

Carnegie Mellon University
HeinzCollege

INFORMATION SYSTEMS • PUBLIC POLICY • MANAGEMENT



**Information
Systems & Management**

Carnegie Mellon University
Heinz College

**ETHICAL
TECHNOLOGY LEADERS**

**Public
& Management
Policy**

Carnegie Mellon University
Heinz College

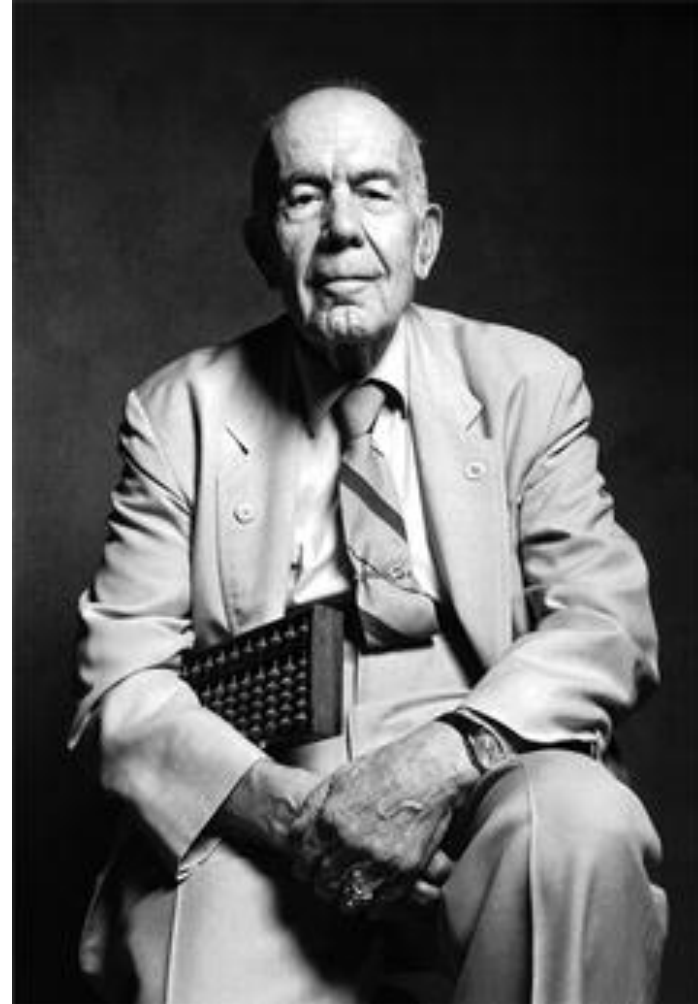
**TECH-SAVVY POLICY
MAKERS**

4800

HAMBURG HALL

*“Educating Men
and Women for
Intelligent
Action”*

**- Founding Dean
William W. Cooper**



Heinz College's history of Human Centered Innovation



412 Food Rescue



Transportation
Security
Administration



ACCESS Paratransit



Pittsburgh Science and Technology
Academy

Carnegie Mellon University
HeinzCollege

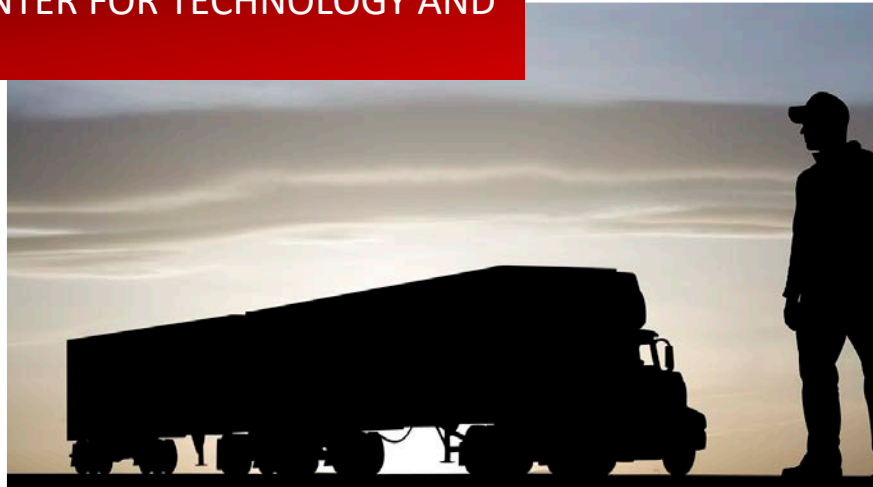
INFORMATION SYSTEMS • PUBLIC POLICY • MANAGEMENT

