Educational Robotics & Digital Technologies
for Resource-Limited Communities

Welcome

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Educational Robotics & Digital Technologies

for Resource-Limited Communities

Presentation Schedule

Research Hypothesis

Theory → Practice

Practice: Practical Projects, Summaries

Theory: Theoretical Framework

Practice: Details of Projects

Summary & Conclusions

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Research Hypothesis

"With Adequate Resources (Human + Technology Assets and Capital), even School Age Children and Families in Resource Poor and Resource-Limited Communities (Inner City, Rural, Remote Villages, Developing Countries), Can be Educated and Prepared to Fully Participate in the Rapidly Advancing and Imminent Global Automation, Digitized and Digital Economy"

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Research Hypothesis

Thus, try to show: It is Feasible and Practical to,

"Prototype the Future Together At All Ages and in All Communities, to Understand the Coming World of Algorithms and Digital Automation!"

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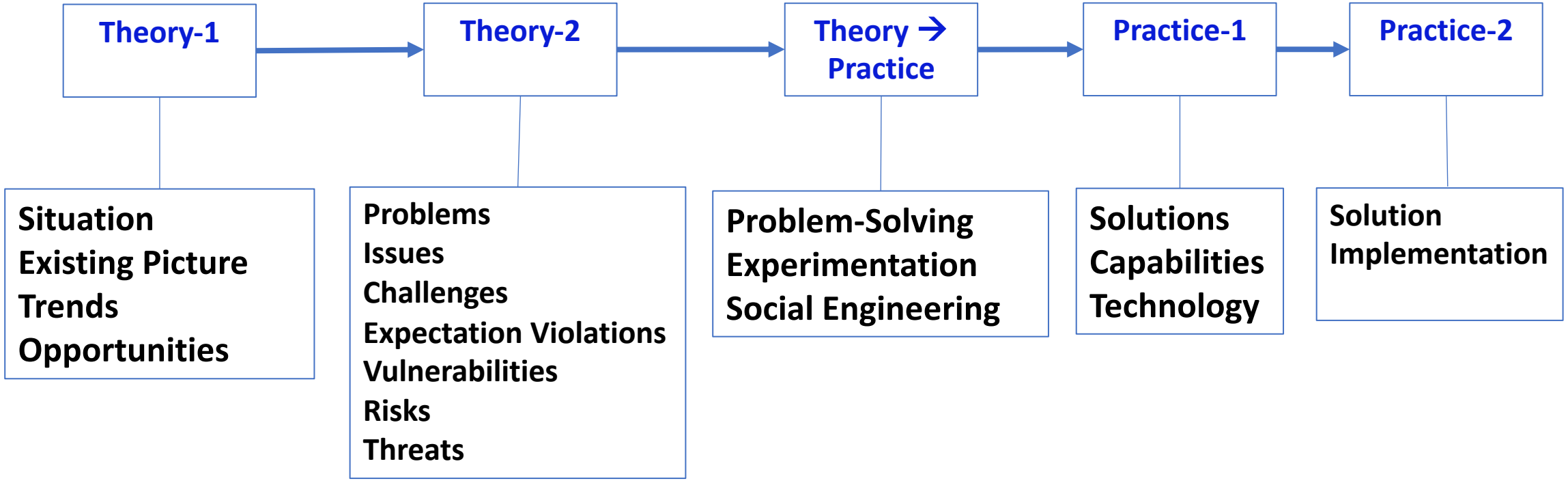
Theory → Practice



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Questions?
Comments?
Suggestions?

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Practice: Practical Projects, Summaries

1* RobotiQK: York College Summer Robotics Program

2* Local Community After-School Programming Projects

3* Village Digital Education Project

4* Village Digital Tech Community Project

5* DevCountry Digital Economy Project

CONTEXT:

(NSF) CS4All

(NSF) Future of Work

(USA) American AI Initiative

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Practice: Practical Projects, Summaries

RobotiQK: York College Summer Robotics Program

Who: K6-K12 (Middle School to High School Students)
Undergraduate Assistant Instructors

Where: Jamaica, Queens, New York City, USA

When: Summer 2018 (120 + 12), Summer 2019 (80 + 12)

What: Use Educational Robotics to Foster STEM+ Learning

How: Students Program Robots + Drones: Use Visual Programming

How: US Department of Education (DOE) Funded

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Practice: Practical Projects, Summaries

