

Iterative Design of a Robot-Centered Curriculum for the Introduction to Computer Science Course

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Focus on Process



Outline

- Goals
- Robots in CS1
- Our Approach
- Results, Design, and more Results!



Design Goals

- Motivate students to further study in Computer Science (CS).
- Develop standalone modules which can be deployed in introduction to CS (CS1) courses.
- Create new robotic technologies that act as an enabler for novel learning interactions.

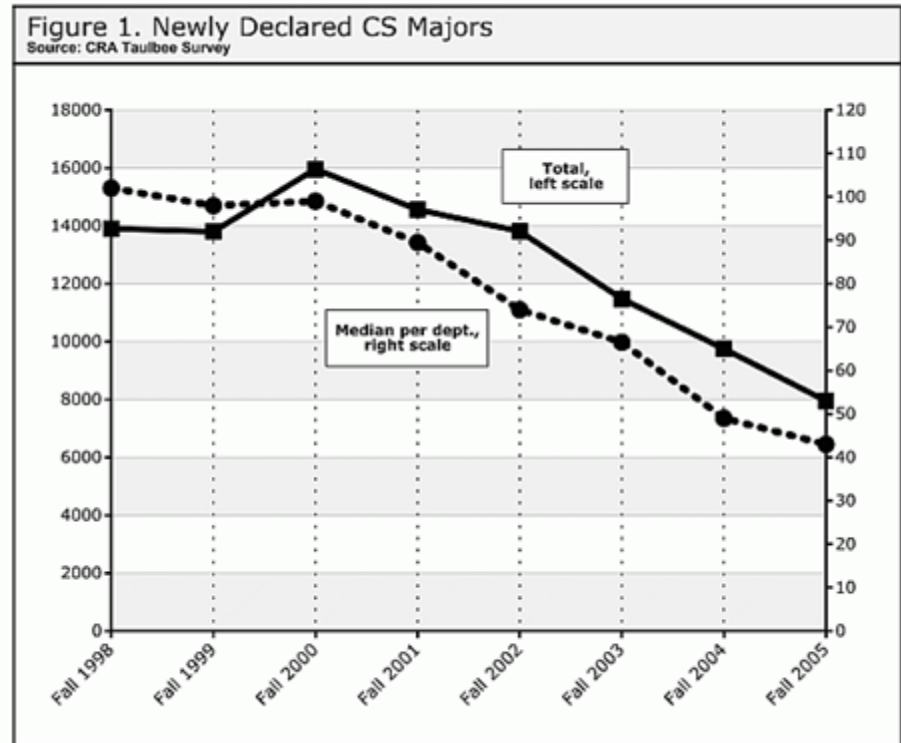


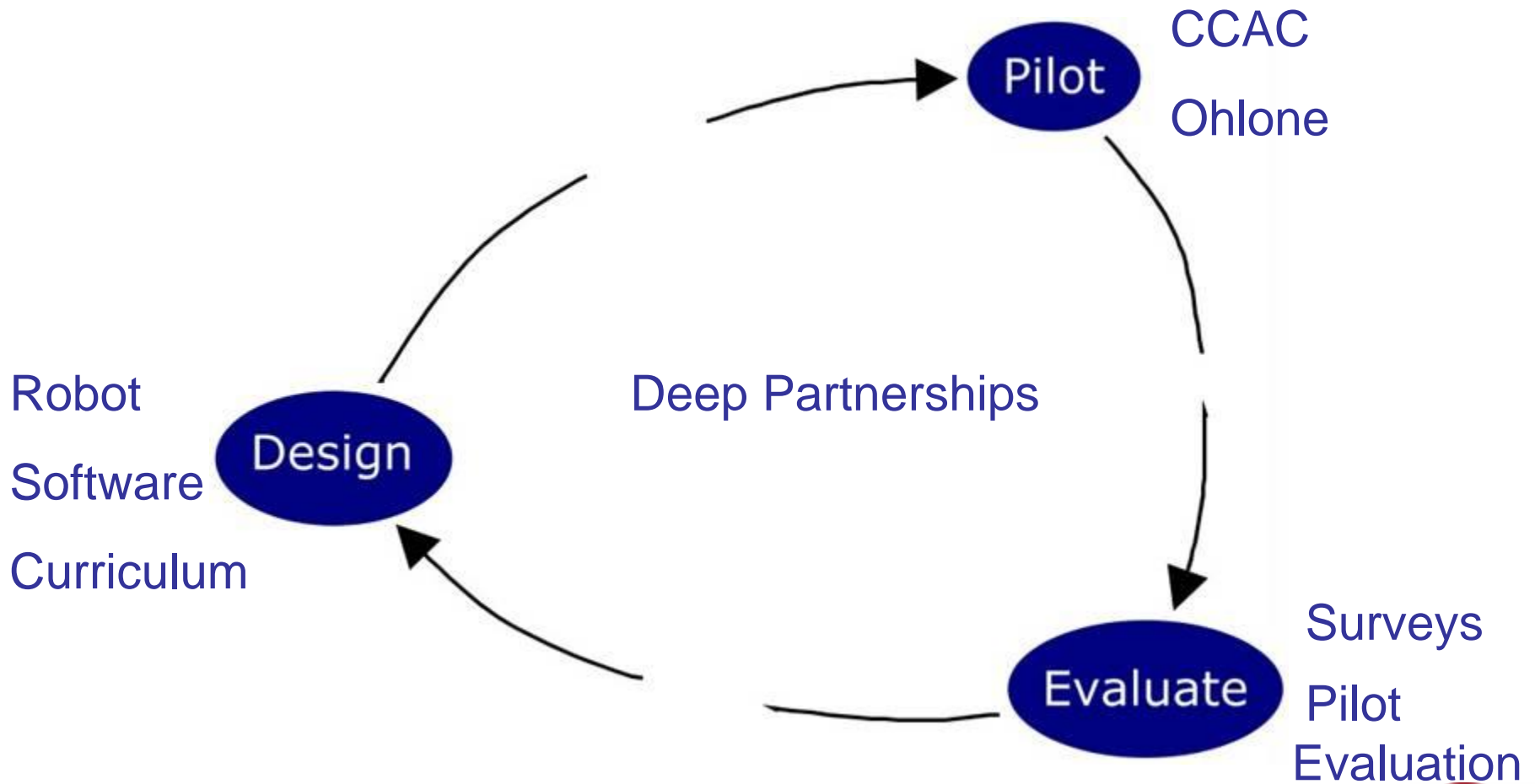
Fig. 1: Newly Declared CS Majors drop from 14,000 to 8,000 in six years. Source, Computer Research News, May 2006.



Robots in CS Education



Our Approach



Survey Goals

- Ground our curricular designs in current classroom realities.
- Ensure that enough educators are **able** and **willing** to use robots as an educational tool.



Survey Methodology

- 33 university and 4 community college CS1 professors participated
- Data collected through a phone interview
- Responses to open ended questions were coded to examine the frequency of conceptual expression.
- Simple statistical methods were used to analyze numerical responses.



Fig. 2: Geographic distribution of participants; participants were diverse with respect to size and type of school, gender, and professional level as well.