Our Goal

The center of excellence in education and research at the nexus of technology and society – where people, policy and technology meet. Be a recognized leader in data intensive social and decision science.



BLOCK CENTER FOR TECHNOLOGY AND SOCIETY



INITIATIVE FOR DIGITAL ENTERTAINMENT ANALYTICS



RISK AND REGULATORY INNOVATION CENTER



METRO 21: SMART CITIES INSTITUTE



Smart Communities Concentration

Faculty co-appointments with Engineering School (Ramayya Krishnan, Sean Qian, Peter Zhang, Karen Clay, Al Blumstein...)

Faculty Chair: Sean Qian (CEE and Heinz)

The Smart Communities concentration integrates technology, social science, and management skills in the key areas driving the future of cities and urban regions in the United States and around the world.

Includes courses from across campus: EPP, SCS, CFA, PHIL, CEE

Sample Courses include:

Smart Cities: Growth and Intelligent Transportation Systems

Privacy, Policy, Technology, and Law (SCS)

Resilient & Sustainable Communities

Policies of Wireless Systems (EPP)

Geographic Information Systems

AI, Society and Humanity (PHIL)

Smart Communities Coursework

90-789	Resilient & Sustainable Communities	HNZ	Spring	12
90-807	OR Planning by Design: Campuses, Waterfronts, Districts, and Cities	CFA	Spring	12
94-845	Smart Cities: Growth and Intelligent Transportation Systems	HNZ	Fall	6
95-818	Privacy, Policy, Technology, and Law	SCS	Fall	12
Additional Courses for the Smart Communities Concentration Courses Select 18 units from the courses listed below.				
12-706	Civil Systems Investment Planning and Pricing	CEE	Fall	12
12-709	Data Analytics for Engineered Systems	CEE	Fall	12
12-749	Climate Change Adaptation	CEE	Fall	6
12-750	Infrastructure Management	CEE	Spring	12
12-761	Sensing and Data Mining for Smart Structures and Systems	CEE	Spring	12
19-722	Telecommunications Technology and Policy for the Internet Age (pre-requisite, knowledge of microeconomics)	EPP	Spring	12
39-611	Energy Demand and Utilization	CIT	Fall	6
39-612	Energy Policy and Economics	CIT	Spring	6
90-734	Urban Policy	HNZ	Spring	6
90-765	Cities, Technology, and the Environment	HNZ	Spring	6
90-766	Intermediate Database Design and SQL (pre-requisite 90-728 Database Management)	HNZ	Fall	6
90-783	Policy Innovation Lab	HNZ	Spring	6
90-812	Introduction to Programming with Python	HNZ	Fall/Spring	6
94-802	Geographic Information Systems	HNZ	Fall/Spring	12
94-831	Design Center: Design Thinking for Social Innovation	CFA	Fall	12

Will machines *REALLY* replace us?

- Problem:

- Rapid advances in Machine Learning and Robotics is driving concern about the impact on employment.
- Estimates are that half of the tasks performed by humans today could be automated.*
- Forecasting the path of diffusion of technology is key to determining who is likely to be affected.



- Potential:

- Researchers at CMU and MIT argue that the next wave of automation will be different-impacting all rungs of the economic ladder.
- Furthermore, though some tasks may transform, very few jobs appear suitable for full automation.
- This insight arms policy makers with the information necessary to identify and plan smartly for those affected.

*A Future That Works: Automation, Employment and Productivity
Chicago: McKinsey Global Institute.