RobotiQK

Prototyping the Future Together At All Ages

York College Summer Robotics Program 2018

| Take Apart | Build, Construct, Innovate | Program, Code | Use, Explore | Apply in Real World Challenges & Problems

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Practice: Practical Projects, Summaries

Local Community After-School Programming Projects

Who: K9-K12 (High School) Students (12) (2 Undergrad Coaches)

Where: Off-Campus, Church sponsored

When: After-school, Extra-curricula activity

What: Learn Computer Programming, Coding

How: Multi-paradigm programming: Use different programming styles

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Practice: Practical Projects, Summaries

Village Digital Education Project

Who: K-K8 Students

Where: Remote, Rural Village, Ghana, W. Africa

When: (In planning) (need funding)

What: Modernize the Curriculum and Train Teachers
Prepare Students in STEM and Digital Technology

How: Include Tele-Presence Robots for Tele-Education

How: In planning with a Not-for-Profit (NFP) Organization and Faculty at Chicago State University, USA.

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Practice: Practical Projects, Summaries

Village Digital Tech Community Project

Who: Village Community

Where: Remote, Rural Village, Ghana, W. Africa

When: (In planning) (need funding)

What: Establish Economic Activity at Village Level. Producers not Consumers. Get paid in the Digital Tech Economy. (Test & Review Apps, Products)

How: In planning with a Not-for-Profit (NFP) Organization and Faculty at Chicago State University, USA.

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Practice: Practical Projects, Summaries

DevCountry Digital Economy Project

Who:	**Government of Ghana**
Where:	**Ghana, W. Africa**
When:	**Summer 2019**
What:	**Establish Multi-sided Platforms (MSP)**
	for a Small Country Government (or a small State)
	to participate in the Global Digital Tech Economy.
	(Taxes, Security, Safety, In-country vs Off-Shore Banking, Marketplaces).
How:	**With Faculty at Chicago State University, USA.**
How:	**MSP built on Cloud + 5G + IOT Digital Technologies**

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Theoretical Framework

Digital Technology:

Transformations, Transitions, Trends, Impacts: Disruptive, Opportunities, Threats

Future-of-X: Question Everything!!! Re-Imagine Everything!!! Creative Destruction (Schumpeter)

Personal (Implantable, Wearable, Hearable), (Food, Diet, Nutrition, Exercise, Sleep, Health, Medicine, Healthcare, Lifestyle, "LifeStreams", Quantified Self, Self-Actualization, Work, Jobs, Employment, Career, Profession, Trade), Family, Household, Residential, Community, Town, City, Municipality, State, Province, Nation, Country, International, Global, Worldwide, Social, Society, Cultural, Economic, Industrial, Commercial Religious, Environmental, Ecological (Water, Climate, Energy, Fuel, Waste, Pollution, Deep Sea), Space, IOT, "Mirror Worlds"

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Theoretical Framework

Digital Technology: Computational STEM+: Age of Algorithms

"I've noticed an interesting trend. Pick any field X, from archeology to zoology. There either is now a "computational X" or there soon will be. And it's widely viewed as the future of the field." (S. Wolfram, 2016)

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Theoretical Framework

(RADICALS) Digital Technology: Physical | Virtual | Augmentation

Cognitive, Smart, Intelligent: Bot, Agent, Server, Actor: Appliance, Device, Instrument, Tool, System, Infrastructure

RADICALS Systems:

Robots, Reactive +
Automata, Augmentation, Automated, Automation, Algorithms +
Drones, Digital, Distributed +
Intelligent +
Computer, Computational, Cybernetic +
Autonomic, Adaptive +
Learning
Self-*

