hello@integrityrobotics.in

Robotics in your School- the 5Ws

India | 2017 | Q4 | V02

IntegrityRobotics Team

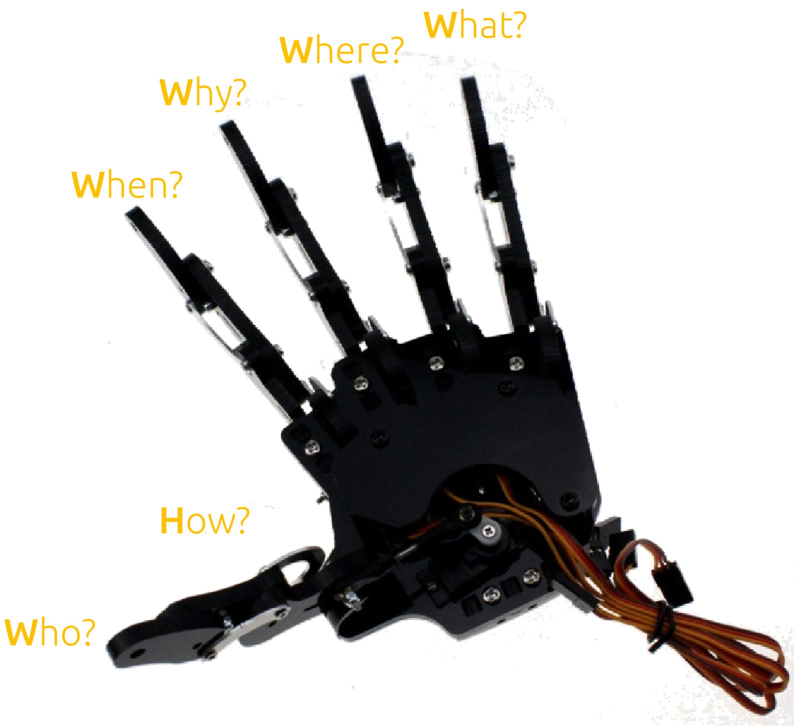
All images shown in this presentation are for illustration purposes.

Einstein once gave an exam and 15 minutes into the exam, one of his students stood up stood up and asked, "*Aren't the questions in this year's exam the same as last year's exam?*" Einstein replied, "*Don't worry; the answers are different this year*."

This wonderful story is very relevant to school education because learning, teaching, curriculum, and pedagogy are the same words but mean very different things than they did 50 years ago. Schools need to reinvent themselves for four reasons:

- early education matters
- our understanding of the brain has progressed in the last two decades
- the world that future generations enter will be very different from ours
- teaching practices are changing to support these developments.

Contents



Mission Statement of IntegrityRobotics

The Constitution of India
Art. 51A, Fundamental Duties

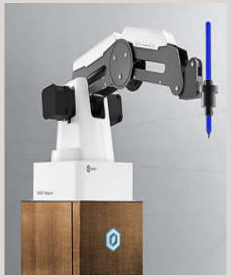
8. *to develop the scientific temper, humanism and the spirit of inquiry and reform*

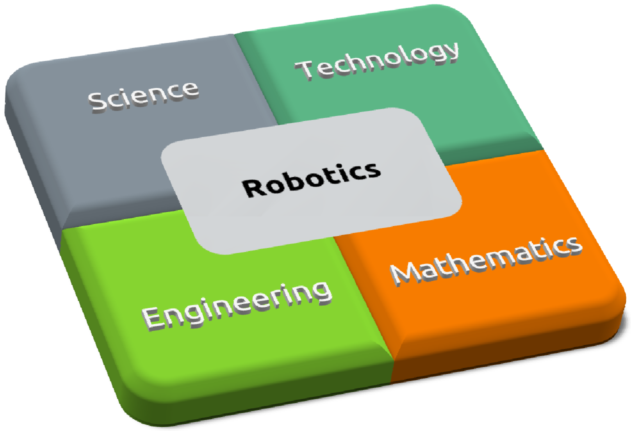
Our Vision: To Integrate Industrial robotics and Educational Robotics

Industry

Experience of industrial robot in Classroom

Classroom



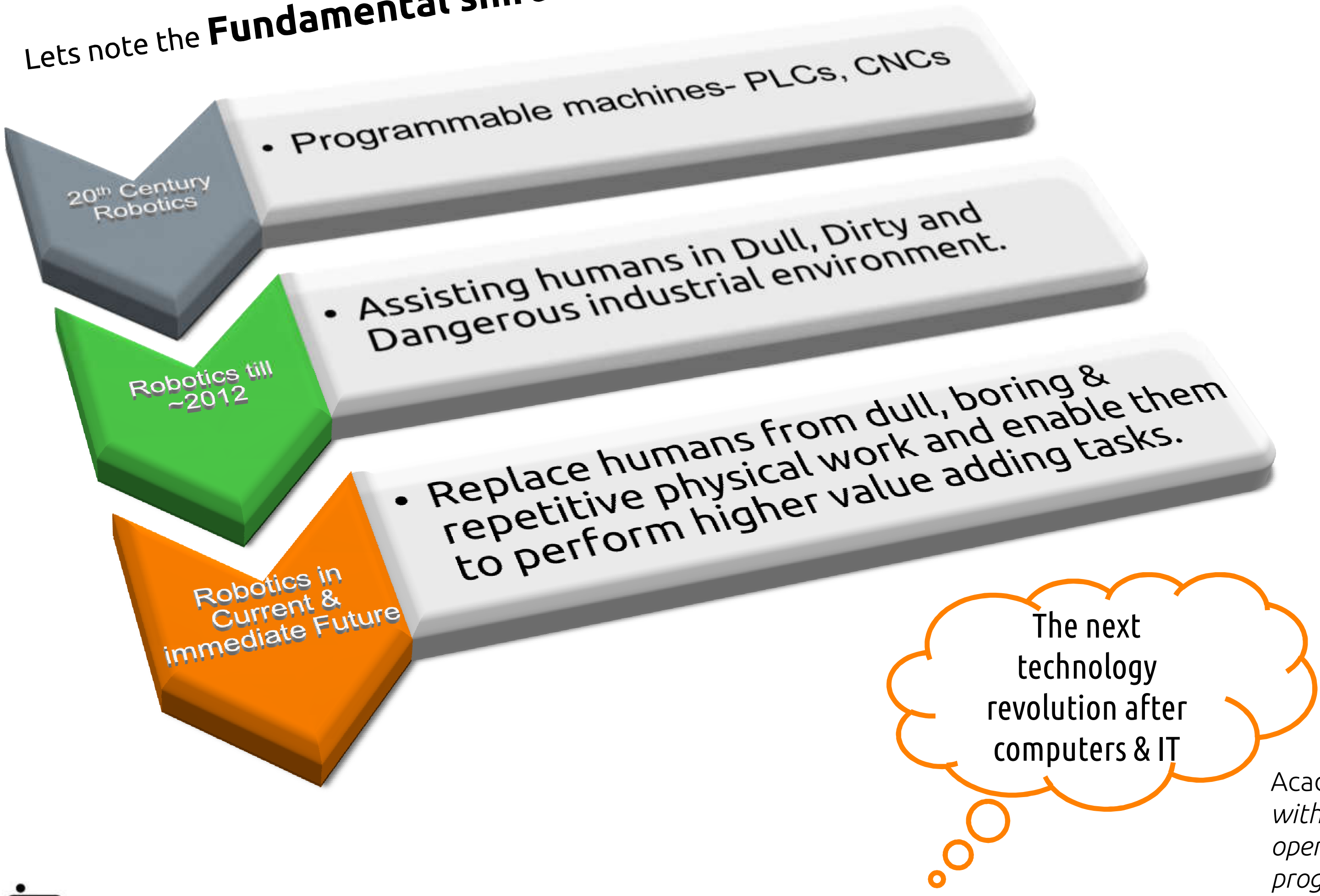


What is Robotics? Is it just STEM learning?

