2014–15
Annual Report

R&D STEM
Learning Exchange
The Illinois Science & Technology Institute is proud to present its second annual report for the Research and Development STEM Learning Exchange (RDLE). This report provides an overview of the 2014–15 school year, detailing the activities of RDLE initiatives; the growth in partners; and key metrics, successes and learnings from the second year of implementation. It also outlines plans for the 2015–16 academic year.

ISTI staff

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Introduction to the R&D STEM Learning Exchange

The Research and Development STEM Learning Exchange (RDLE) is a coalition of more than 60 cross-sector partners dedicated to educating, recruiting, and retaining the next generation of Science, Technology, Engineering, and Math (STEM) talent for Illinois industry research and development (R&D).

The mission of RDLE and its partner organizations is to collaborate to develop, test, and refine high-quality R&D STEM education resources that promote inquiry-based learning, build critical thinking skills, and provide perspective on R&D applications within Illinois industry.

The R&D STEM Learning Exchange is led and managed by the Illinois Science & Technology Institute (ISTI). Founded in 2011, ISTI was formed as a nonprofit, affiliated entity of the Illinois Science & Technology Coalition (ISTC) to strengthen the Illinois talent pipeline for research and development careers.

In 2012, ISTI was selected to lead the R&D STEM Learning Exchange through a competitive process as part of Illinois Pathways, a public-private initiative created by the State of Illinois with Race to the Top funding to better prepare Illinois students for careers in STEM fields.

Through this strategy, Illinois Pathways developed several STEM Learning Exchanges to coordinate educational opportunities and leverage private sector resources in key sectors to better prepare students to compete in the global economy. The R&D STEM Learning Exchange is one of eight Learning Exchanges in the state. RDLE formally launched in mid-2012 after a comprehensive, yearlong strategic planning process. The 2013–14 academic year served as RDLE’s first year of providing services to Illinois schools, with growth seen in all areas in the 2014–15 academic year.

R&D STEM Learning Exchange: Growth by the Numbers

<table>
<thead>
<tr>
<th></th>
<th>2013–14</th>
<th>2014–15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students and teachers impacted</td>
<td>500</td>
<td>1,000</td>
</tr>
<tr>
<td>Partner high schools</td>
<td>14</td>
<td>26</td>
</tr>
<tr>
<td>STEM mentors supporting students</td>
<td>114</td>
<td>350</td>
</tr>
<tr>
<td>Teachers who completed professional development workshop</td>
<td>40</td>
<td>53</td>
</tr>
</tbody>
</table>
The Problem

By 2018, Illinois will demand 319,820 STEM jobs, and 93 percent of those jobs will require some sort of post-secondary education and training. In 2014, Illinois universities produced approximately 35,000 graduates with STEM degrees at all levels—28 percent of all degrees conferred by those institutions that year. While this figure has been steadily growing over the past 10 years, we must do more to meet the growing demand for qualified individuals in STEM fields.

A recent study by the National Center for Education Statistics found STEM graduates are more likely to be employed full time, to have just one job, and to have spent fewer total months unemployed. Average salary for STEM graduates was $65,000, compared with $44,500 for other respondents.

Illinois is a leading state for research and development activity, reaching $15.5 billion annually in R&D investment and expenditures from the state’s businesses, research universities, and federal labs. R&D plays an essential role in advancing new discoveries across basic and applied research, bringing ideas to the market, promoting economic growth, creating jobs, and maintaining Illinois’ competitive edge—which will all be driven by the talent behind these activities.

It is the goal of RDLE to provide opportunities and experiences that educate students about careers in STEM fields, in particular those related to research and development, to ultimately improve the pipeline of qualified talent for Illinois employers and post-secondary institutions.

Next Generation Science Standards

The RDLE mission and tools are consistent with the goals of the Next Generation Science Standards (NGSS)—adopted in Illinois and taking effect in the 2016–17 school year. NGSS provides a new vision for K–12 science and engineering education focusing on process skills, fostering students’ abilities to develop and test ideas and evaluate scientific evidence. Through STEM Challenges and using the Mentor Matching Engine, students engage in the science and engineering practices that are one of the pillars of NGSS.