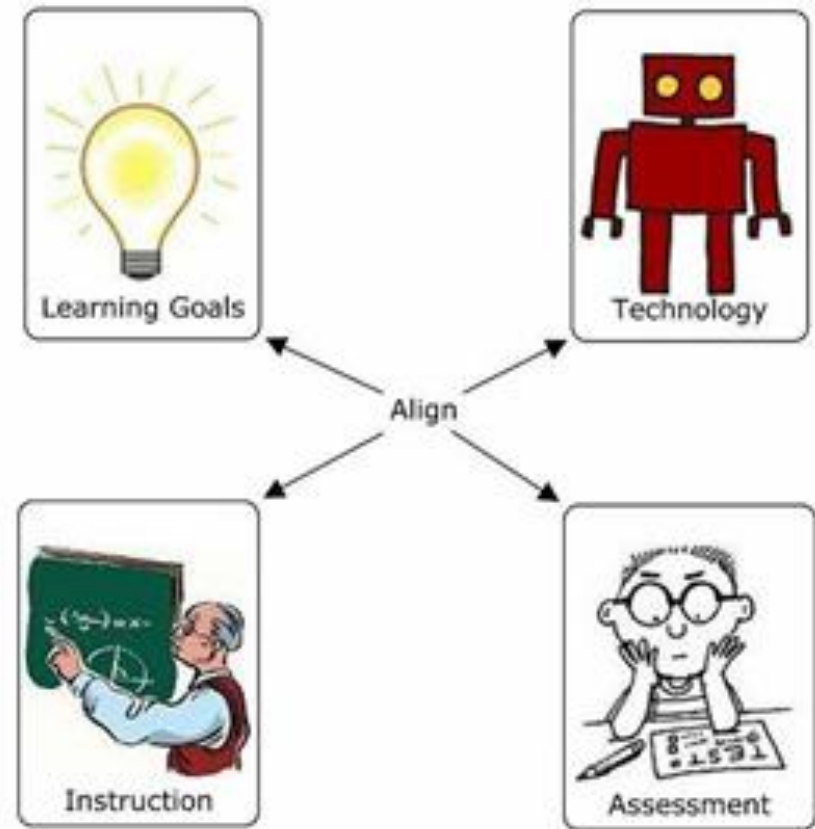
Survey Results

- 12% could make major changes without oversight, 69% could make minor changes
- 91% expect students to be able to complete assignments at home
- The primary languages in use are Java and C++; only one educator stated that they will change their language
- Response to using robots in CS1 was fairly positive, especially amongst professors using Java



Simultaneous Design

- Robot
- Software Framework/API
- Curriculum
- Key Design Principle: **Alignment**



Robot Design

- iRobot Create platform
- Qwerk controller
- TeRK environment
- Audio speaker
- Webcam (not pictured)
- Kitchen sink approach



Software Environment



Curriculum Design

- Resources:
 - Faculty survey
 - Textbook survey
 - Prior Partner Curricula and partner input
- Decisions:
 - Modular to allow for ‘drop-in’ activities
 - Java-based to maximize dissemination potential



Fall 2007 Pilot

- Two pilot programs active during fall semester
- Ran full curriculum with weekly robotics assignments
- CCAC: 72 students, 8 robots.
- CCAC students were evaluated for learning, interest, retention