- Lets take a break to see the larger picture- Industry 4.0
- Robotics Worldwide- Economic/Industrial scenario

Robotics- probably the best way to impart STEM skills!

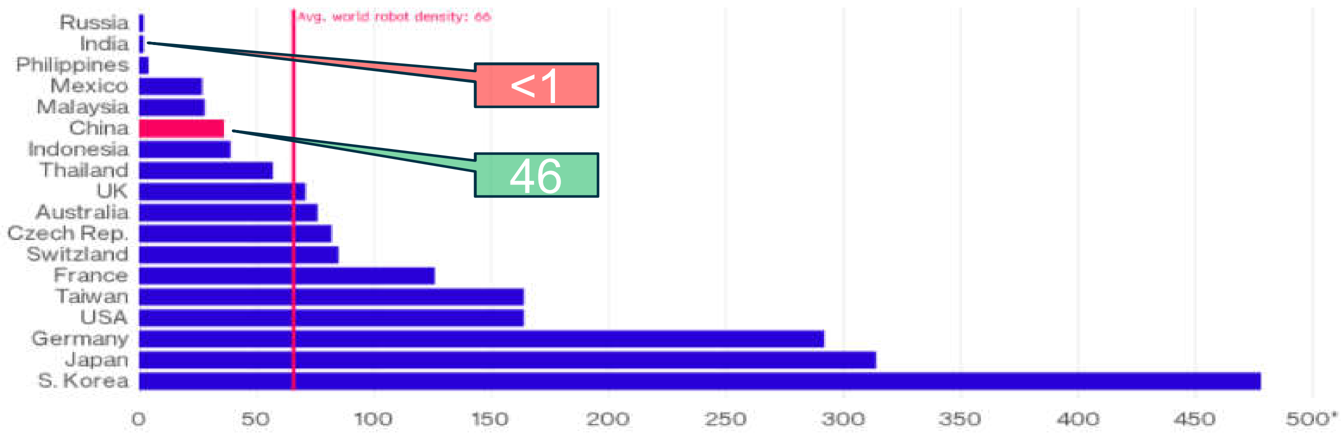
Lets note the **Fundamental shift-**



Academic definition- *Robotics deals with the design construction, operation and application of programmable machines <u>to substitute human efforts</u> for any situation and any purpose.*

Heading for **Robotic Revolution or Industry 4.0**

Robotics Worldwide- Economic/Industrial scenario

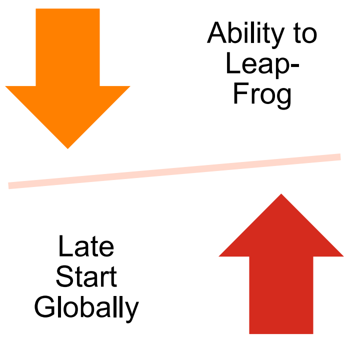


Source: VDMA
*Number of industrial robots per 10,000 employees in manufacturing industry in 2014
Bloomberg

India is 46x behind China & 250x behind Germany in terms of penetration of robotics!

-Robotic revolution is just sprouted in India

-That's <u>the opportunity</u> for schools!



Estimated yearly shipments of multipurpose industrial robots in selected countries. Number of units

Country	2014	2015	2016*	2019*
America	**32,616**	**38,134**	**40,200**	**50,700**
Brazil	1,266	1,407	1,800	3,500
North America	31,029	36,444	38,000	46,000
Rest of South America	321	283	400	1,200
Asia/Australia	**134,444**	**160,558**	**190,200**	**285,700**
China	57,096	68,556	90,000	160,000
India	2,126	2,065	2,600	6,000
Japan	29,297	35,023	38,000	43,000
Republic of Korea	24,721	38,285	40,000	46,000
Taiwan	6,912	7,200	9,000	13,000
Thailand	3,657	2,556	3,000	4,500
other Asia/Australia	10,635	6,873	7,600	13,200
Europe	**45,559**	**50,073**	**54,200**	**68,800**
Central/Eastern Europe	4,643	5,976	7,550	11,300
France	2,944	3,045	3,300	4,500
Germany	20,051	20,105	21,000	25,000
Italy	6,215	6,657	7,200	9,000
Spain	2,312	3,766	4,100	5,100
United Kingdom	2,094	1,645	1,800	2,500
other Europe	7,300	8,879	9,250	11,400
Africa	**428**	**348**	**400**	**800**
not specified by countries**	7,524	4,635	5,000	8,000
Total	**220,571**	**253,748**	**290,000**	**414,000**

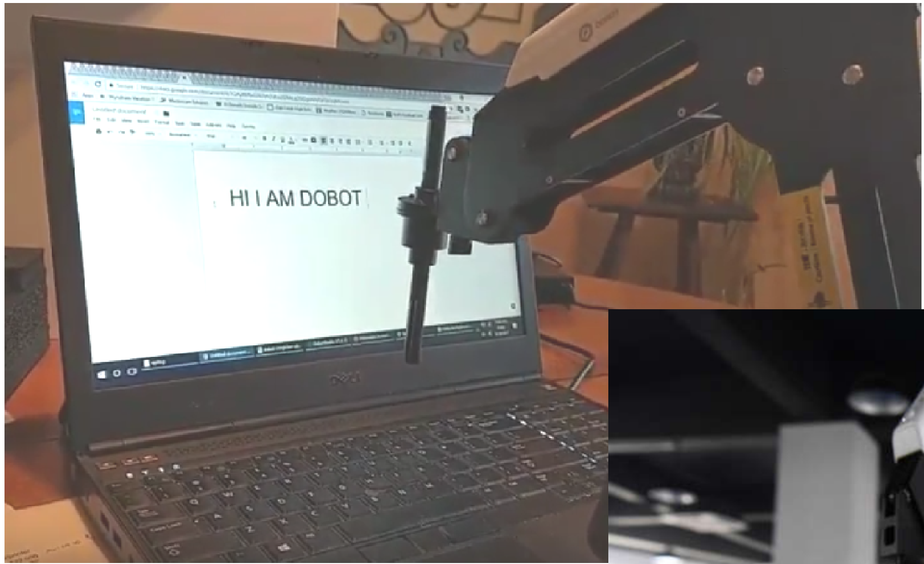
IFR International Federation of Robotics