Read more here about information on these practices, including the pedagogical underpinnings, detailed descriptions, and connections to the content.
### RDLE Partners

#### 2014-15 high schools
- Chicago Vocational Career Academy
- DePaul College Prep
- Glenbrook South High School
- Harlan Community Academy
- Hinsdale Central High School
- Holy Trinity High School
- Illinois Math and Science Academy
- Instituto Health Sciences Career Academy
- Lake View High School
- Lindblom Math and Science Academy
- Maine South High School
- Minooka High School
- Muchin College Prep
- Naperville North High School
- Niles North High School
- North Chicago High School
- Oak Park and River Forest High School
- Palatine High School
- Prairie Central High School
- Stevenson High School
- Urbana High School
- Von Steuben Metropolitan Science Center
- Washington Community High School
- Waukegan High School
- Wheeling High School
- Williamsfield High School

#### Post-secondary institutions
- Illinois Institute of Technology
- Illinois State University
- Loyola University Chicago
- Northern Illinois University
- Northwestern University
- Oakton Community College
- Southern Illinois University
- University of Chicago
- University of Illinois Urbana-Champaign

#### Industry and STEM Challenge partners
- Baxter International Inc.
- ComEd
- ISU Center for Renewable Energy
- Microsoft
- Motorola Mobility
- Motorola Solutions Foundation
- Northrop Grumman Corporation
- Takeda Pharmaceuticals
- TGG Group

#### Nonprofit and government organizations
- Argonne National Laboratory
- Brookfield Zoo
- Chicago Council on Science & Technology
- Fermi National Laboratory
- iBIO Institute EDUCATE Center
- Illinois Business Roundtable
- Illinois Junior Academy of Science
- Illinois Science & Technology Coalition
- Northwest Educational Council for Student NSERVE
- Shedd Aquarium

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*Teachers from Instituto Health Sciences Academy work with students on their STEM Challenge with Baxter.*
In the 2014–15 academic year, RDLE expanded the reach of its three key programs:

**STEM Challenges**
STEM Challenges offer high school students the opportunity to investigate and solve problems relevant to Illinois industry with the support of STEM professionals.

**Mentor Matching Engine (MME)**
The Mentor Matching Engine is an online platform that connects high school students and their teachers to STEM professionals who provide mentor support through student-led research.

**STEM Resource Repository**
The Repository provides connections to more than 100 high-quality STEM resources created for teachers, students, and parents, contributed by more than 50 Illinois companies and research institutions invested in STEM education.
RDLE seeks to impact a diverse group of students and teachers by ensuring that the tools of the Learning Exchange are customizable and accessible to users across the state and from all ability levels. We also want to pay special attention to ensuring our tools are reaching populations that are traditionally underrepresented in STEM—specifically girls, as well as African-American and Hispanic students. As a statewide initiative, we aim to connect schools in areas of the state that might not have access to these opportunities.

When high schools apply to become an RDLE partner school, a plan for implementation is made with the teacher(s) and administrators that is tailored to the school and their needs. This might include hosting a STEM Challenge and/or leading students in independent research through the Mentor Matching Engine. Both the Mentor Matching Engine and STEM Challenges can be implemented across schools with varying resource levels and experience with student inquiry, in a wide variety of class levels and topics. In addition, by harnessing technology through the Mentor Matching Engine, we can eliminate geographic barriers and help to build new industry and academic partnerships.

The commitment of each partner school includes:

- Agreeing to fully implement RDLE initiatives and provide regular feedback to measure impact and support continual improvement
- Appointing a coordinator for ongoing communications and school engagement
- Teacher participation in required professional development training
- Providing estimated demand and project timelines for mentors
- Ongoing integration of industry expertise via Mentor Matching Engine and other engagements
- Participating in data collection through teacher and student surveys and focus groups/interviews

### By the Numbers

#### Students by gender

- Male: 45%
- Female: 55%

#### Students by ethnicity

- Caucasian: 50%
- Hispanic: 30%
- African-American: 16%
- Asian and Pacific Islander: 4%

#### Participating RDLE teacher disciplines

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
<td>24%</td>
</tr>
<tr>
<td>Chemistry</td>
<td>17%</td>
</tr>
<tr>
<td>Physics</td>
<td>15%</td>
</tr>
<tr>
<td>Engineering</td>
<td></td>
</tr>
<tr>
<td>Environmental Science</td>
<td></td>
</tr>
<tr>
<td>Research and Inquiry</td>
<td></td>
</tr>
<tr>
<td>Health</td>
<td>(3%)</td>
</tr>
<tr>
<td>Psychology</td>
<td>(3%)</td>
</tr>
<tr>
<td>Other (Computer Science, IT, Food Science, Sociology, Nanotechnology, Geology, Urban Ecology, Anatomy and Physiology)</td>
<td>19%</td>
</tr>
</tbody>
</table>

Our Approach
STEM Challenges offer high school students the opportunity to investigate and solve problems relevant to Illinois industry. RDLE works with industry partners to customize each project to reflect a current and authentic research problem and spark student interest in R&D careers. R&D STEM Challenge projects are designed to teach the critical skills inherent in problem solving and STEM concepts by exposing students to R&D applications beyond the classroom. They also enable students and teachers to build relationships with Illinois industry and STEM professionals.