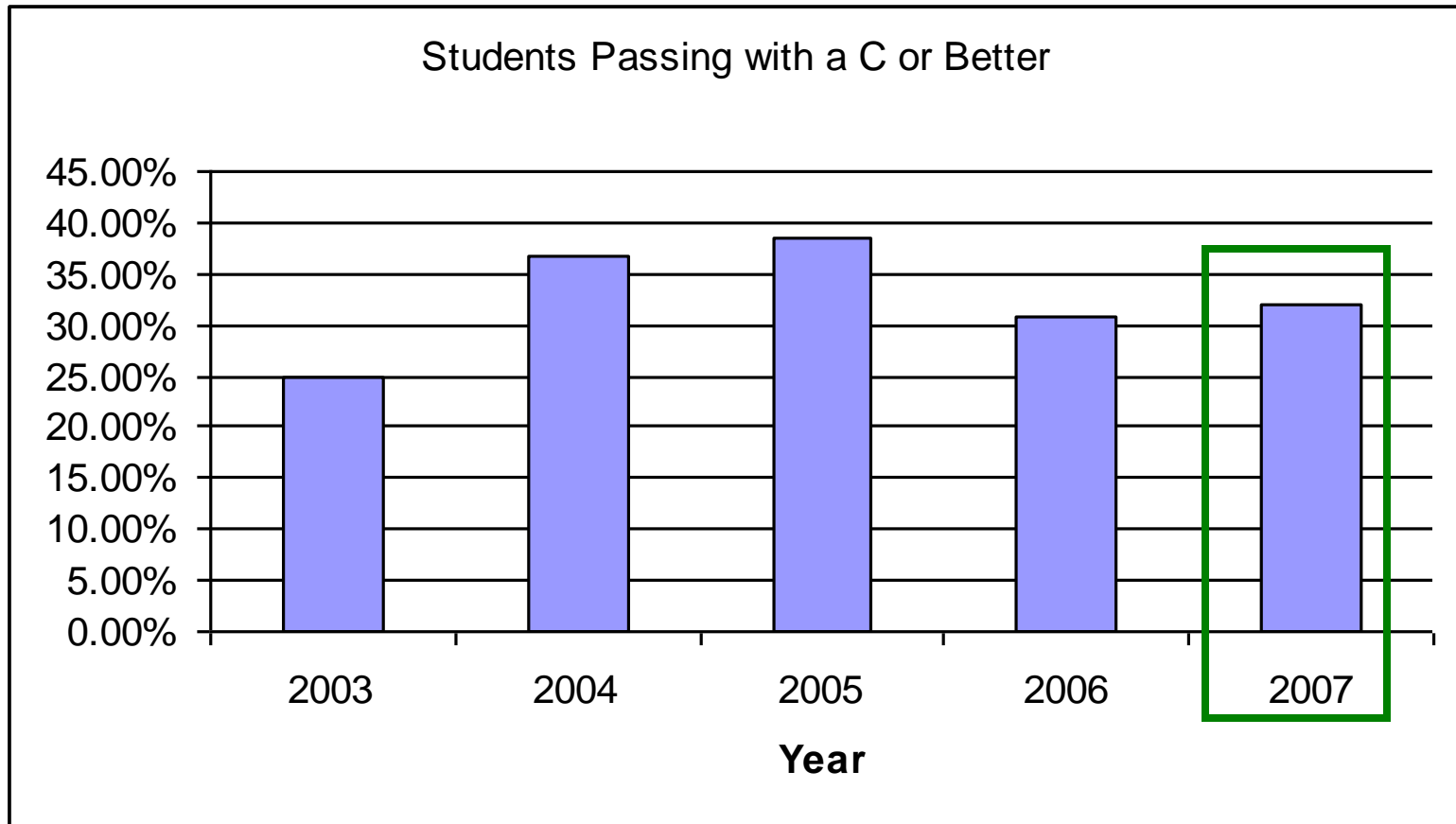


Fall 2007 Results

- Bad news: No improvement in retention figures