Where to teach Robotics to students? *Why in schools?*

- Yes, for fun
- The most effective way of introducing programming to students
- Provides skills useful in future employment
- Demystifies a complex technology
- Improves understanding of present STEM curriculum

By Prof. Leon Sterling
Swinburne University of Technology, Australia

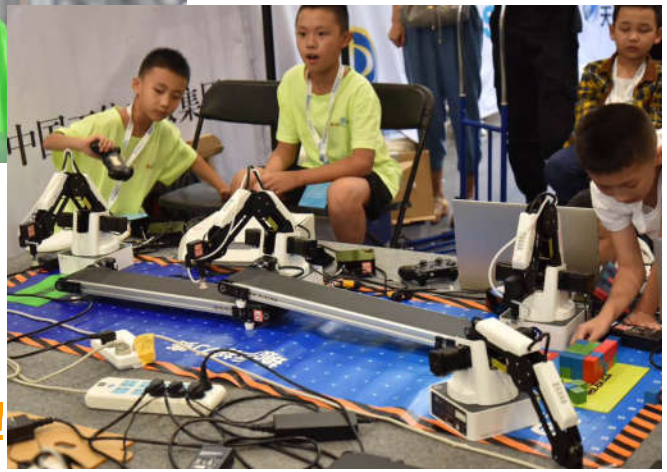
Yes, for fun!



Lets play with it!
(teach-&-playback)

Favourite Cartoon in 3D!
(Easy 3D Printing)

Any robot in school must be easy to use & responsive; otherwise, its frustrating!



Play Games!

Effective way of introducing programming to children

- necessary not only for STEM professionals
- Other professions like accounting & management

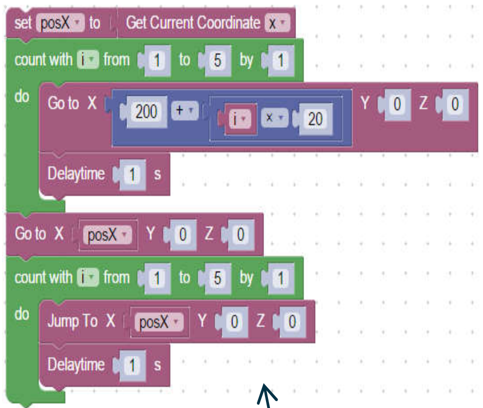
Basic programming skills

- more variety of machines into our surroundings
- Student need to have skills to make use of them.

As technology develops-

- Logical & abstract thinking
- Problem solving skills
- Innovation and creativity

Programming builds-

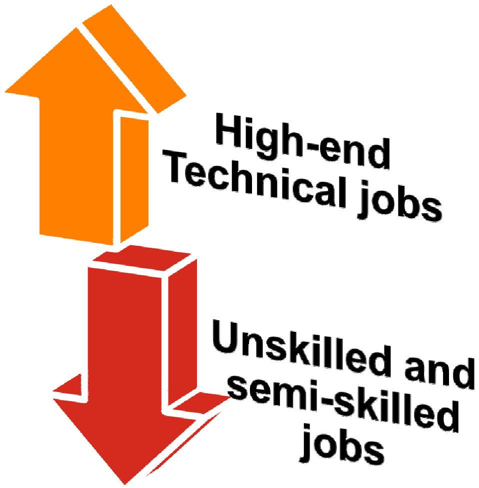


- Robotics is the best way to teach basic programming in schools-
  - See result in physical world | children can feel & touch their code!

- Proven examples-
  - MIT's graphical Scratch programming language
  - Hour of Code's Frozen

Our robots are programmed by **Blockly**- programming in jigsaw-puzzle way- easy & intuitive!

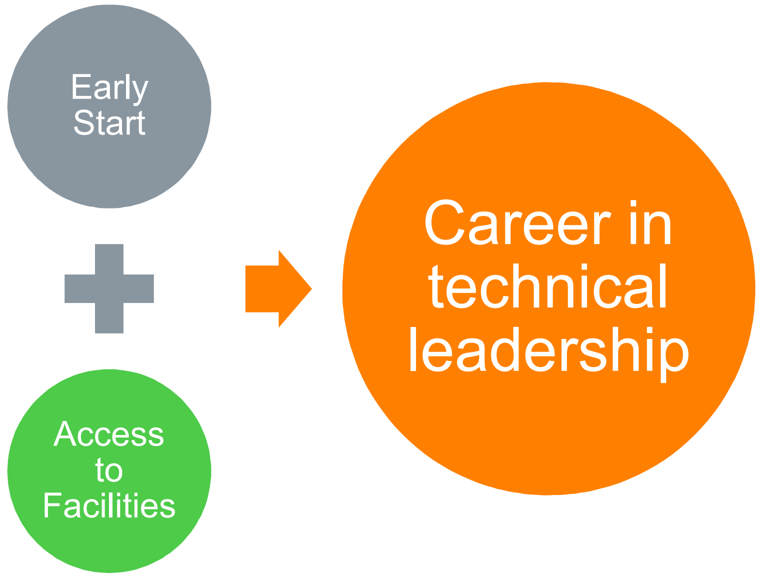
Provides skills useful in future employment



Schools need to prepare students for technical & technical leadership careers

- Current Indian IT workforce did learn computers in colleges and not in schools.
  - Sad story: Only service companies and almost nil product companies in India
  - **We must introduce robotics in schools to *catch them young!***

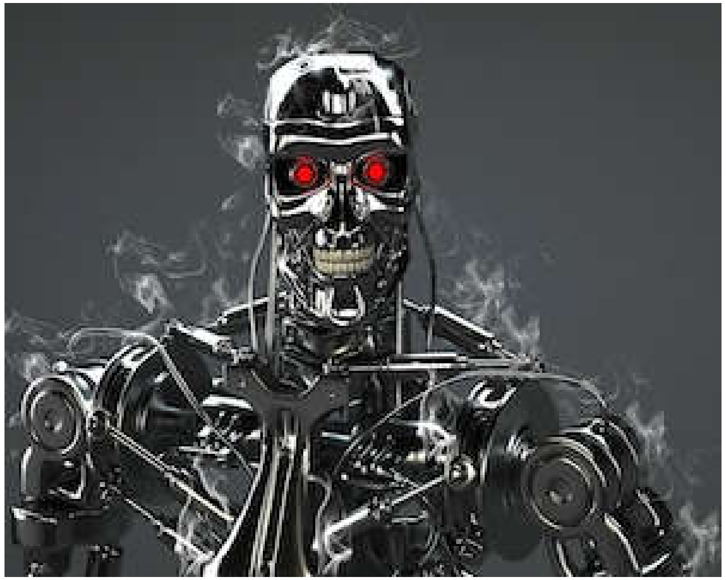
- Bulk of jobs are in STEM occupations*
  - Technical jobs to grow at **8.9%** from 2014 to 2024
  - Non- STEM occupations at 4%



*American Community Survey (ACS)

Demystifies a complex technology:
Apprehensions to Appreciation!

- For most of the children, a robot means this-



- Full of Apprehensions!

- Understanding what machines can and can’t do is the best way to address fears.
- Experience in trying to build and program robots gives Appreciation of their capabilities and strengths.