Projects during the second year of the STEM Challenges addressed topics as varied as water management, community health awareness, aerospace and defense, information technology, environmental sustainability, and behavioral economics. Teachers representing more than 30 disciplines guided these projects with the support of STEM professionals from the sponsoring industry partner who served as mentors.

**R&D STEM Challenge 2014–15 Participation**

<table>
<thead>
<tr>
<th></th>
<th>17</th>
<th>700</th>
<th>34</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teachers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Challenges</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**2014–15 STEM Challenges and Solutions Created by Students**

**Baxter**

**Participating schools:** Instituto Health Sciences Career Academy, Lindblom Math & Science Academy, Muchin College Prep

**The challenge:** How does the environment where you live and work impact your personal health as well as the surrounding environment?

**Example student solutions:** Students examined the presence of bacteria in their schools and developed new messages to educate classmates about the best methods to mitigate the spread of infection.

**Motorola Solutions Foundation**

**Participating schools:** Chicago Vocational Career Academy

**The challenge:** What new mobile technology applications and tools might you develop to help save lives and keep people safe in emergency and disaster situations? What types of critical information could be shared using technology?

**Example student solutions:** Students developed their ideas to incorporate technology solutions into emergency situations, including building athletic wear that can detect heart abnormalities.
Northrop Grumman
Participating schools: Oak Park and River Forest High School, Palatine High School
The challenge: Perform a trade study on a missile defense system that can detect and destroy hostile missiles before they can enter our country.
Example student solutions: Students performed a trade study, ultimately designing a Satellite Orientated Counter Missile System (SOCMS) that would use satellites to detect hostile missiles and signal the launch of a counter missile.

TGG Group
Participating schools: Von Steuben Metropolitan Science Center, Wheeling High School
The challenge: Identify a way in which individuals systematically deviate from rational decision making in a harmful way; develop a recommendation based on behavioral economics for reducing the harmful behavior; prove that your recommendation works and measure the size of its effects.
Example student solutions: Students used nudges and incentives to change human behavior such as eating habits and energy usage.

ComEd
Participating schools: DePaul College Prep
The challenge: How can we best help communities such as yours work together to leverage and build awareness of existing and new opportunities to increase energy efficiency and the reliability of their power supplies?
Example student solutions: Students focused on building awareness within their community around saving energy and smart-grid technology.

Takeda Pharmaceuticals
Participating schools: Maine South High School, Waukegan High School
The challenge: Address the problem of low participation in pediatric studies in one of Takeda’s therapeutic areas and recommend solutions for increasing participation, which might specifically target compliance and diversity.
Example student solutions: Students aimed to develop a complex database to be able to build awareness of clinical trials using demographic information to educate groups of individuals, changing tactics based on the group needed for a particular trial.

Microsoft
Participating schools: Lake View High School
The challenge: Join Microsoft in using tools like sensors and analytics to diagnose and ultimately solve the water management issues in your community, which will help provide solutions for the greater Chicago region.
Example student solutions: Students combined a bioswale with hydroponics to create a hydroswale to address the issue of urban flooding in their community.
Motorola Mobility Foundation  
**Participating schools:** Niles North High School  
**The challenge:** How might we use mobile phones to investigate and solve a current problem for people in our local or, possibly, global community? What would it take to make these new or new uses of technologies work, and what are their potential for future applications?  
**Example student solutions:** A team of students developed a mobile app for individuals with mobility impairment that would help them to assess the accessibility level of public transit and buildings.

Illinois State University Center for Renewable Energy  
**Participating schools:** Glenbrook South High School, Urbana High School, Washington Community High School, Williamsfield High School  
**The challenge:** How can we evaluate our critical energy needs and develop a prototype or plan for an energy-efficient system that can provide reliable power for the community in the midst or aftermath of a weather-related power outage?  
**Example student solutions:** Students at Washington High School, whose town was devastated by tornadoes in 2013, created a floor tile to be placed in high traffic areas where the force of people walking would generate power in an emergency.

STEM Challenges: Process and Participation  
During the summer of 2014, RDLE worked with the nine industry partners to develop their STEM Challenges and matched the industry partners with partner schools and teachers. Each industry partner also identified two mentors to work with each school.