Retention Rates

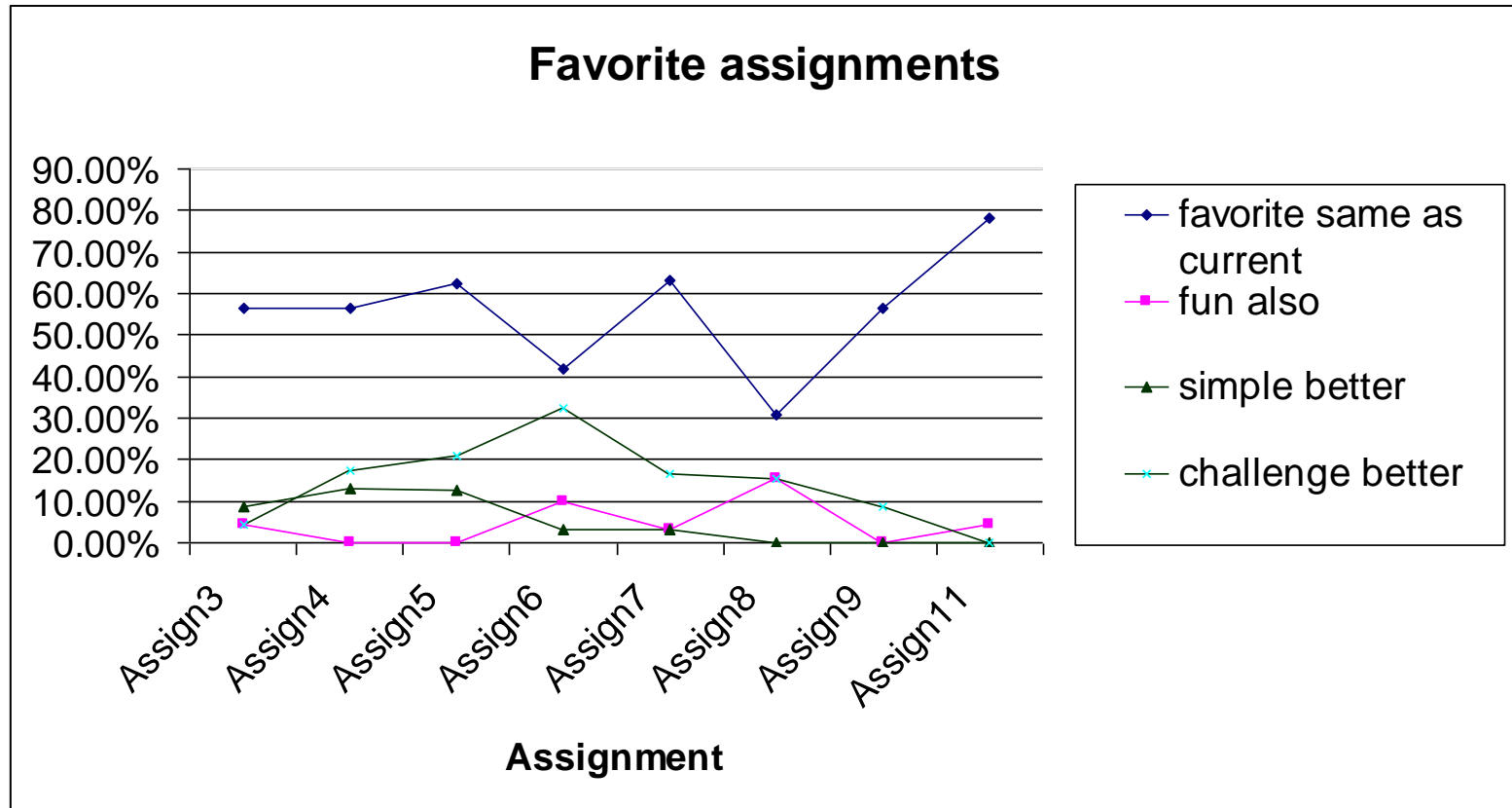


Fall 2007 Results