Improves STEM Academic Performance

The results of the MAP tests for students who participated in robotics indicated that 84% of the students showed improvement and 15% scored lower (Figure 2).

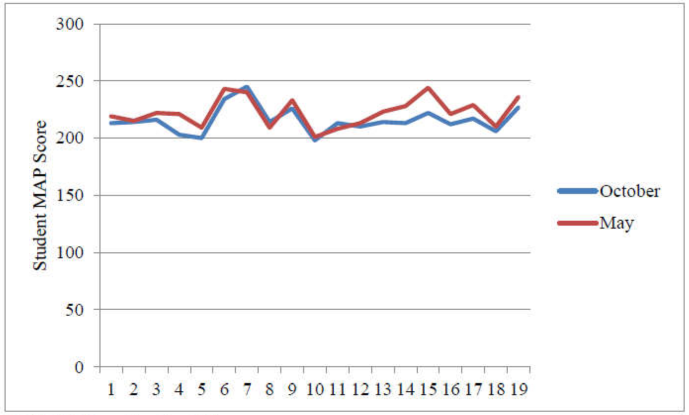


Figure 2. MAP Results, (n=19).

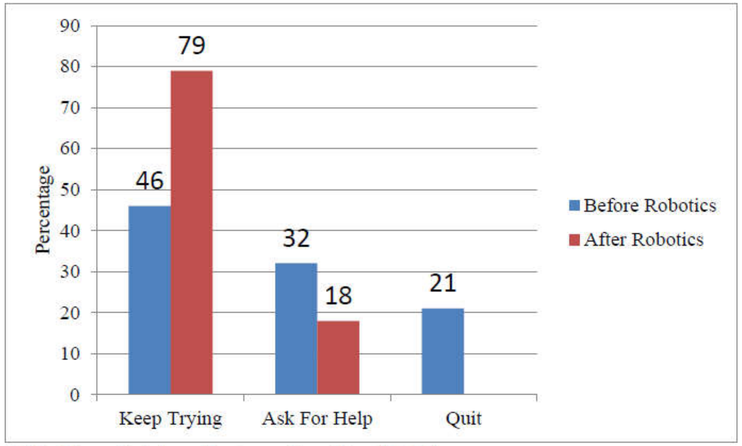


Figure 3. Problem Solving Strategy Results, (N=28).

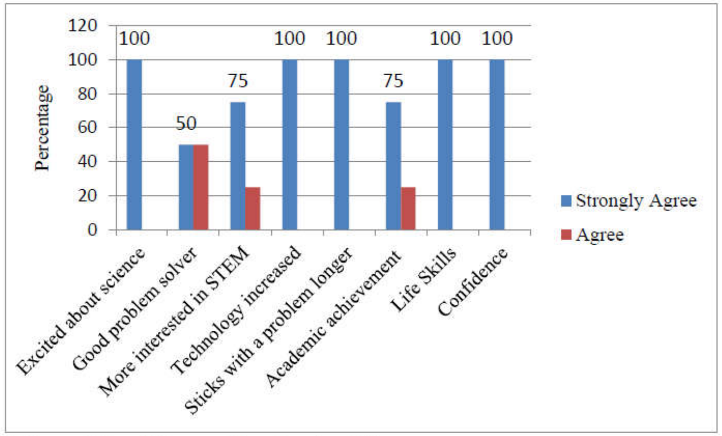


Figure 7. Parent Email Survey Results, (n=10).

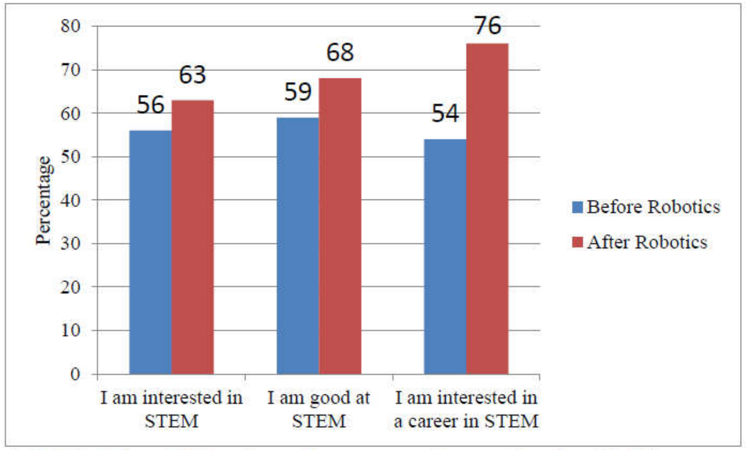


Figure 5. NASA MicroGX Pre-Long Engagement Survey Results, (N=28).

Professional research paper- *The Effects Of A Robotics Program On Students Skills In Stem, Problem Solving And Teamwork,* by Kaye R. Ebelt, Montana State University, USA, 2012

Why Applied Robotics?- *amongst plenty of resources!*

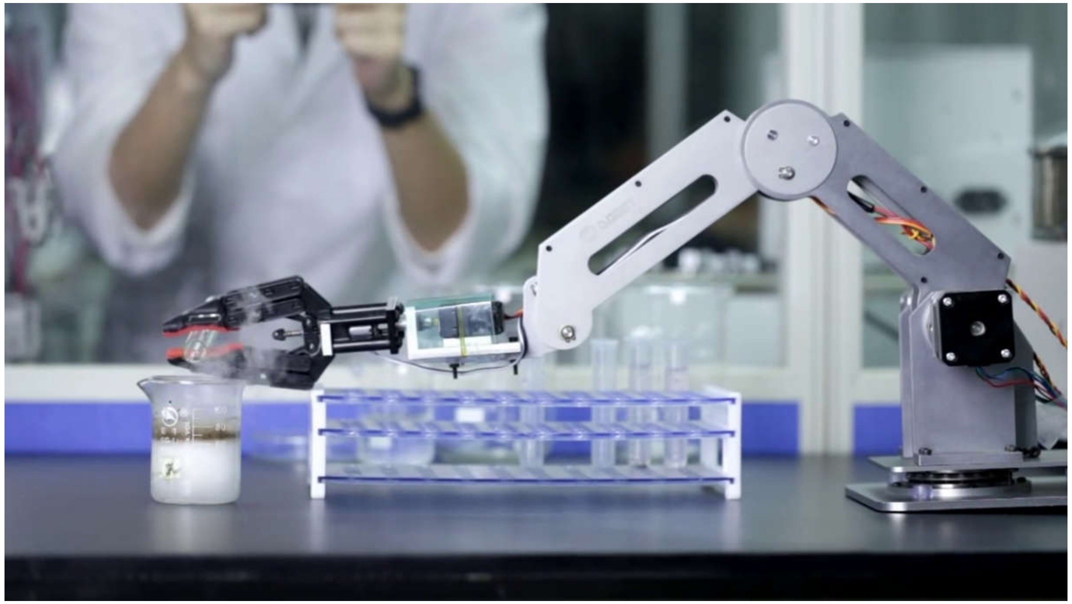
- Real Robotics, no toys!
- Easy to use & fast
- Purpose driven yet Infinite Possible Experiments
- Very Safe

By Prof. Leon Sterling
Swinburne University of Technology, Australia

Why teach Applied Robotics by Dobot Magician?