Participating teachers at RDLE partner schools attended a professional development and training session on October 10, 2014, at Northwestern University where they were introduced to their Challenge or problem statement and to their industry partner. RDLE brought on coaches—former teachers with experience in problem-based learning—to work directly with teachers throughout the Challenge and support them with classroom integration and implementation of the Challenge. The remainder of first semester was used to build relationships between teachers, students, and coaches; assign industry partner mentors; and plan for implementation of the Challenge.

The Challenge kicked off in January and February 2015 on-site at the school or industry partner’s office to present the Challenge and allow the students to meet the professionals who would be helping to guide them. Mentors shared information about their companies, explained the Challenge they were facing in the industry, and laid the groundwork for students to begin their research. After the kick off, students had the spring semester to work in teams to investigate the problem and develop multiple solutions in response to the presented Challenge or problem statement. Mentors committed to two or three in-person engagements both at their institution and in the schools, with supplemental engagements through the Mentor Matching Engine and videoconferencing sessions.
At the project culmination, students presented their solutions to their industry partners at a one-on-one presentation with their Challenge host. Ultimately one group of students from each school was elected to present their research and solutions to their industry partners and representatives from the Illinois STEM community at a half-day capstone event hosted by the R&D STEM Learning Exchange at Motorola Mobility on May 20, 2015. Students from 16 high schools across Illinois presented to more than 200 industry partners and university representatives, in addition to their peers.
Watch the videos below to learn more about STEM Challenges

**STEM Challenges Student Showcase Highlights**

**WGN Feature: Students Team up to Tackle Problems Using STEM**

Press Coverage of RDLE STEM Challenges

- **Students Team up to Tackle Problems Using Science, Technology, Engineering and Math**
  
  *WGN News (TV)*

- **R&D STEM Learning Challenges Ask High School Students To Solve Industry Problems**
  
  *Chicago Inno*

- **High Schoolers Take on Missiles, Solar Energy STEM Challenge**
  
  *Chicago Tribune/Pioneer Press*

- **Students Rise to the (STEM) Challenge**
  
  *News-Gazette*

- **Lake View High School Students Shine at STEM Learning Exchange Challenge**
  
  Microsoft blog post

- **Students Step up with STEM Solutions**
  
  *STEMdaily national newsletter feature*

- **Social Media**
  
  #STEMChallenge trending on Twitter and more than 450 tweets related to event
STEM Challenges: Testimonials

**STUDENT**

“The STEM R&D Challenge was an amazing experience, and I would recommend it to any student that would be interested. One of my favorite parts of the project was the brainstorming session where we came up with over a hundred ideas. From there we began narrowing it down until we came up with our final idea. It was amazing to be able to present our final idea to over 200 people. It gives students an idea of what becoming an engineer is going to be like, and it is amazing to be able to present and get feedback from professionals in the field.”

Gracie, Senior at Palatine High School

**INDUSTRY PARTNER**

“This is a great program for Chicago-area schools to enhance the STEM education for students in the community. With Takeda’s involvement, we get the opportunity to engage with future scientists of America, furthering their understanding of the contributions they can potentially make to healthcare. It’s an incredible experience for both sides.”

David Dieter, Takeda Pharmaceuticals

**INDUSTRY PARTNER**

“Microsoft is committed to helping young people capture opportunity through STEM initiatives not only in Chicago but across the globe. Our STEM Challenge partnership with ISTI and Lake View High School is a shining example of the commitment Illinois is making to its students, and we are proud to be a part of it.”

Shelley Stern Grach, Microsoft
“It was an amazing opportunity to work with these students. It was truly a great experience being involved with the coalition, and the student showcase event was very rewarding. Thank you for a very humbling experience; many years from now hopefully I can look back on this and say I help shaped the future innovators and entrepreneurs of Chicago.”

Sandy Spiers, Motorola Mobility Foundation

“The R&D STEM Learning Exchange has provided the students at Washington Community High School the opportunity to expand and improve our inquiry-based research projects by allowing a group of students to work on solving a STEM Challenge posed by our industry partner, Illinois State University’s Center for Renewable Energy. Through these programs offered by the R&D STEM Learning Exchange, the students of Washington are practicing and learning skills that will be required of them by future employers.”

Jennifer Miller, Washington Community High School

“We saw our kids’ confidence with communication really grow exponentially through the project. When we actually got to the presentation part, it was nice to see ninth graders with good posture leaning across the table to an engineer at Northrop Grumman and telling them, ‘This is what we want to do and this is why we think it’s going to work.’”

Matt Kirkpatrick, Division Head, Oak Park and River Forest High School
STEM Challenges: Strategy for 2015-16 Academic Year

In the 2015–16 academic year, the R&D STEM Challenge will expand to 11 Challenges projects in more than 20 Illinois schools.