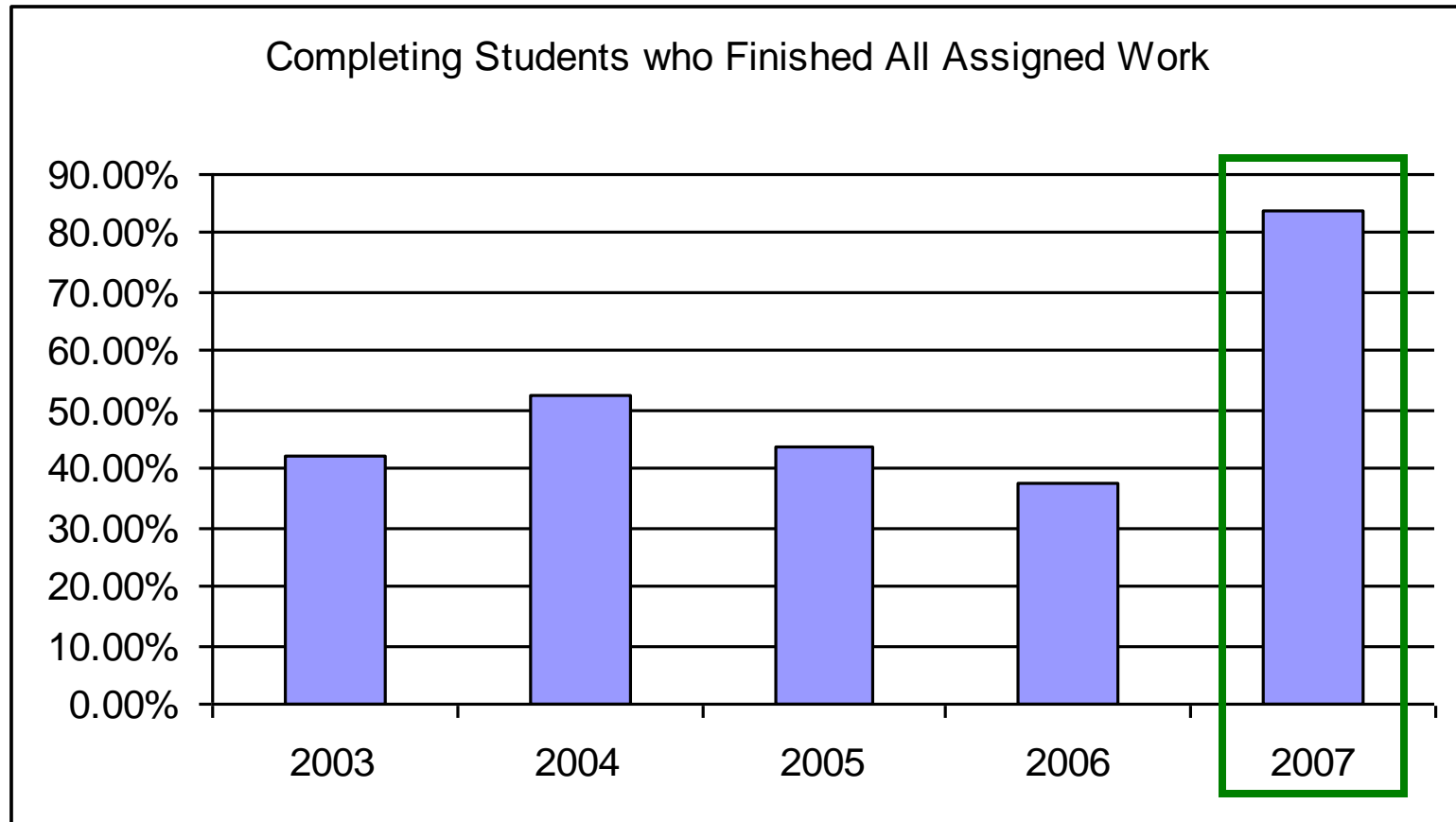
- Good news: Increased student interest among completing students