Dobot Magician is best amongst all of the other robotic STEM learning platforms-

- **Real Robotics, no toys!**
  - Other platforms either teach elements of robotics (build a robot type) or too futuristic & fancy (humanoid robotics)
    - No-tangible output
  - Dobot is a real articulated, industrial robotic arm
- **Easy to use & fast**
  - Extremely easy to use, no clumsiness
  - Quick setup (3D printing starts in minutes)
  - Does not bring frustration to curious minds
  - Award winning programming interface
- **Purpose driven yet Infinite Possible Experiments**
  - Imagination is the only limiting factor
  - Variety of kits included (3D printing, pneumatic, write & draw, milling/drilling, Laser engraving)
  - Rich extensions & software
- **Very Safe**



How to approach robotics?- *the Deployment Methodology.*

- Re-imagining Education
- 3 Major Applications of Dobot Magician
- Compatibility with Atal Tinkering Lab or similar setups

Based on ToI article by Kavita Gupta Sabharwal

Re-imagining Education- Applied Robotics of Dobot Magician

- from didactic teaching of content to Content Building skills (communication, research, thinking, self-management, collaboration)

- creating inquiry and differentiating teaching based on ability, learning styles and interests

- from teaching isolated subjects to transdisciplinary interconnections, integrating content vertically and horizontally in developmentally appropriate stages.

- from incessant repetition for test prep to calculating and charting learning,

Based on ToI article by Kavita Gupta Sabharwal

4 Major Applications of Dobot Magician

IntegrityRobotics proposes the presence of industrial robot in schools with the following three ways to engage with students:

1. NPD (New Product Development) Mindset | Concept-to-reality (3D)
   - Product Conceptualization
   - 3D Modeling & 3D Printing
   - Additional manufacturing operations & Assembly

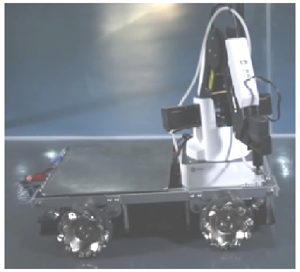



2. Industrial Robotics
   - Pick-n-place applications (a job of 70% industrial robots)
   - CNC Operations- Drilling/Milling (Computerized Numerical Control) machine



3. Crafting & Building (Maker's Assistant)
   - Drawing with Pen
   - Laser Engraving on plywood, leather, etc.
   - Drilling & Milling of Wax & thermocol
   - Highly accurate marking for carpentry & model making

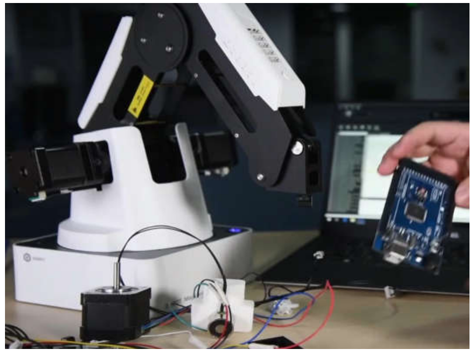
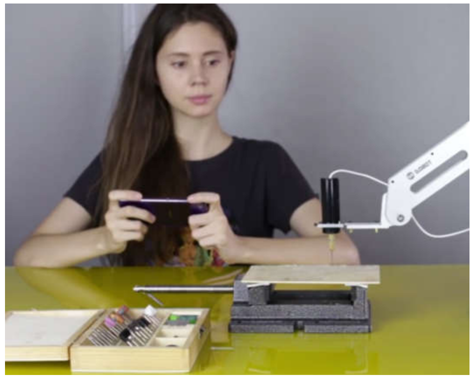

4. Others
   - Chemical Lab Assistant
   - Mobile Robot



Compatibility with Atal Tinkering Lab or similar setups

1. 3D Printing
   - Extremely Accurate (0.1mm resolution)
   - Dense 3D printing (please have a look at the use-cases)
   - SLA is supported
   - Quick setup (no manual levelling is necessary)
2. Compatibility of ATL micro-controllers, sensors with the our robot
   1. Arduino is perfectly compatible Dobot Magician
   2. All 5V sensors can be
3. PCB operations (marking, drilling, etc.)

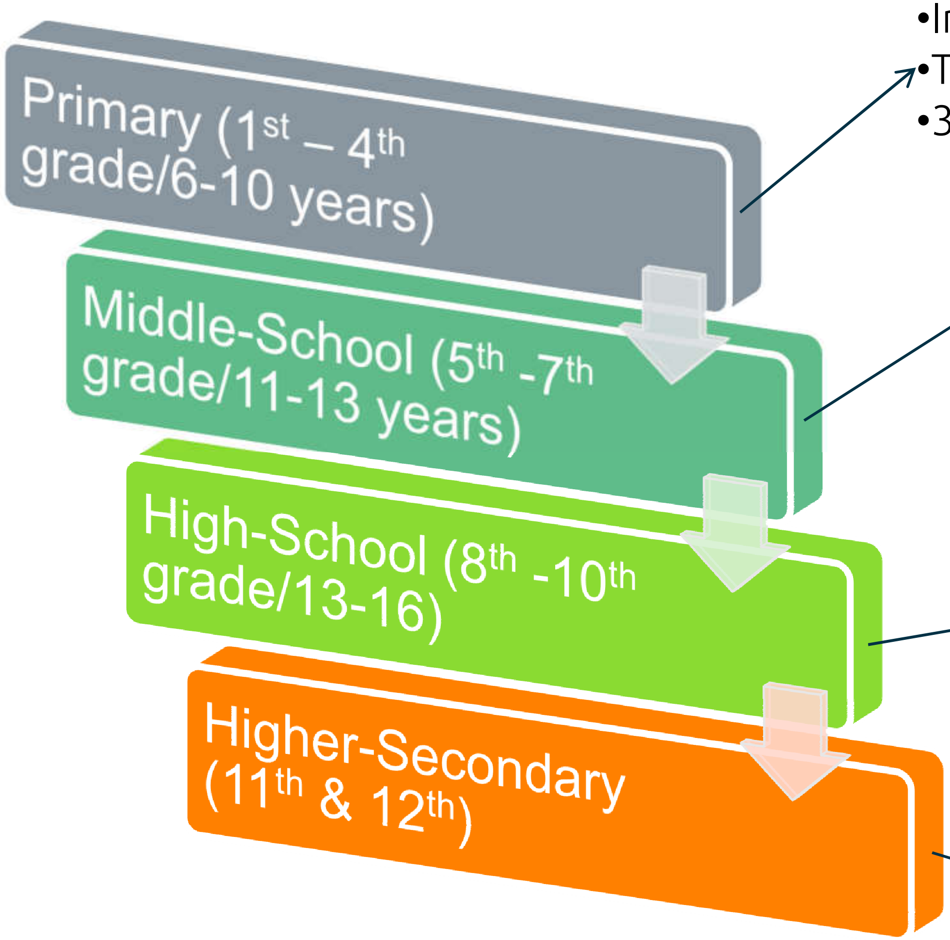


When to engage children to robotics? *Age-groups*

- Suggested Age-group
- Robot Laboratory- Asset engagement calculations

Suggested Age-groups for Robotic Experiments



- Introduction to robotics
- Teacher operates/learning by watching
- 3D printing

- Start operating the robot
- Teacher supervised
- Teach-&-playback/3D printing/start programming

