


LEGO Robotics

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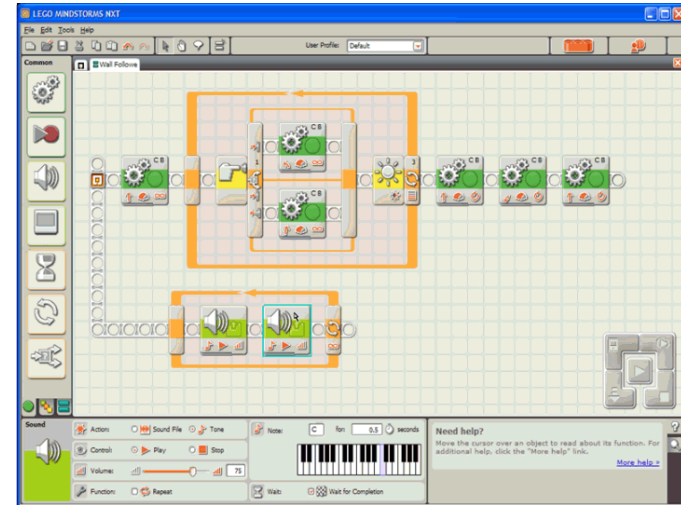
Overview

- Background Information
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 - Using Lego Robotics for STEM Education
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- Outputs from Engagement Activities
- Opportunities for trans-disciplinary exchanges
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- Institutional Support

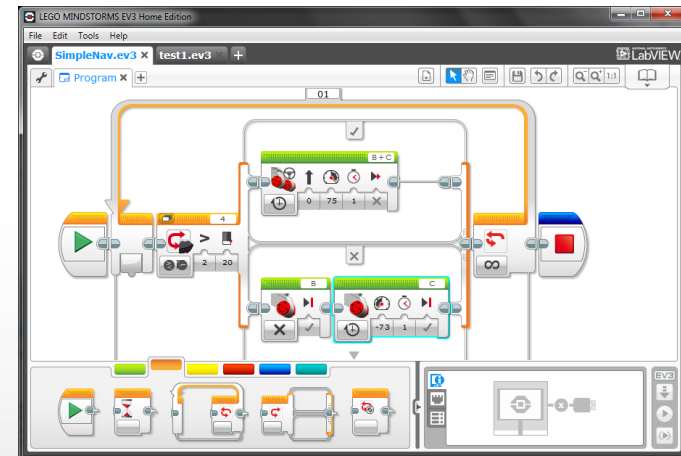
Background: What is Lego Robotics?



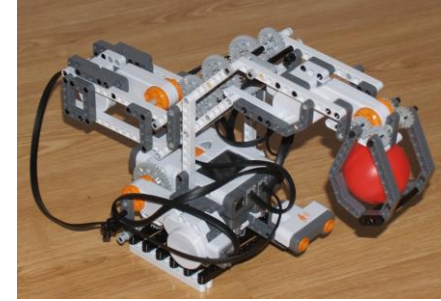
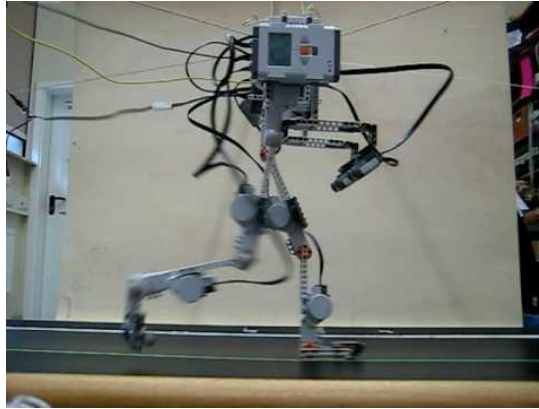
LEGO Mindstorms
NXT



LEGO Mindstorms
EV3



Background: What is Lego Robotics?