To achieve this growth, RDLE staff will focus on these key items:

**Growth in existing schools:** RDLE is currently working with 16 partner schools from 2014–15 to determine how the program can grow within their schools to train more teachers and reach more students. For some schools, it will mean bringing this opportunity from an optional after-school enrichment environment to a classroom setting. For others, it will mean inviting teachers who did not previously participate to teach a Challenge project.

**Growth in new partner schools:** RDLE will also take on new partner schools that commit to hosting an R&D STEM Challenge in the 2015–16 school year and/or putting students on the Mentor Matching Engine who will seek mentors for independent research projects. This expansion is a customized approach based on capacity, as well as existing partnerships, geographic diversity, and the ability to scale in future years.

**Building on existing partnerships:** STEM Challenges have shown to be valuable tools for new partnerships, as well as enhancing existing partnerships that an industry partner might already have with a school or community. As we have seen with Motorola Solutions’ partnership with Chicago Vocational Career Academy (CVCA), and Microsoft’s with Lake View High School, the STEM Challenge brings a concrete project where both the students and partner have a interest. Sirisha Yadlapati, senior program director with the Motorola Solutions Foundation, said, “This was the first joint Motorola Solutions Inc./CVCA project where it was clear that lightbulbs were going off in students’ heads, leading to an unprecedented level of engagement. For the first time, students made a tangible connection between their IT curriculum, the real world, and potential career trajectories.” All stakeholders also get additional support in their partnership by being part of the R&D STEM Learning Exchange. We are also very interested in building on momentum at the community level, which is happening in a number of regions around the state.

**Integration with Mentor Matching Engine:** In order to better facilitate engagement between teachers, students, and industry partners, the Mentor Matching Engine has undergone technical enhancements to better provide virtual engagement that can easily accommodate student teams for STEM Challenges, as well as integrated videoconferencing. This year we will continue to encourage teachers to supplement the support their students receive from STEM Challenge mentors by using the Mentor Matching Engine to allow for further mentor engagement.
The Mentor Matching Engine (MME) is an invitation-based platform that connects Illinois high school students and their teachers to STEM professionals from industry and research institutions to support and enhance personalized, student-led research. Developed in partnership with the Illinois Mathematics and Science Academy (IMSA), this site allows STEM professionals to serve as mentors to guide students through student-led research around a project in an area of interest to the student.

High school students are exposed to multiple perspectives along the STEM pipeline through one-on-one mentorships with a STEM professional mentor. Using examples from their own organizations, mentors provide perspective on how R&D is applied beyond the classroom, giving students insight into the potential impact and reach of their research and applications in the real world. Students explore a topic of interest to them by developing a question that can be answered through an investigative research process. Students post teacher-approved research questions on the Mentor Matching Engine and request mentors with relevant subject matter expertise to provide guidance in a blog format that can accommodate document sharing and teleconferencing.

Teachers are at the center of the Mentor Matching Engine process and are critical in ensuring a productive student-mentor relationship by:

- Introducing basic research concepts in advance of students engaging with the Mentor Matching Engine
- Reviewing and approving research questions
- Monitoring interaction between students and mentors to ensure appropriate conduct
- Working with RDLE to anticipate demand for mentorship and subject areas in which mentors will be needed
- Providing ongoing feedback to improve the platform, process, and user experiences
- Ensuring that students respond to their mentor a minimum of once per week and communicate with their mentors in a professional manner
- Ensuring that mentors are thanked at the end of the project and the end result is communicated to the mentor
Mentor Matching Engine: Process and Participation

All teachers at our RDLE partner schools were introduced to the Mentor Matching Engine at the fall professional development workshop and were enthusiastic about its potential. By fall of the 2014–15 school year, 20 RDLE partner organizations appointed an internal mentor supervisor who identified and recruited more than 350 STEM professionals from within their organizations to serve as mentors. These mentors worked with individual students and student groups on independent research projects, matching with 240 students for this purpose. Mentors from RDLE partner organizations sponsoring a STEM Challenge were assigned to their specific partner school and were able to supplement in-person engagements with the students on the Mentor Matching Engine, so that students were able to consistently ask their mentors questions and receive prompt responses.