- Perform all functions
- Minimum supervision
- Blockly programming/pick-n-place/Teach-&-playback/3D modelling & printing/Milling-drilling

- Complete DIY (do it yourself)
- No supervision
- Blockly programming/pick-n-place/Teach-&-playback/3D modelling & printing/external peripherals/Milling-drilling

Robot Laboratory- Asset engagement calculations

- A typical school
  - Primary Grades- I to IV: 200 students
  - Middle school Grades- V to VII: 150 students
  - High school Grades- VIII to X: 150 students
  - Higher Secondary Grades- Xi & XII: 100 students
- Engagement profile for
  - Primary
    - Demonstration experiments, once every second month, 30mins to 1 hour each
    - 5 experiments in an academic year for each class
    - 20 experiments in an academic year i.e. Once a week
    - **20 hours**
  - Middle school
    - Teacher Supervised experiments, once a month, for a batch of 10; 30min to 1 hour each
    - 150 experiments in an academic year for each class= **150 hours**
  - High school
    - Teacher Supervised experiments, once a month, for a batch of 10; 30min to 1 hour each
    - 150 experiments in an academic year for each class= **150 hours**
  - Higher Secondary
    - DIY experiments, once a month, for a batch of 5; 1 hour each
    - 200 experiments in an academic year for each class= **200 hours**

- Approximate annual engagement of the robotic lab
  - 20 + 150 +150 + 200 = **520 hours/year**

What to do with a robot?

The Curriculum (more than just lessons/experiments)?

- Without a well researched curriculum, the robotic lab goes to dust
- Sample

Sample Experiment

Who will do what?- The stockholders!

- for Successful deployment of robotic laboratory

Stakeholders in Successful Deployment of Robotic Laboratory

Management/Trustee
- Encouragement
- Progress follow-up

The Principal
Teachers/Faculty
- Training
- Conducting experiments
- Evaluation

Students
- Interest & Enthusiasm
- Discipline

IntegrityRobotics
- World class products
- Tonnes of support

What about my concerns?- FAQ

- answers for most of the questions…

Frequently Asked Questions- I

1. What is the useful life of the robot & the Innovation Lab?
   - 1 year is covered by warrantee
   - 3 years is workable life without troubles
   - 5 years is possible with care, however product will be technically obsolete.
   - Actual usable life depends on frequency of use and care

2. How safe is this robot?
   - Robot is perfectly safe for a school environment
   - It uses 12V power; no danger of shocks
   - Overall, the safety profile similar to that of a laptop

3. Is syllabus (curriculum & experiments) available?
   - Yes, a standard curriculum is available for 11-16 years' age group with our Integrated products. experiments complete with procedures, quiz & even competition!
   - We also offer tailor made curriculum

4. Which age group is suitable for studies in robotics?
   - Please see slide 22-23

5. Will training be provided?
   - Yes, 2-days of installation & training is bundled with our Integrated products.
   - Dedicated email DIY helpline is provided to our client schools- we technical representative answers queries if you face any obstacle while performing any experiment.

6. Where can we add robotics in curriculum?
   - Experiments of Physics & Geometry
   - Computer Curriculum
   - Craft & Model Building
   - Any other extra-curriculum activity

Frequently Asked Questions- II

1. How this robot is different from a 3D printer?
   - 3D printing is icing-on-the cake!
   - Our robot can perform professional 3D printing with SLA filaments.
   - Very accurate (0.1mm)
   - Very easy with auto-levelling attachment.

2. How can this robot be useful to our school?
   - Robotics in school curriculum is already adopted by national school authorities worldwide.
   - Robotics today is what computer were in 1990s.
   - Robotics is essential for your school to maintain competitive edge.

3. How long will you support us?
   - As long as you use the product
   - We stock the most important spares
   - Software is updated continuously and is free via internet.
   - New experiments are shared continuously.

4. How is the warrantee provided?
   - The robot has modular construction i.e. Most of the parts can be freely replaced by the users themselves.
   - If this does not work out, you just need to ship the part to us, we will repair/replace and sent it back to you.
   - In no case, breakage is covered by the warrantee!

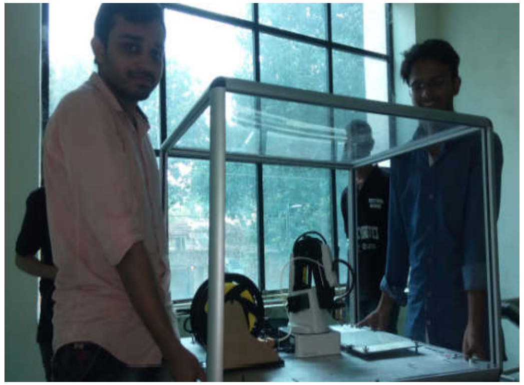
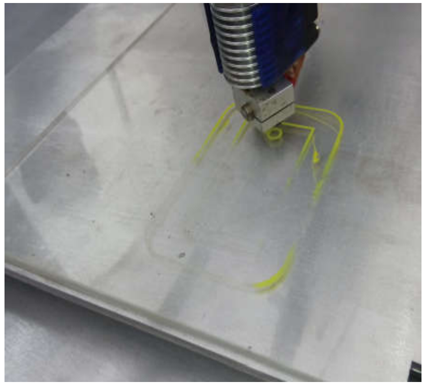
5. Is AMC (annual maintenance contract) available?
   - Yes!

Use-cases of Innovation Lab/Magician

- Verifiable proofs of product capability

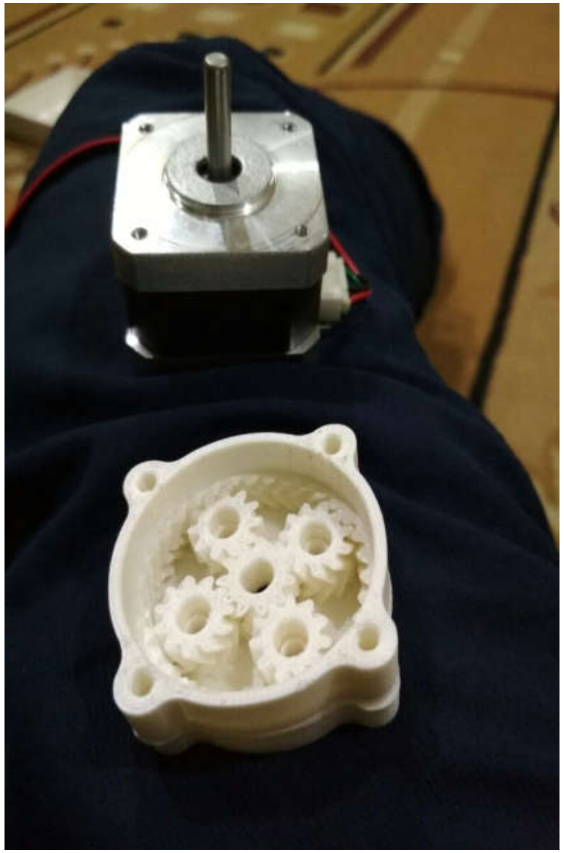
IntegrityRobotics' Innovation Lab- indispensable for a Robocon Team- a 3D Printed Motor Bracket; a use-case from TeamCybrotics, GECA, Aurangabad





