LEGO® Engineering Symposium 2009

Tufts UNIVERSITY | Center for Engineering Education and Outreach

LEGO Engineering for Girls: Building a diverse learning environment with LEGO

Day 1 — Monday, June 1st	Day 2 — Tuesday, June 2nd
REGISTRATION and BREAKFAST (7:15 – 8:30)	**BREAKFAST (8:00 – 8:30)**
Presentations (8:30 – 10:15) Diverse Learning Environment I: *What is the challenge we are addressing?* Chris Rogers, Asli Bilgin, Mitch Resnick, Natalie Rusk	**Presentations (8:30 – 10:00)** Diverse Learning Environment III: *What has worked well and why?* Lisbeth Valter Pallesen, Birger Brevik & Suyun Aidarov, Amy Eguchi, Morgan Hynes
BREAK (10:15-10:30)	**BREAK (10:00-10:15)**
Development labs (10:30 – 12:00) Theme 1: Story-making Theme 2: Competitions Theme 3: Data Logging Theme 4: Collaborative projects	**Development labs (10:15 – 12:00)** Theme 1: Story-making Theme 2: Competitions Theme 3: Data Logging Theme 4: Collaborative projects
LUNCH (12:00- 1:00)	**LUNCH (12:00- 1:00)**
Presentations (1:00-2:15) Diverse Learning Environment II: *Opportunities and challenges when we add LEGO tools to the mix?* Marina Bers, Cathy Helgoe, Eiirik Jatten, Monika Füglister, Kar Tin	**Presentations (1:00- 2:00)** Diverse Learning Environment IV: *Ideas for the future?* Sarah Kuhn, Ethan Danahy, Barbara Bratzel, Merredith Portsmore
BREAK (2:15– 2:30)	**BREAK (2:00 – 2:15)**
Development Labs (2:30 – 4:30) Theme 1: Story-making Theme 2: Competitions Theme 3: Data Logging Theme 4: Collaborative projects	**Development Labs (2:15-4:00)** Theme 1: Story-making Theme 2: Competitions Theme 3: Data Logging Theme 4: Collaborative projects
Debrief and sharing sessions (4:30-5:00)	**Sharing, conclusion, and closing of Symposium (4:00-5:00)**
Informal "Symposium" Hour (5:00-7:00) Socializing, talking, eating, and mingling	**Informal "Symposium" Hour (5:00-7:00)** Socializing, talking, eating, and mingling

ABOUT THE SYMPOSIUM

The purpose of the symposium is to gather educators from around the world with experience teaching with the LEGO Robotic toolsets to focus on how these in particular can foster and support a diverse learning environment for girls.

With inspiration from presentations participants will work together in the development labs to evaluate and develop activities while considering:

- What makes an activity "diverse"?
- What, specifically, makes an activity optimal for girls?
- What other factors implementing the activity can support its diversity and appeal to girls?

OPEN-HOUSE

Join us at the CEEO for a pre-registration Sunday, May 31st from 6 – 8 PM. There will be an opportunity to explore the newest LEGO toolsets on an informal basis.

The symposium opens officially June 1st at 8:30 with registration opening at 7:15.

REGISTRATION

To download more information and registration form go to:
http://www.legoengineering.com

"LEGO Engineering for Girls: Building a diverse learning environment with LEGO"

Presentations Monday June 1st from 8:45 – 10:15

What is the challenge we are addressing?

Chris B. Rogers
  "Engineering in the classroom: promoting hands-on problem solving to motivate math and science learning"
Asli Bilgin
  "WomenBuild: An entrepreneurial program for professional and future leaders for women in technology"
Mitch Resnick
  "Low Floor, High Ceiling, Wide Walls: Providing Multiple Pathways into Engineering"
Natalie Rusk
  "Artful Themes"

Presentations Monday June 1st from 1:00 – 2:15

Opportunities and challenges when we add LEGO tools to the mix!