By the Numbers: Mentor Matching Engine Metrics 2014–15

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<thead>
<tr>
<th></th>
<th>2013–14</th>
<th>2014–15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students matched</td>
<td>35</td>
<td>242</td>
</tr>
<tr>
<td>Projects on MME</td>
<td>60</td>
<td>318</td>
</tr>
<tr>
<td>Students on MME</td>
<td>158</td>
<td>582</td>
</tr>
<tr>
<td>Mentors on MME</td>
<td>114</td>
<td>350</td>
</tr>
</tbody>
</table>

The 2014-15 academic year was the second year of implementation for RDLE, and it saw significant growth for the Mentor Matching Engine, as shown below:
Mentor Matching Engine: Strategy for 2015-16 Academic Year

After hiring a program manager to oversee management of the Mentor Matching Engine prior to the 2014–15 academic year, RDLE was able to provide a proactive and concierged experience to partner teachers, students, and mentors. Usership on the system grew more than 400 percent and brought the Mentor Matching Engine from a testing stage to full usage.

With the substantial growth seen on the platform over the 2014–15 academic year, and after receiving and reviewing user feedback through I-STEM’s evaluations and direct feedback, it was determined that the platform on which the Mentor Matching Engine was situated was not going to allow the program to continue to grow at its current rate.

To address this issue, RDLE and IMSA worked with developers to redesign and re-platform the Mentor Matching Engine over the summer of 2015 to be ready for the 2015–16 academic year. The new platform’s increased usability for teachers allows the program to continue to scale and for the number of partner schools and students to continue to grow. A lot of time was previously devoted to assisting the teachers with using the Mentor Matching Engine, and the new functionality frees up time that can be used for mentor recruitment and professional development efforts.

The new platform is ready for use for the 2015-16 academic year:
The Resource Repository is an open resource that offers teachers, students, and parents access to more than 100 high-quality STEM resources offered by more than 50 leading Illinois-based organizations, including RDLE partner companies and research institutions invested in developing Illinois’ future innovators. The Resource Repository hosts curriculum, summer programs, professional development opportunities, and local events aligned to NGSS practices by the owner of the resource. The Repository serves as central hub of STEM-focused programs and content as well as related resources in a digital library for students and teachers.

Resource Repository: Process and Participation

STEM leaders, including RDLE partner organizations, contributed the best of their organizations’ existing STEM curriculum, case studies, and resources to reach more educators and students. Teachers, EFE directors, and guidance counselors referred students to high-quality STEM resources and learning opportunities to help them explore R&D STEM careers. Teachers, students, and parents explored high-quality STEM resources and learning opportunities offered by RDLE’s partner companies and research institutions. RDLE also featured resources on the Repository through monthly newsletters.

By the Numbers: STEM Resource Repository 2014–15

<table>
<thead>
<tr>
<th>Number of unique users</th>
<th>Average page views per visit</th>
<th>Total page views</th>
<th>Average session duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,205</td>
<td>2</td>
<td>10,061</td>
<td>2</td>
</tr>
</tbody>
</table>

Students from Instituto Health Sciences Career Academy visit Baxter’s R&D facility.
ResourceContributors

AdlerPlanetarium
AfterSchoolMatters
ArgonneNationalLaboratory
Astellas
BenedictineUniversity
C2ST
ChicagoZoologicalSociety
CityCollegesofChicago
EasternIllinoisUniversity
CEO
Fermilab
GTLResources
HarvardGraduateSchoolofEducation

HinsdaleTownshipHighSchool
HiveChicago
I-STEM
iBioInstituteEDUCATE
Center
IllinoisInstitutedeTechnology
IllinoisJuniorAcademyofScience
MillikinUniversity
MindResearchInstitute
MotorolaSolutions
MuseumofScienceandIndustry
NASA

NilesTownshipDistrict219
NorthernIllinoisUniversity
NorthropGrumman
NorthwesternUniversity
OaktonCommunityCollege
CitywidePaytonMathCircle
PBS
RooseveltUniversity
SheddAquarium
SouthernIllinoisUniversity
CenterforWorkforceDevelopment

STEMSummit
STEMFunder
RDCEP(CenterforRobustDecisionMakingonClimate
andEnergyPolicy)
NetworkforTeaching
Entrepreneurship
SEE(Science
EntrepreneurshipExchange)
SERC(ScienceEducation
ResourceCenter)
ScienceFist
STEMFunder
UniversityofChicago
WheelingHighSchool

ResourceRepository:Strategyfor2015–16AcademicYear

RDLEstaffarefocusedonincreasingawarenessoftheseresourcesthroughsocialmediaandcontinued
exposurethroughothercommunicationschannelsliketheRDLEmonthlynewsletter.RDLEstaffwillpromote
theResourceRepositoryanditscontentstoreachnewusers,parents,guidancecounselors,andother
STEMinfluencers.RDLEpartnersareaskedtosupportthiscampaignbyalertingRDLEstafftopromotion
opportunitieswithintheirorganizationsandcommunities.

