Snapshot of Accomplishments

PhET Team Expanded

To address PhET’s growing research activities and international outreach plans, PhET has added five new members to their team.

New Funding

PhET has successfully acquired additional funding to bolster its global impact.

Mastercard: $1.5M (expected)
To expand the suite of PhET sims, add localization for use across Africa, and enable quality integration of sims into African education technology products and university instruction.

Organization of American States:
$10,000
To develop a virtual workshop on the use of science sims for the Caribbean.

Schmidt Futures: $500K
To advance development of PhET-iO simulations as a tool for learning research and engineering.

Sims Developed and Improved

The following simulations are under development with funding from this grant:
- Circuit Construction Kit - AC
- Density
- Buoyancy
- Geometric Optics

Other simulations have been identified for development, revisions, and cultural modifications.

Expanded Access through Teaching Materials and Workshops

24K+
teachers reached globally through short dissemination activities, such as presentations and webinars.

595
teachers in the Americas participated in extended PhET professional development activities.

40
teachers in Rwanda participated in extended PhET professional development activities.
Research

Goal 1: Build the research base on simulation-supported STEM expertise development.

To carry out new research to examine and further advance the educational value of PhET simulations

To prepare for expanded research activities, PhET conducted an extensive search and hired Dr. Loenora Kaldaras as a post-doctoral research associate working directly with Dr. Carl Wieman’s Research Group at Stanford University. Leonora (Lora) holds a Ph.D. in Education from Michigan State University and a M.S. in Chemistry from Bowling Green State University. Her work focuses on designing learning environments and assessments to support students in developing deep understanding of big ideas in science. She has worked with teachers and students in a wide range of educational settings, including middle, high school and undergraduate gateway courses in science. She is a co-author of award-winning NGSS-aligned curriculum materials for high school called “Interactions”. Her research with Dr. Wieman will study student learning and instructional design strategies to support the development of conceptual understanding and bridging conceptual and mathematical understanding across scientific disciplines.

Academic activities funded by this grant will support explorations to answer the following research questions:

- How well do students learn predictive frameworks through sim-based educational activities?
- How well does this learning process transfer?

Possible complex models for Lora’s study may include Gas Laws and Acids and Bases simulations, among others.

Lora’s work will ultimately focus on the cognitive process of learning about fundamental science concepts and problem-solving skills. Her work will reveal the specific affordances of various sims to teach science topics, including how they can be most effectively designed as different representations and used to serve as formative assessments to:

- reveal student thinking for teacher intervention,
- provide feedback for self-assessment, and
- promote interaction and engagement.
Access

Goal 2: Expand simulation content coverage and access.

To complete the design and development of 8-10 next-generation HTML5 PhET simulations for both physics and chemistry, filling in some of the most critical conceptual gaps in the current collection.

Simulations

The following simulations are under development, with partial or full funding support from this grant:
- Circuit Construction Kit - AC
- Density
- Buoyancy
- Geometric Optics

The team expects to have at least three of these four simulations published by the end of 2021. Other simulations have been identified for development, revisions, and cultural modifications.

Offline Access

In January, PhET released the first version of the PhET offline desktop app. Users download and install the desktop app onto their Windows or MacOS computer, providing seamless use of all HTML and Java simulations without internet access.

Localization

Language: As part of its plan to make PhET as accessible as possible, the team is working with its Africa specialists to identify translators for languages not currently available among PhET’s 97 language options. All 90 simulations have been translated into Yoruba, a language spoken by approximately 52 million speakers, mostly within Nigeria and surrounding countries.

Usage Analytics: The PhET team has created two analytics reports that shed light on educational and technological tendencies across Latin America and Africa, including the following:
- Country-level usage sessions and downloads
- Traffic sources
- Common devices used, including screen resolution
- Languages

Throughout the grant, the team will track these analytics annually to observe any large-scale changes.

Culture: The team is also developing ideas for re-design of simulations that make use of analogies that lack cultural relevance in non-western cultures. For example, the Reactants, Products and Leftovers simulation uses sandwiches to illustrate ideas of chemical equations and limiting reactants. In cultures where sandwiches are not standard fare, this simulation will be adjusted for something more relatable, such as creating beaded necklaces with given patterns.
Teaching Materials
Goal 3: Create simulation-based lessons and teaching materials.

To create high-quality simulation-based lessons and teaching materials for each next-generation PhET simulation with a co-design approach which involves experienced secondary physics and chemistry teachers from US, Canada, Latin America, and Africa regions.

In Mexico, two teachers have been recruited to work on national curriculum-aligned lessons, which are currently in development under the supervision of the Latin America PhET Ambassador. Other initiatives in progress include the incorporation of PhET materials into a science textbook to be adopted by 30+ schools in the state of Veracruz.

In Colombia, in collaboration with IU Digital de Antioquia, PhET developed 20 sim-based lesson modules including student worksheets and teacher guides for biology, physics, and chemistry. These materials are accessible from the IU Digital Comunidad de Aprendizaje website, and also on the PhET Teacher Materials pages for their respective simulations.