Student Interest

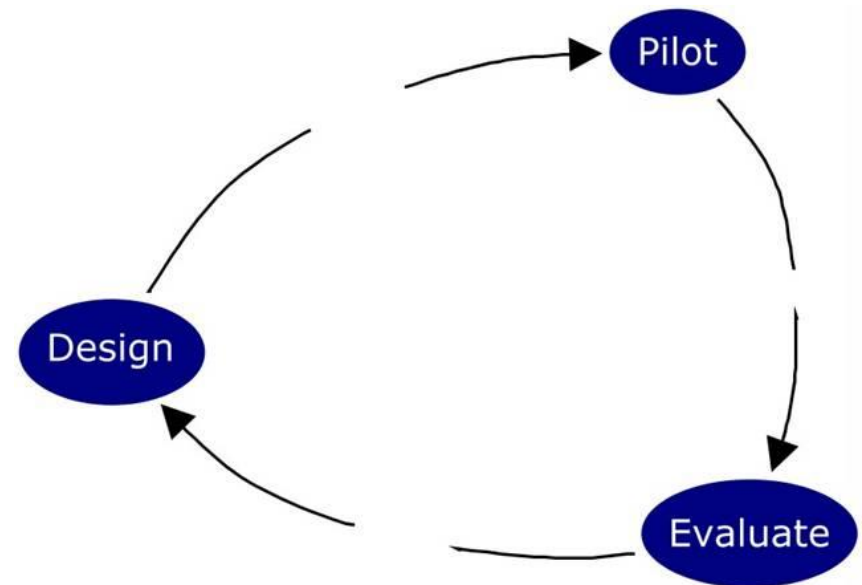


Student Interest



Next Steps

- Use Evaluation Results to Redesign
 - Optimal Feature Set
 - Motivating Characteristics of Activities
- Pilot again in Fall 2008
 - Stronger Control Group
 - Looking for additional partners
- Involvement of High School Teachers
 - July workshop



Questions, Comments?

Create Robot Building recipe:

<http://www.terk.ri.cmu.edu/recipes/create-overview.php>

Latest Java software for CS1 students:

<http://www.terk.ri.cmu.edu/software/myfirstrobot-overview.php>

Curriculum Overview:

<http://www.terk.ri.cmu.edu/curricula/introCS-overview.php>



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