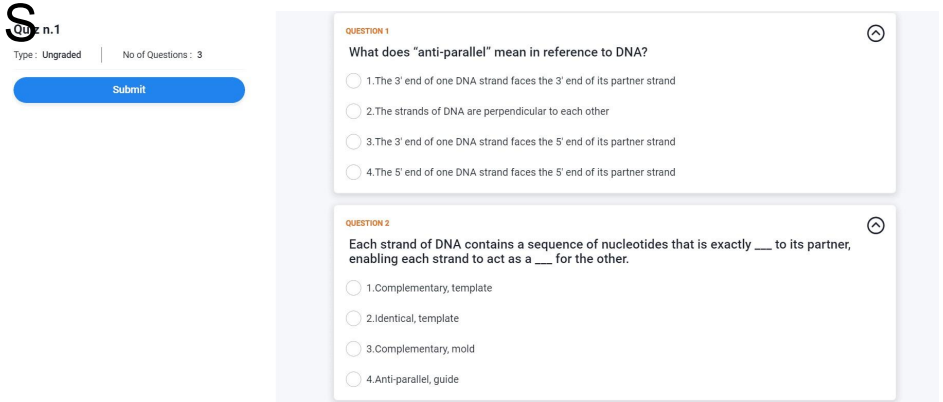
Features: Building Accessibility

VIDEOS



QUIZZES



TRANSCRIPTS

5.2 : DNA as a Genetic Template

Two structural features of the DNA molecule provide a basis for the mechanisms of heredity: the four nucleotide bases and its double-stranded nature. The Watson-Crick model of double-helical DNA structure, proposed in 1952, drew heavily upon the X-ray crystallography work of researchers Rosalind Franklin and Maurice Wilkins. Watson, Crick, and Wilkins jointly received the Nobel Prize in Physiology or Medicine for their work in 1962. Franklin was, controversially, excluded from the prize for reasons that are still debated.

The Watson-Crick model of DNA, very simply, proposed that DNA is made up of two strands of nucleotides that twist around each other to form a right-handed helix and that nucleotide pairing takes place between a purine and a pyrimidine.

The two DNA strands are antiparallel, meaning that the 3′ end of one strand faces the 5′ end of the other. This allows each strand to act as a template for its partner during DNA replication, producing two new strands of DNA that are exactly complementary to each other. However, whether or not DNA replication occurred in this fashion was not clear.

The Meselson and Stahl Experiment

Meselson and Stahl grew *E. coli* for several generations in a medium containing a "heavy" isotope of Nitrogen, ^{15}N. Over time, the heavy Nitrogen was incorporated into the nitrogenous nucleotide bases and, thus, into the DNA. After this, the *E. coli* was placed into a medium containing a different isotope of Nitrogen, ^{14}N, and grown for several more generations. After each generation, a DNA sample was isolated from some of the cells, loaded into a gradient, and centrifuged at high speeds. In a gradient, the DNA will separate according to its buoyant density (i.e. the density within the gradient where the DNA will float).

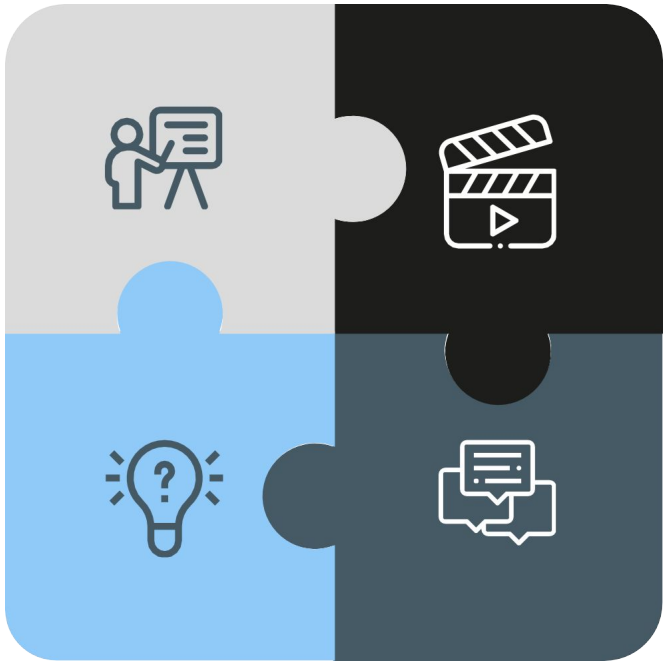
Case Study: Engaging Students in Class

Traditional lecture

Explanation of key concepts in short 10-minute modules

Snap quiz

QR code to ask students to answer using their phones



Short video

Consolidation through a 2-minute video, shown in class

Immediate feedback

Immediate results to assess the efficacy

Method adopted at the University of Pisa by Dr Sandro Francesconi, for his course in Chemistry aimed at engaging international students

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How do I select the right videos and quizzes?

- Contact us!
  - Information: representatives who will help you understand your needs
  - Support: JoVE-proficient scientists with a background in education
  - Mapping your course syllabus to the right videos
  - Support to integrate videos and quizzes within the main LMSs
  - (Learning Management Systems)
  - Personalised tutorials and webinars to help you and your colleagues

Thanks!

Do you have any questions? info@jove.com

For more information…

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Projets pilotes de technologies émergentes d'eCampusOntario - JoVE (français)

JoVE Product Page on Edtech Sandbox