Marina Bers
  "Storytellers and engineers in early childhood: Developing technological fluency by making robots"
Monika Füglister
  "What are girls' initial barriers and how can they be overcome"
Eirik Jatten
  "Using LEC's in school - the Norwegian experiences"
Kar-Tin Lee
  "Cultivating digitally prepared teachers to cater for girls in schools"
Cathy Helgoe
  "Inviting Everyone In: LEGO WeDo as a friendly engineering environment for female teachers and students"

Presentations Tuesday, June 2nd from 8:30 – 10:00

What has worked well and why?

Lisbeth Valther Pallesen
  "Girls are different, but still the same! What to focus on when engaging girls in learning with LEGO materials"
Birger Brevik and Suyn Aidarov
  "LEGO engineering in science and vocational education for street children in Kyrgyzstan"
Amy Eguchi
  "Are robotics competitions for girls? – How RoboCupJunior attracts girls"
Morgan Hynes
  "A glance at interesting projects"

Presentations Tuesday, June 2nd from 1:00 – 2:00

Ideas for the future

Sarah Kuhn
  "Lego Engineering and Girls: Many paths to the future"
Ethan Danahy
  "Using RoboBooks as a Tool for Motivating Innovation and Creativity"
Barbara Bratzel
  "Door Wide Open: Attracting Girls to Engineering"
Merredith Portsmore
  "Thinking about how we approach teaching engineering to first grade boys and girls"

Speaker Bios

Marina Bers

"Storytellers and engineers in early childhood: developing technological fluency by making robots"

Marina Bers is a professor at the Eliot-Pearson Department of Child Development and the Computer Science Department at Tufts University. Her research involves the design and study of innovative learning technologies to promote children's positive development. She received her PhD from the MIT Media Laboratory http://www.media.mit.edu/ working with Seymour Papert. Bers received the 2005 *Presidential Early Career Award for Scientists and Engineers (PECASE)*, the highest honor given by the U.S. government to early stage investigators and an NSF *Career Award, as well as the AERA's Jan Hawkins Award*. Her book "Blocks to Robots: Learning with Technology in the Early Childhood Classroom" http://www.amazon.com/Blocks-Robots-Technology-Childhood-Classroom/dp/0807748471 has been published by Teacher's College Press in 2008.

Barbara Bratzel

"Door Wide Open: Attracting Girls to Engineering"

Barbara Bratzel has been a teacher of science and mathematics for more than twenty years, teaching every age from kindergarten through high school. She currently teaches at the Shady Hill School in Cambridge, Massachusetts. She is the author of Physics by Design (College House Books, 2005, 2007; MINDSTORMS software edition to be published Summer 2009), an activity book for science teachers, which uses LEGO MINDSTORMS to teach physics and engineering.

Asli Bilgin

"WomenBuild: An entrepreneurial program for professional and future leaders for Women in Technology"

Asli Bilgin is a Principal Developer Evangelist at Microsoft and is responsible for educating developers and architects on Wall Street with Microsoft future vision for software development and engineering. She is the founder of WomenBuild and iGive, two programs focused on US workforce stimulus, specifically geared at developing professional and pre-professional women who posses an aptitude for science and technology . Prior to joining Microsoft, Asli was employed as a senior software architect at Dell and at Xerox. Asli is a recognized presenter at conferences across the globe and she serves as a contributing author to various technical publications. Her latest book is "Mastering Database Programming With Visual Basic.NET" (Sybex).

Birger Brevik and Suyn Aidarov

"LEGO engineering in science and vocational education for street children in Kyrgyzstan"

Birger Brevik is a present educational researcher at Akershus University College Norway, and is presently earning a doctoral degree in science education at the University of Oslo. He has ten years of experience as a teacher in the Norwegian upper secondary school. He has used LEGO in his teaching practice since 2001. Through his involvement in the development of the project "Teknobuss" Brevik has taught more than 3000 pupils at elementary school level technology by using ROBOLAB. The title of his master thesis, Technological work processes into elementary school, uses LEGO ROBOLAB as a pedagogical tool. His present main interest is to increase understanding about the application of technology to teaching in technical and vocational sections of the Norwegian upper secondary school, through his PhD thesis under the title, Development of new learning environments based on pedagogical robotics and on automatically controlled tasks.