Inpreparationforthe2015–16schoolyear,RDLEhasbuiltoutsasectionoftheRepositorytohostSTEMChallenge
contentonline.TeachersandstudentswillbeabletoaccesstheChallengecontentprovidedtothem—a
taskthatinthepasthaddenbdoviaPDF.Thiswillmaketheinformationaccessibleanywhere,anytime.Students
willalsobeabletosubmittheirprojectsonlinethroughthisportalandseevideosandcasestudiesaboutpast
Challenges.Inthelongerterm,theResourceRepositorycouldhostChallengesonlineforschoolsthatarenott
formalRDLEpartnerssupporteddirectlybyindustry,butthatwouldliketousetheChallengecontentontheir
ownwithoutthesupportofmentors.ThiswouldhelpRDLEtoscaleSTEMChallengesandintegrateproblem-based
learningintomoreschools.
Evaluation and Outcomes

The R&D STEM Learning Exchange collects detailed metrics on its programs to track impact and outcomes from all users, in particular students and teachers. For a second year, RDLE worked with the University of Illinois’ I-STEM initiative as the external program evaluator. To frame this year’s evaluation, our evaluators focused on four key questions:

1. **Implementation**: Is R&D STEM Learning Exchange programming being implemented on schedule and as planned?

2. **Effectiveness**: Are the three initiatives (STEM Resource Repository, STEM Challenges, and Mentor Matching Engine) of the R&D STEM Learning Exchange program operating effectively? How might they be improved?

3. **Impact**: What student/teacher outcomes are associated with participating in the R&D STEM Learning Exchange program? What is the value added for participants in the R&D STEM Learning Exchange program?

4. **Sustainability**: What elements of the R&D STEM Learning Exchange are being sustained and how? What barriers to sustainability exist, and how can they be sustained?

Multiple data collection methods and sources were employed to obtain information from teachers and students to assess the impact of, effectiveness of, and satisfaction with the program. Data sources included a pre/post student survey, teacher surveys, a focus group, and individual interviews, as well as observations of program participants at RDLE events such as the STEM Challenge student showcase and professional development.
Impact

Impact on teachers: Teachers reported that their teaching style changed due to participating in RDLE programs. As a result of using problem-based learning (PBL) in the STEM Challenge, teachers reported that they are incorporating PBL into their curriculum as well as in other classes.

Further, participating in RDLE encouraged teachers to ask their students more open-ended questions, and they have begun giving students more freedom and time for their ideas.

Teachers reported that participating in RDLE allowed their students to be problem solvers, interact with real professionals who are solving real-world problems, and present in front of professionals.

Impact on students: Students reported having a better understanding of research and the skills required to do research as a result of participating in RDLE.

Students gained confidence in their research skills and ability to succeed in college. Students also increased their knowledge in planning and conducting a research project, learning how scientific knowledge is built, learning how to work collaboratively with others, developing a hypothesis, preparing a research poster for presentation, communicating with business professionals, and managing time efficiently.

Regarding interest in STEM—on average, students demonstrated an increased interest in pursuing a STEM major as a result of participating in a STEM Challenge, and their interest in pursuing a STEM career also increased.

Sustainability

During the 2015–16 academic year, RDLE is instituting a participation fee to create investment in schools, hold the program at high value, and avoid attrition, as well as supplement State funding. The majority of teachers would like to participate in RDLE next year, indicating commitment to sustainability.
In year three, RDLE will grow to more than 30 partner schools that commit to implement RDLE initiatives and provide feedback throughout the year, as well as growing within our partner schools. RDLE is proud of its success in engaging underrepresented students in STEM and will build on its goal to expand the level of diversity in each program area. As described earlier, RDLE looks at diversity as reaching underrepresented populations, as well as reaching traditionally underserved parts of the state.

**STEM Challenges**
RDLE plans to increase the number of schools participating in STEM Challenges by bringing on new partners to match with schools, as well as building on existing partnerships that corporations have with schools in their communities. RDLE is planning for growth of 10 percent in students participating in Challenges, including growth in participating urban and rural schools.

**Mentor Matching Engine**
RDLE aims to continuously add to the pool of mentors on the Mentor Matching Engine so that more students are able to use the platform and so there are mentors to meet the growing diversity of disciplines and research topics. This includes working with RDLE partner schools to track the number of students, the subject matter of the students’ projects, and the timeline of the students’ projects so that mentor recruitment can be targeted to meet the need of each RDLE school and student. RDLE plans to grow the Mentor Matching Engine to match 500 students with STEM mentors. It is also our goal to recruit 100 new mentors this year from our partner organizations to serve this growing demand. RDLE has already increased mentor recruitment efforts by establishing new partnerships for 2015–16 and hopes to grow the research and corporate institutions at which mentor recruitment events are held.