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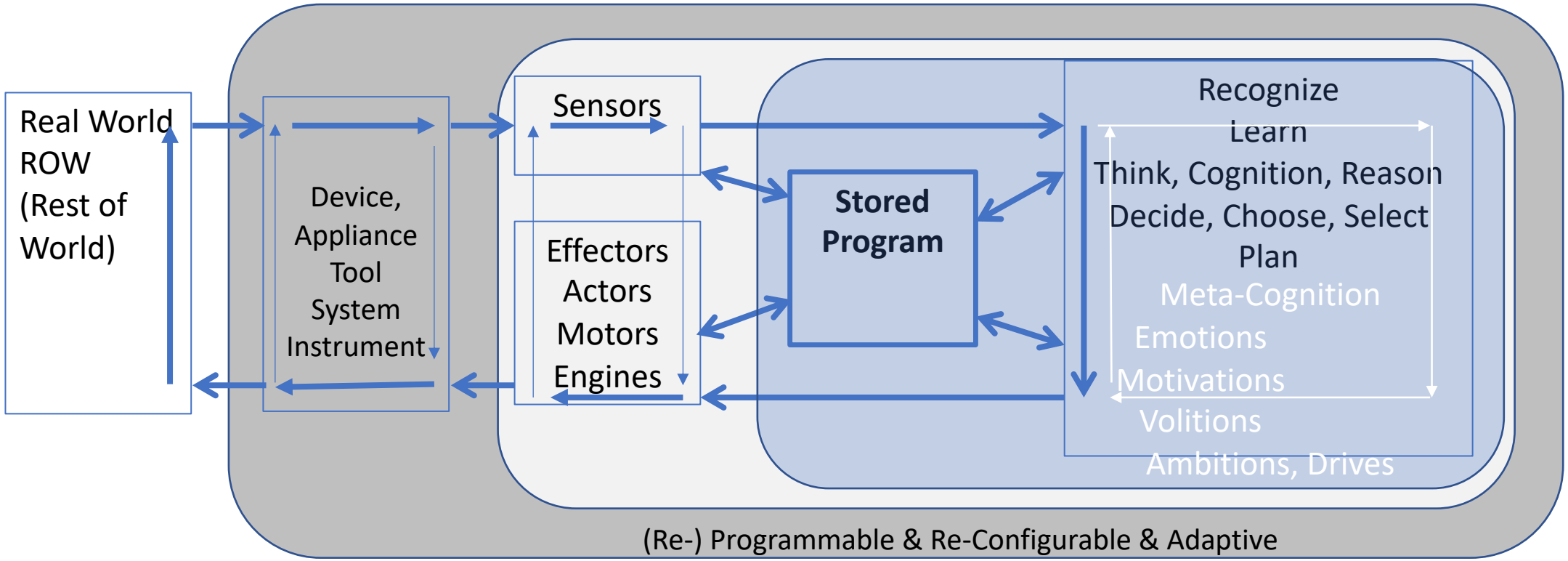
Theoretical Framework: Reactive & Cybernetic & Intelligent Agent Model



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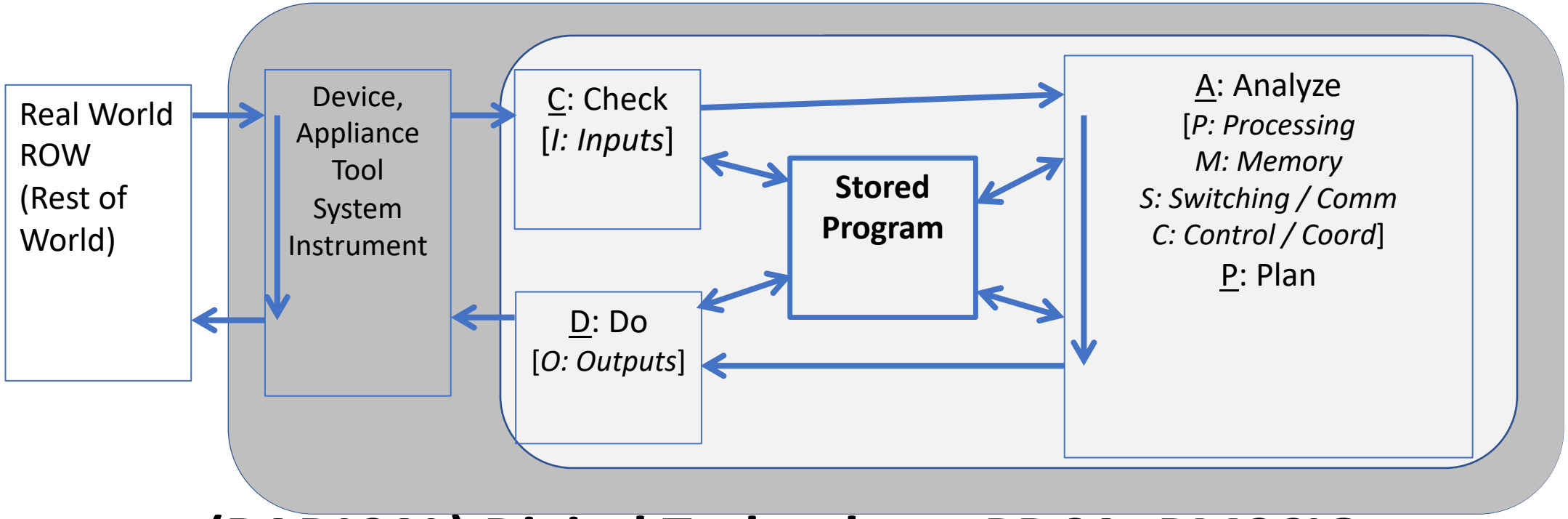