STEM Education using Lego Robots

- <https://www.youtube.com/watch?v=s1QdZy8as48>
- https://www.youtube.com/watch?v=nt_6z1Lb3dE
- <https://www.youtube.com/channel/UCvwSMQbOYUa7-FosfmrEUCw>
- <https://www.youtube.com/watch?v=MdQwWfw7JhU>

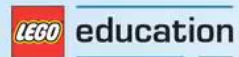
Background: Using Lego Robotics for STEM Education





Maths

Year 1, Tuesday, 2:00pm.



Background: What is *FIRST*®?

Introducing learners to science and technology in a sporty atmosphere

- **F**or **I**nspiration and **R**ecognition of **S**cience and **T**echnology



“To transform our culture by creating a world where science and technology are celebrated and where young people dream of becoming science and technology heroes.”

– Dean Kamen, FIRST Founder
(and inventor of the Segway)

<http://www.usfirst.org/>

Background: What is *FIRST*®?

- FIRST Robotics Programs
 - Junior FIRST LEGO League (6 – 9)
 - **FIRST LEGO League (9 – 16)**
 - FIRST Tech Challenge (14 – 18)
 - FIRST Robotics Competition (14 – 18)

Background: What is *FIRST* LEGO League?

- An international program created through a partnership between FIRST and The LEGO Group
- The aim of FLL is to
 - INSPIRE learners to engage with science, technology engineering and mathematics
 - ENGAGE learners in playful and meaningful learning
 - PROVIDE a fun, creative, hands-on learning experience
 - CHALLENGE learners to solve real-world problems
 - TEACH learners to experiment & overcome obstacles
 - BUILD teamwork, self-esteem and confidence

<http://www.firstlegoleague.org/>

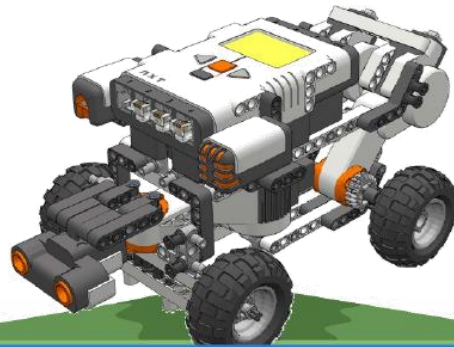
Background: Overview of FLL Challenge?



Life skills that promotes teamwork, responsibility, exploration, collaboration and gracious professionalism

Core Values

How you do it



Learning about technology and engineering in a playful, hands-on manner whilst designing and programming a robot to complete missions autonomously