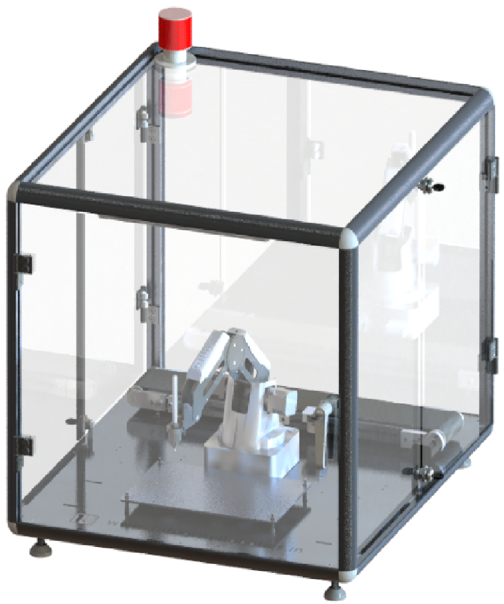
IntegrityRobotics' Innovation Lab- essential for an ATL setup- a 3D Printed gear box; a use-case from school students



Dobot Magician as a Chemical Lab Assistant

Click this black box to watch a complete video

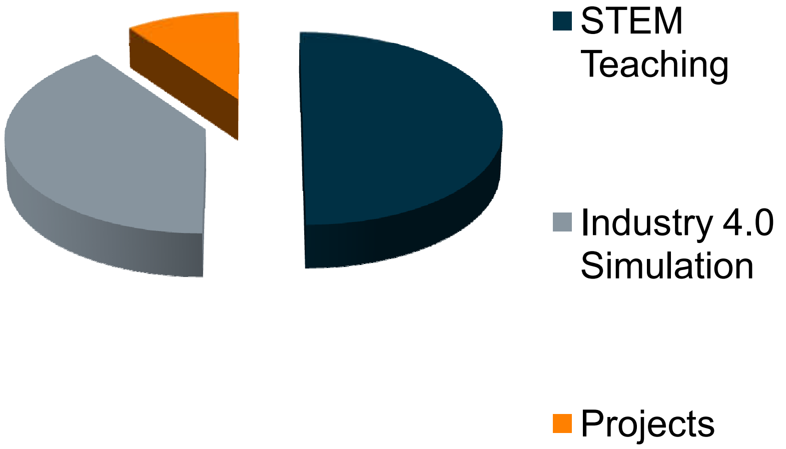
IntegrityRobotic Cells:
Built around Magician 2.0- Proven by Leaders



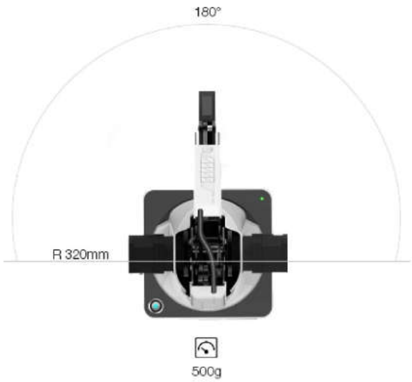
Common Applications

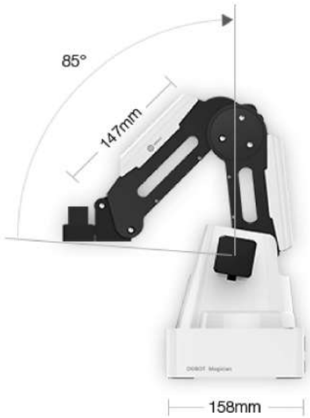
Name	Country/area	Application
Tsinghua University	China	production line simulation
University of Waikato	New Zealand	Teaching
J. J. Strossmayer University of Osijek	Croatia	pick and place ,suction, for project
Monash University	Australia	Laboratory research
Shandong University	China	Laboratory research
Stevens Institute of Technology	USA	robot teaching
University College London	UK	used for painting project
Chengdu University of TCM	China	Clinical medicine research
Natinal Tsing Hua University	Taiwan	robot, programming teaching
National Taiwan Normal University	Taiwan	robot, programming teaching
Harbin Engineering University	China	verification of algorithm
Xi'an Jiaotong University	China	Automated production line simulation
St. Aloysius Technical School	Taiwan	electronics teaching
Murdoch University	Australia	A tool for Biological Research
Yangzhou University	China	programming teaching
Avon Grove High School	USA	STEM program,CNC component
Rafik Hariri University	Lebanon	mechatronics teaching
Politecnico di Milano	Italy	roboteducation
Hohai University	China	robot teaching
Guangdong Technical College of Water Resources and Electric	China	Laboratory research
Zhongshan University	China	Laboratory research
Nanchang Institute of Technology	China	Automated production line program
ROBERT TOWNSON HIGH SCHOOL	Australia	STEM education
National Taipei University of Technology	Taiwan	robot, programming teaching
Cheng Shiu University	Taiwan	robot, programming teaching
Taiwan University	Taiwan	contest-2016 NVIDIA
University of Miami Biomedical Engineering	USA	robot, programming teaching
Southen Cross University	Australia	connected with the syringe
University of Tennessee	USA	help for surgical treatment

Institutional Application Pattern



Broad Specifications



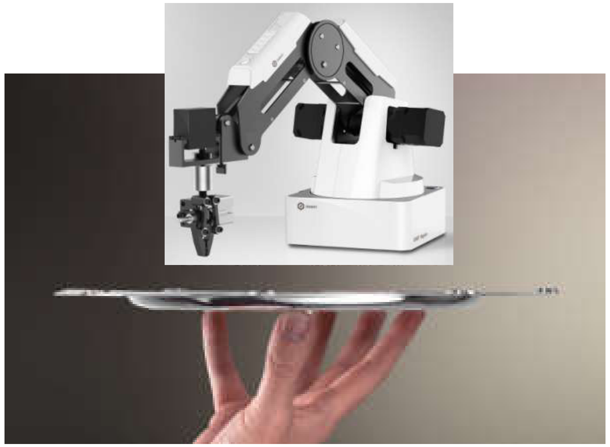


Number of Axes	4
Payload	500g
Max. Reach	320mm
Position Repeatability(Control)	0.2 mm
Communication	USB / WIFI / Bluetooch
Power Supply	100 V - 240 V , 50/60 HZ
Power In	12 V / 7A DC
Consumption	60W Max
Working Temperature	-10°C - 60°C

Axis Movement

Axis	Range	Max Speed (250g workloa
Joint 1 base	-90° to + 90°	320° / s
Joint 2 rear arm	0° to +85°	320° / s
Joint 3 forearm	-10° to +95°	320° / s
Joint 4 rotation servo	+90° to -90°	480° / s

