Cooperative Learning and the Affinity Research Group Model

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OCTOBER 6, 2011
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This presentation is sponsored in part by the Following grants NSF DUE-0920300; CNS 0837556

Orientation meeting

- In the first meeting we want to get to know each other.
- Please present yourself
  - Name
  - Where are you from
  - What are you studying
  - Year (freshman, sophomore, junior, senior)
  - Area of interest (if any).

Introduction

- Nayda Santiago
  - Aguada, Eladio Tirado Lopez (SU Guanabano), 1st class ever.
  - PhdEE MSU, MSEngEE Cornell, BSEE UPRM
  - Associate Professor
- Area of interest:
  - Parallel computing
  - High Performance Computing
  - GPUs
  - Low power software
  - FPGAs

Additional Qualifications

- Working in undergraduate research since 1990.
  - +150 undergraduate students supervised
  - Awards
    - Distinguished Professor of ECE
    - Distinguished Computer Engineer and Mujer de Vanguardia CIAPR
    - HENAAC (Hispanic Engineer National Achievement Awards Conference) Education Award
  - Member of the CIAPR, IEEE, SACNAS, and the ACM
  - Founding member of the Computing Alliance for Hispanic Serving Institutions (CAHSI).
  - Committee member of the GPGPU-3 and GPGPU-4 conference.
  - Coordinator of CSEdweek, co director Femprof and Mentorgrad

INTRODUCTIONS-1

Birthplace

Favorite movie

Name

Favorite food

Country I would like to visit

INTRODUCTIONS-2

- Form Groups
- Fill out Worksheet
  - Check the elements your group has
  - The group with most elements wins a price

TIME LIMIT: 5 minutes

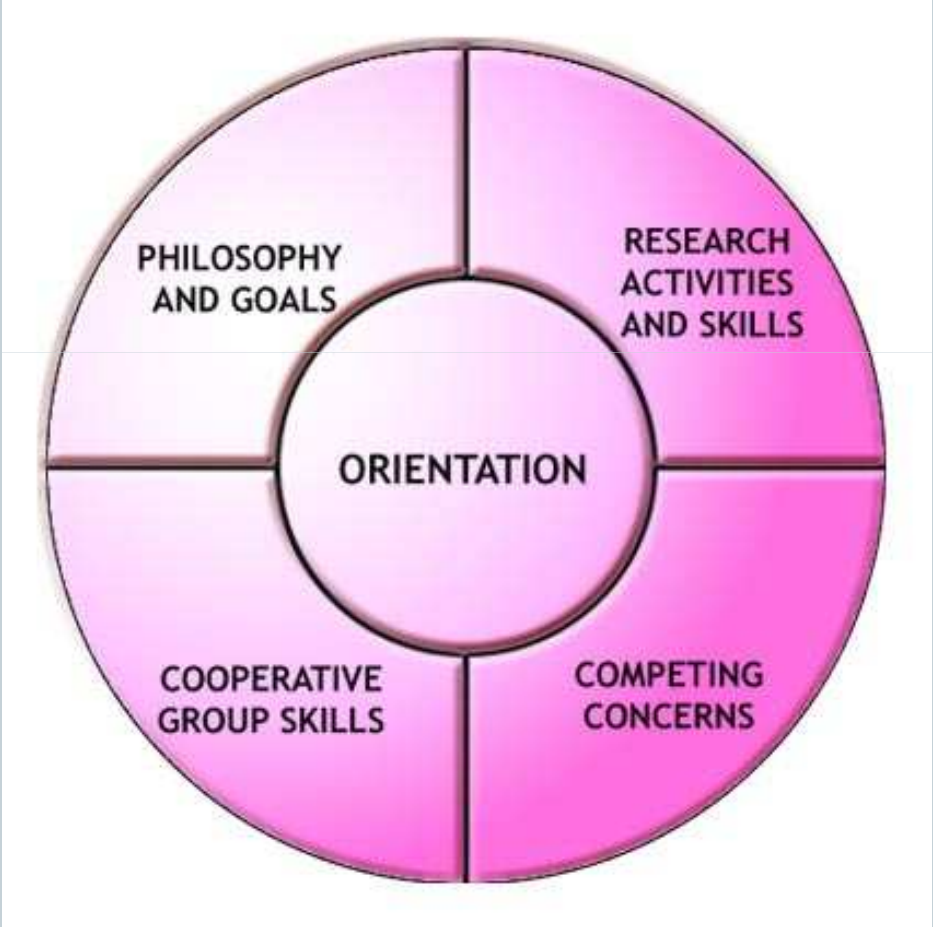
ORIENTATION OVERVIEW

Purpose:

- Facilitate assimilation of new students
- Increase ownership of model

Benefits:

- Understand basic group/research skills
- Reevaluate model



OBJECTIVES

- Philosophy and Goals
  - To understand the motivation for being involved in an ARG
  - To learn about ARG's philosophy and goals
- Research Activities and Skills
  - To discuss the purpose and activities of research
  - To engage in ARG activities that develop a basic research plan
- Cooperative Team Skills
  - To learn and practice the basic elements of a cooperative team
- Competing Concerns
  - For faculty to hear the concerns of students
  - For students to hear the concerns of faculty

Some numbers

- 1.4 million
  - Computer Specialist job openings expected in the US by 2018
  - 29% of these jobs could be filled up by US graduates by 2018
- 57% of undergraduate degree recipients were women
  - 1% of women in computing occupations in 2009 who were hispanic.
- 6.5% Engineering Bachelors Degrees Awarded to Hispanics (2008)
- Bachelors in Engineering (2008)
  - 18.1% Female
  - 81.9% Male

What is ARG?

- ARG stands for Affinity Research Group Model
  - Model based on cooperative learning to teach research skills
  - Developed by Ann Gates, Steve Roach, Elsa Villa, Kerrie Kephart, Connie Della Piana and Gabriel Della Piana and other researchers
  - Published widely in literature
  - Deliberate development of skills
  - ARG Core Values
    - Student success
    - Cooperation
    - Excellence

A bit of history

- ARG's birth, 1995
  - Retaining and advancing students from CS, EE, CpE into graduate school.
    - Andrew Bernat, Ann Gates, Sergio Cabrera
    - UTEP
  - Two fundamental ideas
    - Interaction faculty ←→student increase likelihood of student persisting to graduation (Astin, 1985; Rodriguez, 1994; Tinto, 1993)
    - Cooperative learning techniques maximize student learning (Johnson and Johnson, [1])

A bit of history

- Nayda's experience
  - Before Cahsi (2005)
  - After Cahsi
    - Formal introduction to ARG
  - How many students?
    - 150+ uRA so far

What is Cahsi?

- Computing Alliance for Hispanic Serving Institutions
  - Eight universities
    - California State University Dominguez Hills
    - Florida International University
    - New Mexico State University
    - Texas A&M Corpus Christi
    - University of Houston Downtown
    - University of Puerto Rico Mayaguez
    - University of Texas at El Paso
  - Joined efforts to increase the number of Hispanics who earn baccalaureate and advanced degrees in computing

Why is ARG part of Cahsi?

- Cahsi has several interventions
  - CS0/CS1
    - Retaining/attract students into CS
  - PLTL
    - Peer led team learning
    - Increase success retention, boost confidence and knowledge
  - **ARG**
    - **Skills to succeed in graduate school**
  - Mentorgrad/Femprof
    - Strategy to help students prepare portfolio to attend graduate school
  - Workshops
    - Recent graduates/ succeed in tenure track
  - Web page (cahsi.org)
    - Provide information on best practices, share information

Femprof and Mentorgrad

Femprof/Mentorgrad strategies

Strategies:

- student recruitment
- research mentoring
- career mentoring
- empowerment.

Requirements

Student

- Enroll in an undergraduate research course in the first year of the program and work on a research project for at least one academic year; or join an Affinity Research group for at least one academic year;
- Are encouraged to spend at least one summer in research internships at other institutions of higher education;
- Attend a research or career development conference at least once a year;

Mentor-Grad students attend seminars and workshops on:

- research skills development (if not in an ARG),
- career development to prepare for graduate school and onto the professoriate,
- empowerment to help overcome ethnic or gender bias that can preclude students from following a career in academia.