Suyun Aidarov is MSW, National Coordinator of UNDP Vocational Education for Street Children Project (VESC) in Kyrgyzstan. The VESC Project funded by the Norwegian Government is currently being implemented by the United Nations Development Program in Kyrgyzstan. The Project helps the Kyrgyz government and civil society to reduce poverty and increase quality of life through the establishment of vocational education courses for street children in vocational schools. It strengthens the capacity of the vocational education system and helps the street children better reintegrate into societal mainstream. Among a wide range of various activities the project aims to develop street children methodology and concept with focus on the issues of social inclusion.

Ethan Danahy
"Using RoboBooks as a Tool for Motivating Innovation and Creativity"

Ethan Danahy is a software designer at the CEEO, working on developing the Center's educational tools. He received bachelors and masters degrees in Computer Science, and recently finished a doctorate (May 2007) in Electrical Engineering, all at Tufts University. He started work at the Center in June 2007 and his main focus has been on the design, development, and implementation of RoboBooks, an interactive digital workbook software and curriculum/activity deployment tool.

Amy Eguchi
"Door Wide Open: Attracting Girls to Engineering"

Amy Eguchi is an assistant professor at Division of Education at Bloomfield College in New Jersey. She has been teaching educational robotics (LEGO robotics) for 2nd grade up including K-12 educators and undergraduate students. She has been involved in RoboCupJunior – a project-oriented educational initiative that sponsors local, regional and international robotic events for young students up through age 19, since 2000 (http://www.robocupjunior.org). RoboCupJunior offers three challenges – Soccer, Rescue and Dance. She is a member of Dance Technical Committee and RoboCup Executive Committee. Also, she is a co-chair of RoboCupJunior International 2009 in Austria, and the chair of 2010 in Singapore.

Monika Füglister
"What are girl's initial barriers and how can they be overcome"

Monika Füglister is a Biologist from Baden, Switzerland. She started to teach gifted children immediately after her studies and has experience in the matter for ten years now. She realized children's interest in technical subjects and started to work with LEGO MINDSTORMS. The children she teaches are from 7 to 12 years old and attend her courses for two hours a week. Lately she is involved in the training of primary school teachers that are interested in teaching with LEGO MINDSTORMS.

Cathy Helgoe
"Inviting Everyone In: LEGO WeDo as a friendly engineering environment for female teachers and students"

Cathy Helgoe develops science, technology and other learning materials for LEGO Education, a global division of the LEGO Group. She has been involved with robotics projects, including LEGO MINDSTORMS, ROBOLAB, Control Lab and LEGO TC logo, and currently, Globot. She has been an active contributor to conferences and workshops over the years and has recently earned her doctorate in Educational Technology focusing her research on science education and constructivist teaching practices.

Morgan Hynes
"A glance at interesting projects"

Morgan Hynes is a Post Doc at the Center for Engineering and Education Outreach. He received his Ph. D. from Tufts University in Engineering Education. Morgan's dissertation research focused on middle-school teachers and the subject matter and pedagogical content knowledge they used and developed as they taught an engineering unit using LEGO robotics. Morgan looks forward to continuing work with teachers as they prepare to teach engineering in the classroom.

Eirik Jåtten
"Using LEC's in school - the Norwegian experiences"

Eirik Jåtten is a science teacher at Røyneberg Elementary School, Stavanger, Norway, and has been using Lego as an educational tool since 2003. In that time, he has coached 25 First Lego League teams and is now oversees Teknolab, an organization which runs 34 Lego Educational Centers in different schools around southern Norway. In 2006, he received his MSc in ICT and learning, where he focused on FLL and stimulating the learning of science and math. Recently, he has been experimenting with the use of commercial computer games in educational situations.