Robot Game



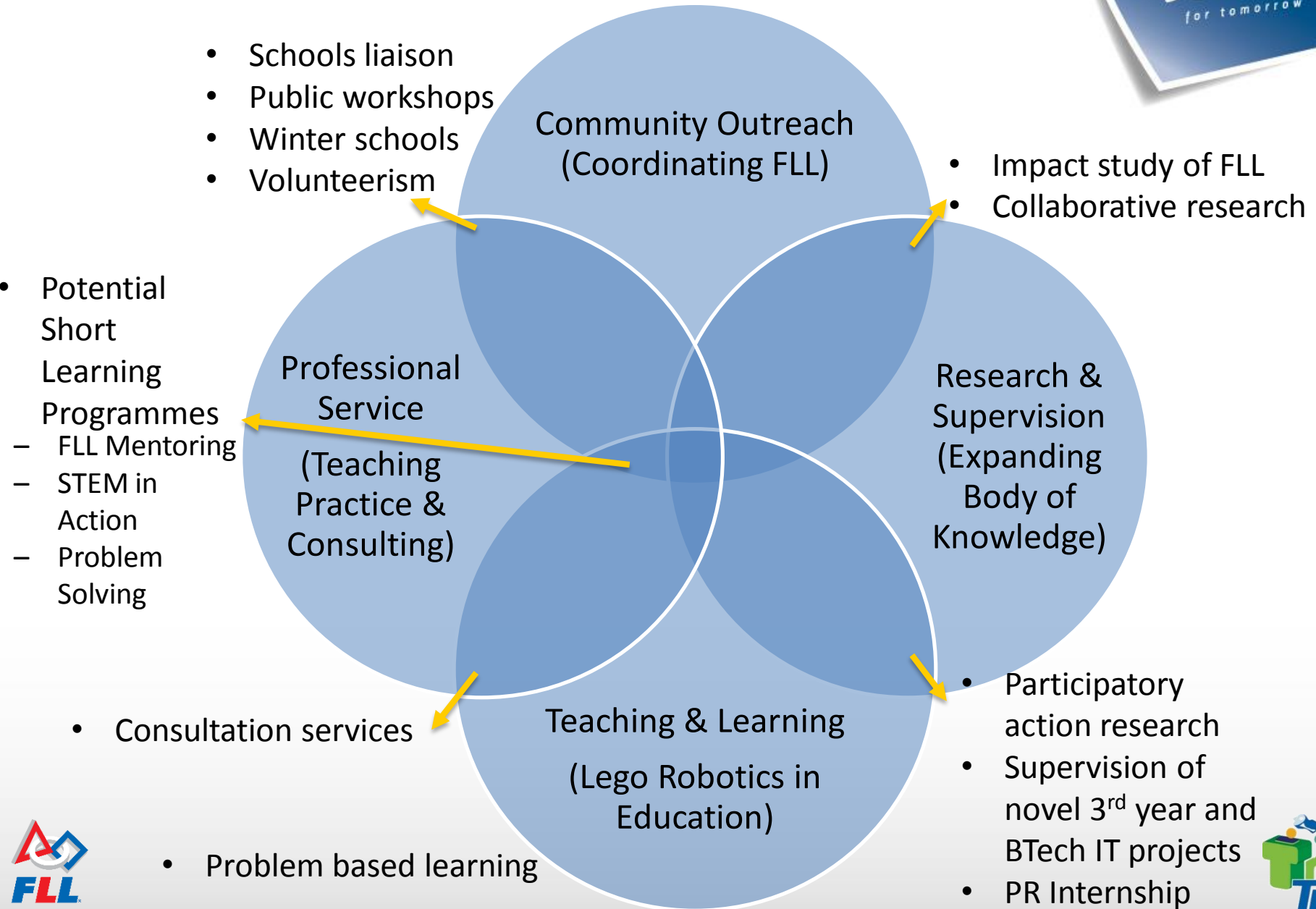
What you do



Theme-based research assignment that inspires innovation, improves presentation skills and encourages community outreach and industry collaboration

Project

Integrating engagement categories



Target Groups

- Community Outreach: FLL for STEM Awareness
 - **Learners aged 9 – 16**
 - Addressed issue with demographics in 2015
 - Want to focus on recruiting female participants next
- Professional Service: Consulting on Lego Robotics in education
 - **School Teachers/Parents:** FLL Coaching, Quest school for Autistic Learners
 - **University Academics/Corporate Consultants:** Incorporating Lego Robotics in their curriculum
- Teaching and Learning: Applying Lego Robotics in education
 - **3rd year and BTech IT students** (other EBEIT students also possible): Supervision of projects involving Lego Robotics
 - **Software Development students:** Use Lego Robotics to teach
 - Problem Solving and Programming
 - Artificial Intelligence
- Research and Scholarship: Contribute to existing body of knowledge
 - **FIRST:** Contribute to global FLL impact study (FLL in developing country)
 - **South African Educators:**
 - Evaluate effect of Lego Robotics in STEM education
 - Use of Lego Robotics for Problem-based Learning