**Resource Repository**
RDLE would like to encourage further use of the Repository as a resource not only for our partner schools but also for all teachers and students to take advantage of. It is our goal to see a 10 percent increase in visits by the conclusion of the 2015–16 academic year.

**Professional Development**
RDLE will host its annual professional development workshop on October 9, 2015. This is a full day providing training and insight on best practices for leading students in a Challenge and independent research. Teachers will hear from their fellow RDLE partner teachers to learn about what methods worked well for them, what they would do differently, how to build links to Next Generation Science Standards, and how to best utilize RDLE resources such as Challenge coaches. This year there will be a workshop on design thinking and communication. These techniques can be brought back to the classroom to help students study a problem from multiple perspectives; learn how to frame the design challenge properly; ideate, prototype, and iterate solutions; and communicate their ideas clearly in design reviews, reports, and presentations. Teachers will also receive technical training about how to use the Mentor Matching Engine.
RDLE is also planning professional development webinars on an ongoing basis to take a deeper dive into topics that teachers have expressed interest discussing further, such as tips for engaging with mentors, teaching students to ask significant questions, and presentation strategies.

**Evaluation**
Through additional metrics, evaluation, and consultation with school districts, RDLE also seeks to measure more quantitative and longer-term student impact for each of our programs. RDLE will include a more robust evaluation plan for mentors to indicate their level of satisfaction and what RDLE can do to improve their experiences to make the most of their time and expertise.

**Partnerships**
The R&D STEM Learning Exchange is built on partnerships. The initiatives that RDLE has built rely on the idea of bringing diverse groups together in order to advance STEM education and expand opportunities for students. It is our goal to retain existing partners and add to the list of more than 60 members of our STEM coalition.

RDLE staff are always working to identify new industry partners and cultivate those relationships to find mutually beneficial ways to support the goals of each stakeholder. We are excited to bring on new corporate and post-secondary partners this year to host innovative STEM Challenges, as well as tap into the human capital talent in these organizations to lend their expertise as mentors on the Mentor Matching Engine.

In 2014, RDLE established a pilot partnership with the Network for Teaching Entrepreneurship (NFTE) Chicago. RDLE and NFTE came together using the Mentor Matching Engine as a tool to be a component of NFTE’s existing programmatic and in-person mentoring efforts. Now, not only can NFTE students ask their mentors questions during their time in the classroom, but they can share progress about their project on an ongoing basis through the Mentor Matching Engine. RDLE is open to and currently exploring other similar partnerships with complementary nonprofit partners like NFTE. This will help us to scale the impact of the Mentor Matching Engine and support the ecosystem of nonprofits in Illinois connecting students with mentors.

Building and maintaining partnerships with secondary schools is also a critical piece of the work of the Learning Exchange. Teachers are the lynchpin in a lot of work that we do—as they are the implementers. They are our link to students in the classroom and facilitate the work that they do. They are willing to try innovative ways of teaching and provide us with invaluable feedback about how RDLE programs can be implemented to better serve other teachers and their students. We are happy to have a number of our partner teachers serve as ambassadors for these initiatives, helping to grow the program both within their own schools and to other teachers throughout the state.
The RDLE Steering Committee meets every other month, and its members have lent their support and expertise as partners of the Learning Exchange. They also serve as program ambassadors within their own organizations and spread awareness of the R&D STEM Learning Exchange to their broader networks. We appreciate their commitment to the R&D STEM Learning Exchange.

### R&D STEM Learning Exchange Steering Committee Members

- **Meridith Bruozas**  
  Argonne National Laboratory
- **Alice Campbell**  
  Baxter International
- **Ann Vogel**  
  iBio Institute
- **Judy Scheppler**  
  Illinois Mathematics and Science Academy
- **Mark Harris**  
  Illinois Science and Technology Coalition
- **Dr. William Hunter**  
  Illinois State University
- **Gerald Doyle**  
  Illinois Institute of Technology
- **Linda Brazdil**  
  Loyola University Chicago
- **Adam Hecktman**  
  Microsoft
- **Matt Blakely**  
  Motorola Solutions Foundation
- **Kristin Brynteson**  
  Northwestern University
- **Dr. Kemi Jona**  
  Northwestern University–Office of STEM Partnerships
- **Martha Eldredge-Stark**  
  NSERVE
- **Dr. Lizanne DeStefano**  
  University of Illinois

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  Takeda Development Center Americas Inc.
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  Illinois Biotechnology Industry Organization (iBIO) & iBIO Institute

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