Sarah Kuhn
"Lego Engineering and Girls: Many paths to the future"

Sarah Kuhn is a Professor in the Department of Regional Economic and Social Development and a Faculty Associate of the Center for Women and Work at the University of Massachusetts Lowell. She is a member of the Social Science Advisory Board of the National Center for Women in Information Technology. Her current research is about joining computer science and arts in undergraduate education (http://teaching.cs.uml.edu/Performamatics/), and creating web based tools that allow students to analyze and share sensor data that measure environmentally and socially important phenomena (http://www.cs.uml.edu/isense/). Kuhn received her PhD in Urban Studies and Planning from the Massachusetts Institute of Technology in 1987. She was a member of the National Research Council Committee on Workforce Needs In Information Technology and has been a Fellow at the Radcliffe Institute for Advanced Study.

Lisbeth Valther Pallesen
"Girls are different, but still the same! What to focus on when engaging girls in learning with LEGO materials"

Lisbeth Valther Pallesen heads the Community, Education & Direct Division which was set up in February 2006. CED is the division that handles the direct contact with consumers, establishes new business and is in charge of development and sales of educational products. Lisbeth Valther Pallesen joined the LEGO Group in 1989. Since 2003 she has been in overall charge of the LEGO Group's Internet activities and was in 2006 appointed Executive Vice President of CED, and at the same time became a member of the LEGO Group's Corporate Management.

Merredith Portsmore
"Thinking about how we approach teaching engineering to first grade boys and girls"

Merredith Portsmore is a PhD student in Tufts Math Science Technology and Engineering Education Program. She has worked at Tufts Center for Engineering Education and Outreach for over 14 years on projects that work to include engineering in K-12 classrooms. Her dissertation work focuses on looking at how first grade students engage in design activities and comparing classroom instruction variations for teaching engineering.

Mitch Resnick
"Low Floor, High Ceiling, Wide Walls: Providing Multiple Pathways into Engineering"

Mitchel Resnick, Professor of Learning Research at the MIT Media Lab, develops new technologies to engage people (especially children) in creative learning experiences. His research group has collaborated closely with the LEGO Company on the development of the MINDSTORMS and WeDo robotics kits. Resnick co-founded the Computer Clubhouse project, an international network of after-school learning centers for youth from low-income communities. Resnick's group recently developed a new programming language, called Scratch, which makes it easier to create your their own interactive stories, games, and animations. Resnick earned a BS in physics from Princeton, and an MS and PhD in computer science from MIT.

Chris B. Rogers
"Engineering in the classroom: promoting hands-on problem solving to motivate math and science learning."

Chris got all three of his degrees at Stanford Univ., where he worked with John Eaton on his thesis looking at particle motion in a boundary layer flow. From Stanford, he went to Tufts as a faculty member, where he has been for the last 20 years, with a few exceptions. He received the 2003 NSF Director's Distinguished Teaching Scholar Award for excellence in both teaching and research. Chris is involved in six different research areas: particle-laden flows (a continuation of his thesis), telerobotics and controls, slurry flows in chemical-mechanical planarization, the engineering of musical instruments, measuring flame shapes of couch fires, and in elementary school engineering education. His work has been funded by numerous government organizations and corporations, including the NSF, NASA, Intel, Boeing, Cabot, Steinway, Selmer, Fulbright, and the LEGO Corporation. He has worked with LEGO to develop ROBOLAB, a robotic approach to learning science and math. He works in various classrooms once a week, although he has been banned from recess for making too much noise.