To support self-paced professional development anywhere and anytime, PhET has designed and developed a virtual workshop template. This year, the Math Virtual Workshop was published and is now available in English and Spanish, and an English-language Science Virtual Workshop is under construction.

PhET has updated its curriculum alignment guides for the USA's Next Generation Science Standards Performance Expectations and the Common Core State Standards for Math, as well as added new alignment guides for Mexico's national science curriculum.

Alignment of PhET sims with NGSS

Download all files as a compressed .zip
Global Professional Development

Goal 4: Support global dissemination and teacher professional development.

To enhance offline dissemination and access of PhET simulations globally and create a network of partnerships between PhET and global, regional, and local partners with an ultimate reach of at least 2,000 STEM teachers through the train-the-trainer model.

Worldwide Activities

To prepare for expanded global initiatives, PhET conducted an extensive search and hired Rebecca Vieyra to support activities related to global professional development, dissemination, and partnerships. Rebecca brings her experience as a STEM education-focused program manager for the Inter-American Teacher Education Network of the Organization of American States. Previously, she served as K-12 Program Manager for the American Association of Physics Teachers. Rebecca is a prior high school physics teacher, and currently a doctoral candidate in Science Education at the University of Maryland. She received the Presidential Award for Excellence in Math and Science Teaching, and is an alumna of the Albert Einstein Distinguished Educator Fellowship where she advised NASA Aeronautics on education efforts.

PhET has engaged in extensive professional development and outreach activities across the globe, including those listed below.

Worldwide Dissemination

Presentations given by Dr. Carl Wieman

Brazil
July 19: NSEF Colloquium

Canada
March 31: McGill University

Myanmar (Burma)
January 15: Parami University

Netherlands
January 28: University of Groningen

Saudia Arabia
August 16: KFUPM

United Kingdom
April 21: Cardiff-UCL DBER STEM Webinar

USA
January 15: National Partners in Science Conference
September 8: The Optical Society

Partnerships

mEducation Alliance
PhET joined a global partner in the alliance’s math-focused initiative, MathPower!, and is participating as a panel member in its September global virtual event.

Virtual Pro
Virtual Pro - an education technology company in Colombia - has integrated PhET sims into its digital laboratories.

Worldwide Professional Development

Philippines
March 3: Hosted by MinSCAT

Publications

Times Higher Education (August 31)

Follow the (learning) science and put problem solving at the centre of teaching

World Economic Forum (20 August)

This is how we teach young people to use science and data to make better decisions
Latin America and the Caribbean

PhET's work across Latin America and the Caribbean is carried out primarily by Dr. Diana López, a specialist in physics education who has extensive experience in teaching. Together with a number of on-the-ground partners in secondary and tertiary schools, Diana is leading initiatives to integrate PhET into undergraduate coursework, student textbooks, and teacher professional development programs.

**Mexico**
- May 28-29: Benemérita Universidad Autónoma de Puebla 3-hour online workshop "Inquiry Learning and PhET Sims" (50)
- September 2-November 11: Universidad de San Luis Potosí/Escuela Normal 40-hour online course "Teaching Math with PhET" for middle school math teachers (40)

**Costa Rica**
- July 6-8: Universidad Estatal de Costa Rica 3-hour online workshop "Inquiry Learning and PhET Sims" (9)

**Colombia**
- March 12: IU Digital face-to-face workshop for high school science teachers in rural regions (26)
- April 19-23: IU Digital online course "Active Learning" with PhET for 3,500 registrants across the hemisphere (370 completions)
- July 9-23: IU Digital face-to-face mini workshops for high school science teachers (60)

**Argentina**
- April 5-May 28: Fenómeno Phi, 40-hour online course "PhET and Inquiry" for middle and high school science teachers (40)
Global Professional Development (continued)

Africa

The PhET team has begun to lay the foundation for intensive work in Africa, adding three specialists. Zachariah Mbasu and Sola Olateju are respectively located in Kenya and Nigeria, and will advance professional development and dissemination efforts across Africa. Zach Mbasu is a prior math teacher and founder of African Maths Initiative with expertise in managing educational research projects and STEM camps across the continent. Sola Olusola brings experience disseminating and supporting the adoption of education technology solutions and teacher professional development across Africa. Nosa Oghafua is founder of Learnira, an organization engaged in teacher professional development using PhET sims in Nigeria, and is currently an MBA student at CU-Boulder.

This work will be accelerated with a substantial grant from Mastercard Foundation (currently in contract negotiations). In addition to funding HTML5 sim development, this grant will fund PhET partnerships for 10 African edtech companies, professional development with 12 universities, localization of sims for the African context, and a African-focused PhET webinar series.

Mastercard Foundation Network
PhET is working to establish connections with universities in the following countries:

- Benin
- Cameroon
- Ethiopia
- Ghana
- Kenya
- Rwanda
- Senegal
- Tanzania
- Uganda
- South Africa

South Africa
- Integration of 90 PhET simulations into Zibuza.net, a virtual platform funded by the Dr. CL Smith Foundation that provides free resources to thousands of math and science teachers.

Rwanda
- March 10-11: University of Rwanda 6-hour virtual workshop for 40 education faculty and leaders of a large World Bank funded curriculum project.