Systems Synthesis

- Clients
 - House AI Caucus
- Two Bills
 - Life long Learning Benefits Bill
 - Tax Policy for Investing in Human Capital Bill
- UG Econ Seniors and Heinz MS in Public Policy students advised by 2 faculty members
- Briefing to congressional staff, Aspen Institute and Accenture

Narrowing the achievement gap

- Problem:

- Gap in scholastic performance between racial groups is wide and persistent.
- Personalized tutoring methods are proven to narrow the gap significantly.
- These interventions are very high cost and as a result, infeasible.



- Potential:

- AI-based cognitive tutors demonstrate rapid learning acceleration, especially in math, across all segments.
- Human tutors are even more effective in tough cases as they provide inspiration that is difficult to replicate digitally.
- Complementing human tutors with AI tools may narrow the gap and permit deployment at scale.

Ed Tech to Support *Doing Math to Learn Math*

Ken Koedinger

Professor of Human-Computer Interaction & Psychology

Carnegie Mellon University

Director of  Co-leader of



Father of

**Carnegie
Mellon
University**

The
Simon
Initiative



Prepared for CZI Project Partners, March 2019

on University
College
PUBLIC POLICY • MANAGEMENT

Learning is not a spectator sport!

- Doing has 6x more impact than reading or watching!
- Data from college-level online courses show:
 - The formative assessment activities students *do* has a *six times* bigger influence than the readings or lectures they watch
 - On student learning outcomes, including grades & final exam scores

Cognitive Tutors: Adaptive Support for Learning by Doing

My current cell phone company charges me \$14.95 per month for service and \$.13 per minute. PPS Cellular Phone Company has offered me \$15.00 worth of free calls a month if I switch, but the charge is \$.39 per minute.

Quantity Name	Time	Current cost
Unit	minutes	\$
Expression	t	.13t
Question 1		
Question 2		
Question 3		
Question 4		

The cost from my current company increases by 0.13 each minute, but remember that it starts at 14.95 dollars.

Authentic problems

Feedback *within* complex solutions

Progress...

Scenario

My current cell phone company charges me \$14.95 per month for service and \$.13 per minute. PPS Cellular Phone Company has offered me \$15.00 worth of free calls a month if I switch, but the charge is \$.39 per minute.

- How many minutes of calls can I get from PPS Cellular Phone Company for \$50? What is the cost from my current company for that number of minutes?
- How many minutes of calls can I get from my current company for fifty dollars? What is the cost from PPS Cellular Phone Company for that number of minutes?
- What is the cost from both companies for sixty minutes

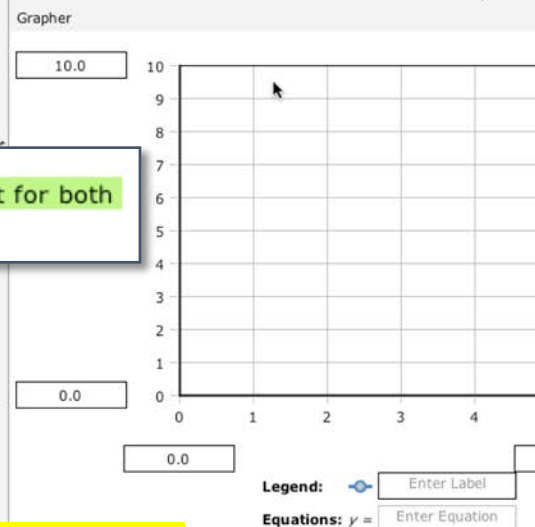
Worksheet

Quantity Name	Time	Current cost
Unit	minutes	\$
Expression	t	.13t
Question 1		
Question 2		
Question 3		
Question 4		

Personalized instruction

Challenging questions

4. After how many minutes of calls will the cost for both companies be the same?



Hint

If the cost from my current company and the cost from PPS Cellular Phone Company are equal, then their expressions are equal. Write an equation and solve it to find the number of minutes.

Close << Previous Hint Next Hint >>

... individualization

- Calculate input value.
- Writing expression, any form.
- Set axis bounds.
- Label point of intersection.
- Enter given.

Koedinger et al. (1997). Intelligent tutoring goes to school in the big city. *International Journal of Artificial Intelligence in Education*,