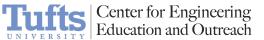**Natalie Rusk**
"Artful Themes"

Natalie Rusk specializes in developing technology-based programs that build on young people's interests. She is a lead developer of Scratch software and support materials at the MIT Media Lab. She also contributed to the design of PicoCrickets, programmable devices children can use to create artistic inventions. She served as Project Director of the NSF-funded PIE Network, collaboration between MIT and six museums to create hands-on science activities that integrate art, crafts, and computer programming. In 1993, she founded the Computer Clubhouse, a model after-school learning program that engages young people in creating projects with the support of adult mentors. She is currently pursuing doctoral studies at Tufts University in Applied Child Development

Kar-Tin Lee
"Cultivating digitally prepared teachers to cater for girls in schools"

Kar-Tin Lee is currently Head of the School of Mathematics, Science and Technology Education, Faculty of Education, Queensland University of Technology, Australia. She has over twenty years of ICT in education and leadership experience. Her research interests focus on pedagogic issues and learner experience in online learning; organizational, strategic and pedagogical issues relating to design and implementation of online learning environments; and, leadership and management issues relating to strategic implementation of ICT policy in education at all levels. She teaches and supervises doctoral students in the area of design and implementation of online learning, and strongly supports her faculty members in advocating the infusion of LEGO robotics in teacher training courses and professional development programs.

Development Labs

For three hours each day the LEGO Engineering Symposium participants will work in the development labs. Each participant can choose two development labs, one for each day of the symposium.

With inspiration from the presentations the **purpose** of the development labs is to evaluate and develop new ideas for LEGO Engineering Robotic activities while considering:

- What makes an activity "diverse"?
- What, specifically, makes an activity optimal for girls?
- What other factors implementing the activity can support its diversity and appeal to girls?

The **outcomes** from the development labs are:
- Ideas for the classroom (activities, learning sequences, curricula)
- Guiding principles for good activity/curriculum design
- Insights into learning, teaching, capabilities, and product development

Guidelines for development lab sessions:
- An initial driving question, need, or problem related to the symposium theme
- Exploration of the driving question through the design, creation, interaction, testing of LEGO MINDSTORMS and/or WeDo activities and ideas
- Collaboration amongst educators and CEEO personnel ("red shirts")

The development lab will explore the "Diverse Learning Environment" theme from four different points of departure.

I: Data Logging Development Lab
Mathematics is a subject that is often times difficult to make connections to daily life. It is typically presented in a way that is less compatible with many people's learning styles, especially girls. Anecdotally, girls seem to prefer material to be put into context - learning about concepts related (or connected) to the bigger picture. Often educators have difficulty finding a medium to teach mathematics that aligns with the contextual learning style preferred by girls. In this development lab, we'll explore how data logging might reverse this trend by connecting mathematical concepts to daily life. We will consider how data logging makes mathematics more approachable to girls by experimenting with LEGO robotics activities that transform abstract numbers into tangible - and relevant - values for a more diverse learning environment.

II: Story-making Development Lab
The purpose of this development lab is to explore the role that story-making plays in building a diverse learning environment. Story-making allows students to make connections to the content of an activity in a meaningful way. While adults may not see story-making as an important component in the creative process, and therefore may over look it in designing activities, it is very important for younger students, especially girls. Participants in this development lab will discuss methods to integrate story-making into the classroom and outline activities that include story-making in the creative process.

III: Competitions Development Lab
Do you feel lucky? Well, do you? In this development lab, we'll explore the idea of inclusive competitions: what aspects of contests support involvement of the group and what conditions foster the opposite. Additionally, we'll look at elements that can be incorporated to encourage cooperation, both within and between rivalry groups. Considering both large-scale (e.g. FIRST) and smaller (e.g.1-hour) contests, we'll attempt to derive a guiding set of principles for designing, developing, and deploying inclusive tournaments. Through tinkering with the LEGO NXT and LEGO WeDo platforms, the goal will be to uncover collaboratively how features of these educational sets can be leveraged to engage all students in educational competitions.

IV: Collaborative Projects Development Lab
We will explore the idea of large scale collaborative work i.e. collaboration that goes beyond small independent "group" assignments. We will discuss large-scale collaborations that require smaller teams to contribute to an overarching greater goal. In this type of collaboration, each project's success is dependent on each individual group's contribution. We'll attempt to derive a guiding set of principles for designing, developing, and deploying inclusive large scale collaborative challenges through the LEGO NXT and LEGO WeDo. Our goal will be to investigate how these platforms can enable authentic multi-group collaborative learning.