(RADICAL) Digital Technology: PDCA: PMSCIO

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Theoretical Framework

Mechanics: Thinking: Scientific | Engineering | Other

Computational Thinking, Integration, Systems Thinking, Design Thinking, Disruptive, Re-Imagined, Creative Destruction, Re-Engineering Thinking, Self-*, Autonomic Thinking, Engineering, Terra-forming Thinking, Visual Thinking, Reflection, Practice, Prototyping, Meta-Cognition, Scenario, Case-Based Thinking, Multiple Intelligences

Analytic Thinking, Synthetic Thinking, Logic Thinking

Cope with: Volume, Scale, Variety, Diversity, Complexity, Multi-Scale, Order, Hierarchy, Velocity, Veracity, Efficiency, Change, Evolution, Adaptation, Migration, Variation, Continuous Total Quality Improvement

Approaches: Simulations + Games + Models + Play + Animations + Visualizations + Prototyping + Storytelling+Ideation (Generation.Of.Diversity (G.O.D) → Compare, Grade, Optimize → Selection)+ Augmentation + Prosthesis + Exoskeleton

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Theoretical Framework

Mechanics

Parent: What do you want your children to achieve? Student: What do you want to achieve?

Learning, Learn something: What? (Topics, Themes, Concepts) How? (Learning Styles)
Explore, Familiarize, Gain Experience, Mastery, Expertise, Deep Learning
Innovation, Creativity, Ingenuity, Problem-Solving, Disruptive, Active, Life-long Educ.
Multi-paradigm Learning: Hands-on, Constructivist, Inquiry-based, Goal-driven

Game-Like: Easy Fun | Hard Fun | Social Fun | Epic, Serious Fun (N. Lazzaro)

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Practice: Details of Projects

RobotiQK: York College Summer Robotics Program 2018

***110 K6-K12 Students + 12 Undergraduate Assistants**

***About 12 – 15 different types of (x50)(Educational) Robots and Drones**

***Visual Programming of the Robots and Drones Using Scratch and variants (Block Coding) (Can Teach Scratch to anyone 5yrs-100yrs!)**

***STEM Explorations using Modular Electronics Kits**

***Highlights: Demo Day: Students Exhibit Achievements to Families, College Community, Local Community. mini Research Project Reports. www.york.cuny.edu/RobotiqK**

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Practice: Details of Projects

RobotiQK: York College Summer Robotics Program

Projects: Mini-problems from the Real-World:

Fetch; Pick-&-Place; Sweep; Inspect;

Navigate, Traverse thru Barriers, Obstacles;

Recruit, Tandem Running; Follow Me; Fly With Me;

Project Canvas Method

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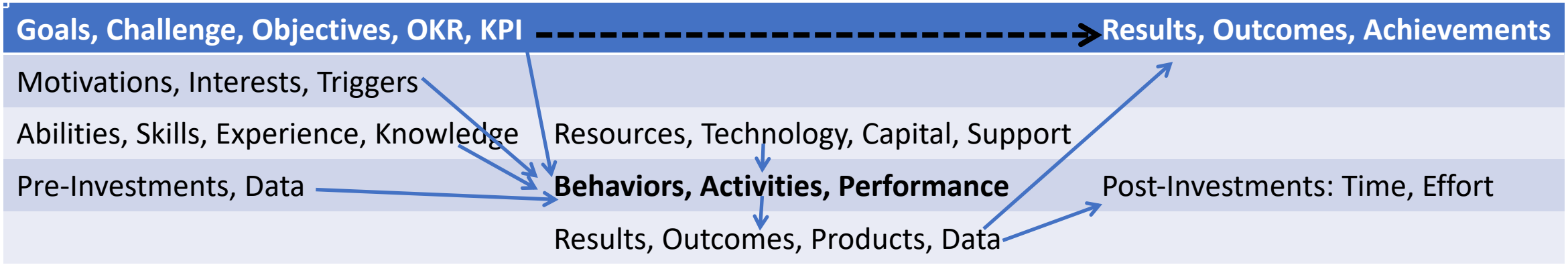
Practice: Details of Projects