Net Weight	3.4KG
Gross weight (Standard Version)	7.2KG
Gross weight (Education Version)	8.0KG
Base Dimension(Footprint)	158mm x 158mm
Materials	Aluminum Alloy 6061, ABS Engineering Plastic
Controller	Dobot Integrated Controller
Robot Mounting	Desktop



Product Offering

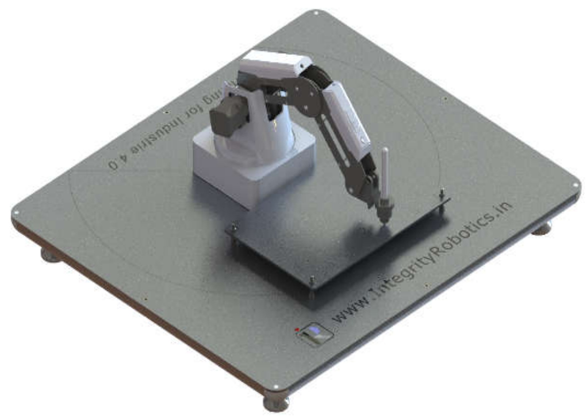
- Integrated Products
- Bare products
- Other Premium Educational technlogy Products

Based on ToI article by Kavita Gupta Sabharwal

Integrated Products- An asset!

- Innovation Lab, Full Featured
  - Loaded to the brim
    - 3D printing, Pneumatic pick-n-place, Laser Engraving, writing, milling / drilling, Conveyor, joystick / Wifi / bluetooth
  - Superb Packaging
    - Industrial aluminium cell on table with panels
    - Inbuilt drawers for tools storage
    - 3D Printing base with level adjustments, internal lighting
  - Onsite installation & kick-starting training
  - Curriculum formation
  - Dedicated email DIY support helpline

- Innovation Lab, Midget
  - Most functions
    - 3D printing, Pneumatic pick-n-place, Laser Engraving, writing, milling / drilling
  - Great packaging
    - Industrial aluminium platform
    - Inbuilt drawers for tools storage
    - 3D Printing base with level adjustments
  - Curriculum formation
  - Dedicated email DIY support helpline

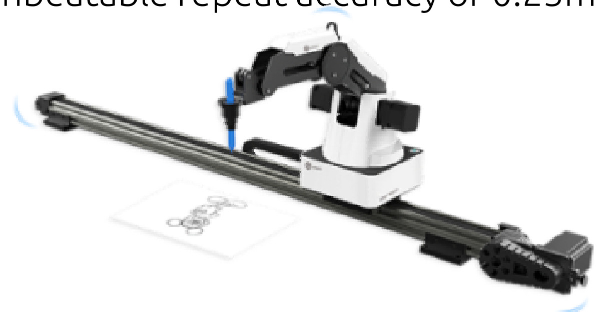


Bare Products from Dobot- for the DIY mindset

- Dobot Magician
  - Fully functional robotic arm that forms our Innovation Lab, Full Featured.
  - Comes loaded with all kits (Pnumatic, 3D printing, writing)
  - Comes in two versions
    - Standard
    - Educational (laser engraving, wifi/bluetooth, joystick controller)

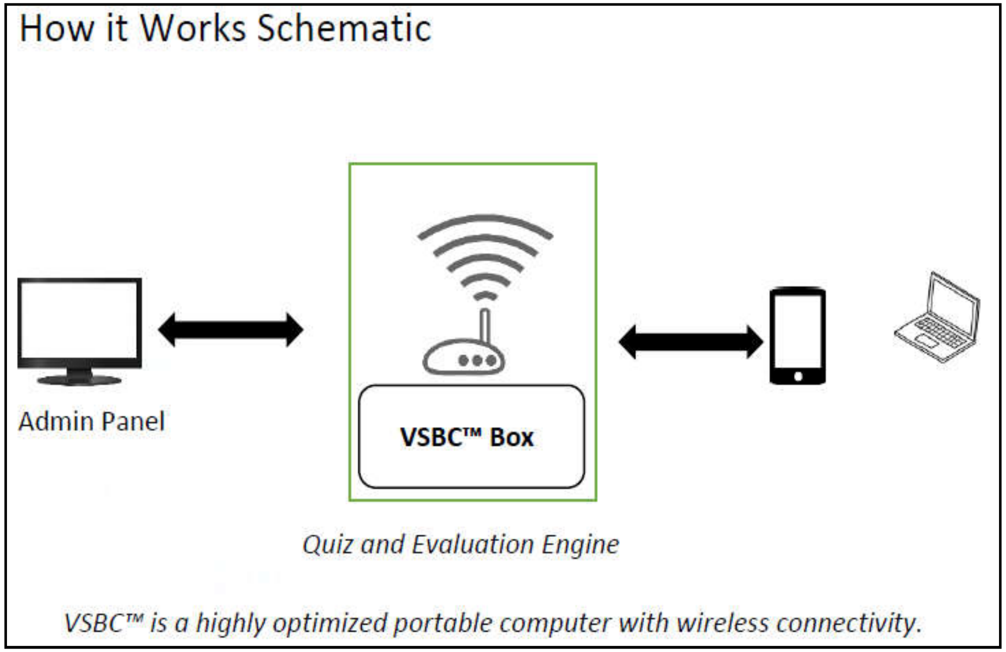
- Conveyor Belt Kit
  - Multiplies industrial pick-n-place experiments
  - Plug-n-play with the Dobot Magician
  - Comes with IR sensor, colour sensor, wooden blocks

- Sliding Guide Rail Kit
  - Great way to extend reach of the robot to over 1m; for ultra-large tasks such as 3D printing
  - Plug-n-play with the Dobot Magician
  - Unbeatable repeat accuracy of 0.25mm.



Other Educational Products by IntegrityRobotics

- SmartKwiz™ by VinSonTech is an innovative, patent pending **Quiz and Evaluation Management Platform**
- Students can attempt question paper on any smart device (phone, laptop, etc.) over wifi without internet connection.
- A must for-
  - Schools
  - Colleges
  - Universities
  - Coaching classes
  - Training workshop
  - Seminars, etc.



Benefits

- Prevents piracy of your content
- Significant Savings In OPEX (Paperless, Internet)
- Anytime Anywhere- Portable Plug And Play Unit. Low Power Device
- Smartphone Client (Works With Laptop, Desktop & Tablet As Well)
- On The Go Quiz Solution
- Works Online And Offline (Without Internet)
- Better Engagement With Student / Participants / Attendees

Features

- Supports MCQ (Single / Multiple Correct, Descriptive)
- Supports Picture / Audio / Video Questions
- Unlimited Users/Students; Unlimited Question Bank
- User Friendly Interface
- Instant Result With Analysis
- Multilingual Ready
- Admin Panel- Easy Workflow
  - Add/register users
  - Create Questions & add into question bank
  - Create Quiz and add questions from question bank.
  - Generate Result Reports

You are welcome at-

- Web
  - https://www.integrityrobotics.in
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  - support@integrityrobotics.in | for support of any kind
  - kapil@integrityrobotics.in | for inquiries
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