Partners and Stakeholders

- **FIRST:** Creating the annual challenge
- **FLLSA:** Supporting South African regions
- **Brandeis, UNISA, TUT:** Collaborators on impact study research
- **Schools in Nelson Mandela Bay** (wishing to extend into the Eastern Cape): FLL (training and hosting of competition)
- **New High Advanced Technology Institute:** Signed MoU for recruitment, training and mentorship of FLL coaches
- **UBUNTU Education Centre:** Initiated talks to incorporate Lego Robotics as part of their Cradle to Career interventions
- **Unako:** Initiated talks to expand their community focused education programmes to include Lego Robotics
- **School of ICT:** Staff and students assist with training and the FLL competition as judges and referees

Outputs from Engagement Activities

- Developed and hosted FLL Workshops:
 - Basic Lego Robotics Workshop
 - FLL Robot Game Workshop
 - FLL Project and Core Values Workshop
- Number of participating FLL Teams:
 - Regional qualifier: 8 (2013), 7 (2014), **11 (2015)**
 - National South African Championships: 5
 - International Open African Championship: 1 (2015)
- Consultation:
 - Built and programmed Lego robots to train factory workers in production plant optimization

Outputs from Engagement Activities

- Supervision of BTech and 3rd year projects:
 - Simulation of a hazard robot using Mindstorms NXT
 - Lego Racing car game
 - Lego Soccer game
 - Incorporating Learning Styles in a Lego Robotics tutorial
 - Using RFID to secure Lego Robotics lab
- Teaching and Learning:
 - Co-developing problem solving activities for 1st year Programming module
 - Co-developing activities for 4th year Artificial Intelligence module, e.g. maze learning robot
 - Co-developing Lego Robotics activities on request from Quest School for Autistic Learners

- Teaching, Learning & Research in EBEIT Faculty:
 - Electrical Engineering: Developing and testing sensors and actuators
 - Industrial Engineering: Teach production processes
 - Civil Engineering: Teach structures
 - Mechanical Engineering: Automation, Robotics
 - Mechatronics: Electronics, Mechanical, Programming
- FLL provides opportunities for collaboration with:
 - Education Faculty
 - Jr FLL (6 – 9)
 - Technology Classroom Practice
 - Mentoring and Coaching FLL teams
 - WELA
 - Increase female participation in FLL
 - Anyone who can mentor FLL teams in:
 - Robot Design, Robot Programming, Problem solving, Innovation, Research skills, Project presentations, Poster Design & Teamwork

Challenges

- Attracting and supporting coaches
- Attracting and retaining student volunteers
- Increasing female participation
- Supporting under resourced schools
- Training material for mentoring workshops
- Attracting sponsors
- Generating public awareness

Benefits

*Evaluation of the 2012-13 FLL Program
Center for Youth and Communities, Brandeis University

*Learners

- Create innovative solutions to challenges facing today's scientists
- Apply real-world math, science and engineering concepts
- Develop career and life skills
- Become involved in their local and global community
- Exposed to university
- Networking with professionals

*Teachers

- Improves their own classroom practice
- Opportunities for problem based learning
- Improved relationship with learners
- Increased job satisfaction

NMMU

- Grow potential pool of learners in STEM disciplines
- Opportunities for student volunteers
- Inter-disciplinary collaboration
- Engaged institution
- Research opportunities
- Improves learning experience
- Opportunities for Short Learning Programmes and External Consultation

Lessons Learnt

- Build a solid team to help share the load
- Attracting volunteers is easy, retaining them a challenge
- Take baby steps
- Try as far as possible to integrate core academic functions
- Focus on what you can offer a potential sponsor

Institutional Support

- Community Outreach
 - Ambassadors for FLL
 - FLL coaches and mentors
 - Funding for FLL teams, workshops and competitions
 - Volunteers to assist with the annual FLL competition
- Teaching, Learning and Research
 - Assistance with registering Short Learning Programmes
 - Research Collaboration
 - Encourage students to undertake projects involving Lego Robotics
- Professional Service
 - Contact FLL@nmmu.ac.za to consult on incorporating Lego Robotics in the classroom

Thank you!