RobotiQK: Project Canvas Method



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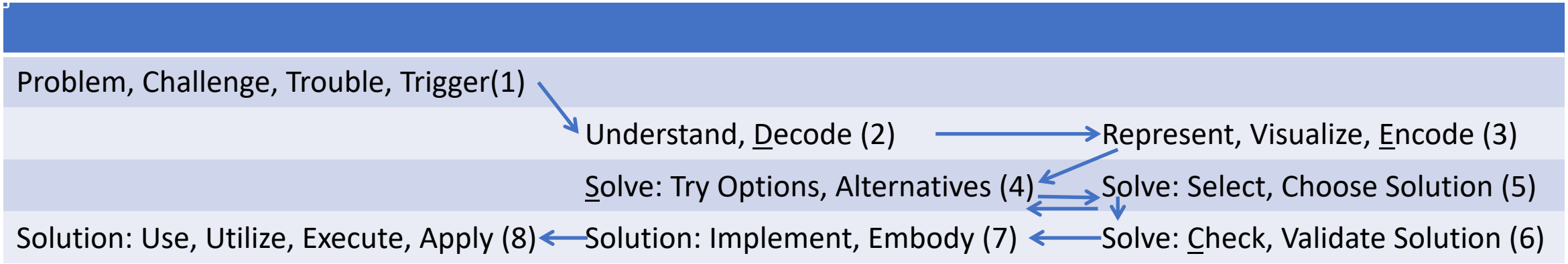
Practice: Details of Projects

RobotiQK: Problem-Solving Canvas Method



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Practice: Details of Projects

RobotiQK: Dual Process Canvas Method

Activity	Reflection, Meta	Symbolization
Processes, Behaviors, Dynamics	Linguistic, Verbalizations, Record, Log	Algebra
Manipulations of Patterns, Schemas, Structures	Terms, Terminology, Words, Concepts: clusters, Maps	Symbols, Icons, Indexes, Emojis, Glyphs, Viz, Graphics
Computations, Calculus, Calculi	Glossary, Dictionary, Thesaurus	Notations

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Practice: Details of Projects

RobotiQK: (Gamification, Game-like) "Fun" Method

Focus	"Fun" Learning, Problem-Solving (N. Lazzaro)
Build, Explore	Easy Fun + Hard Fun + Serious Fun + Social Fun
Program, Explore	Easy Fun + Hard Fun + Serious Fun + Social Fun
Use, Explore	Easy Fun + Hard Fun + Serious Fun + Social Fun
Apply	Easy Fun + Hard Fun + Serious Fun + Social Fun

Integrate SGM+PAV: Simulations + Games + Models + Play + Animations + Visualizations
Tele-presence Robots for Educational Tele-Tourism and Student Peer-to-Peer Tele-Visits

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Practice: Details of Projects

RobotiQK: Ongoing Research & Further Research

(Visual) Programming Building Blocks ("Lego" Blocks) ToolBox, ToolSet for End-User Programming (Children and Non-Programmers), to Build, Program, Use, Apply and Explore:

Parallel Programming & Computing

Distributed Programming

Concurrent Programming

Multi-Paradigm & Hybrid System Computing

Programming & Multi-scale Computing

Heterogenous System Computing

Collective Computing: Using Swarm, Ensemble and *Society of* Multiple AI Bots, Agents, Robots, Drones, Automata, "Ants", Intelligent Assistants, Actors, Processes, Objects, Entities, Devices, Machines

C*: (Coordination, Choreography, Control, Cybernetics, orChestration): ➔

Synergism, Emergence Computing

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Practice: Details of Projects

Becoming Producers NOT Just Being ~~Consumers~~ of Digital Tech & AI Tech

Value Chain Model of Producer Opportunities

Supply Chain →	Production Chain →	Demand Chain
Purchasing, Procurement, Provisioning	Manufacturing, Production, Deploy	Use, Service, Maintain, Update
↑	↑	↑
	Facilities & Infrastructure Engineering	Experience, Learning, Teaching

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Summary & Conclusions

***Resource-Poor Communities Need Not be Left Behind.**

***Digital Technology, (including Intelligent Cognitive Assistants and Augmentation Systems), can in fact be used to ensure such Communities Participate.**

Further Information: WWW.YORK.CUNY.EDU/ROBOTIQK

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Thank You

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