Benefits for student

- Increased technical skills
- Ability to act independently
- Insight into graduate study and career possibilities
- Understanding of the value of team work
- Ability to work with setbacks and/or ambiguity
- Desire to learn
- Ability to think creatively and/or synthetically
- Self confidence
- Communication skills
- Understanding of where “knowledge” comes from

Taken from [3]

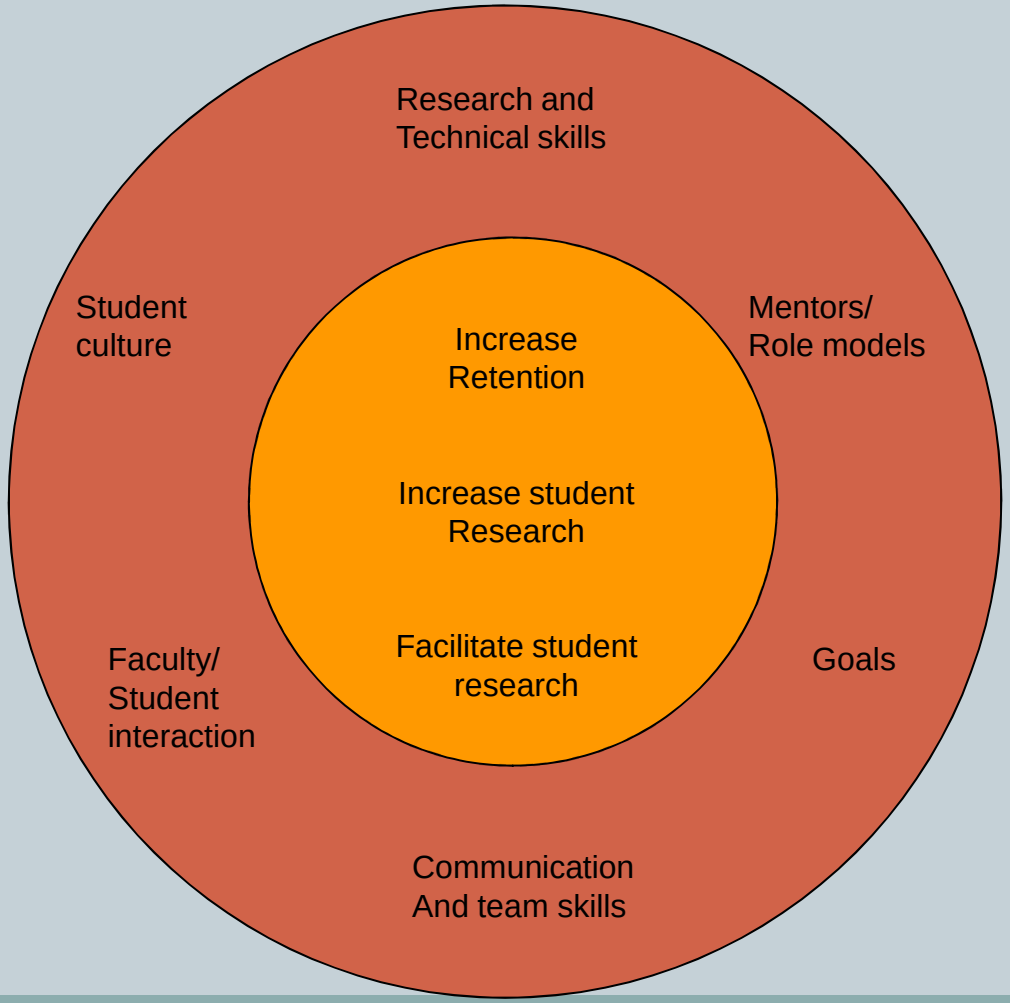
How does an undergraduate researcher behave?

- Lifelong learner
- High level of competence in area of study
- Technical skills
- Communication skills
  - Write articles and reports
  - Posters
  - Presentations
- Understands research methods and processes
- Makes informed judgment
- Dependable
- Soft skills

Soft Skills

- Teamwork
- Leadership
- Negotiation
- Make decisions
- Solve problems
- Work under pressure
- Manage time
- Constructive critique
- Listening
- Coaching
- Problem solving
- Self management

Main Elements of ARG



Components of an Affinity Research Group

- Core purpose
  - Drives decision making
- Orientation
- Research project definition
- Management Scheme
  - Define timelines/dependencies
  - Define deliverables
  - Regular meetings
  - Process improvement (Assess, evaluate)

Please see page 2 ARG handbook

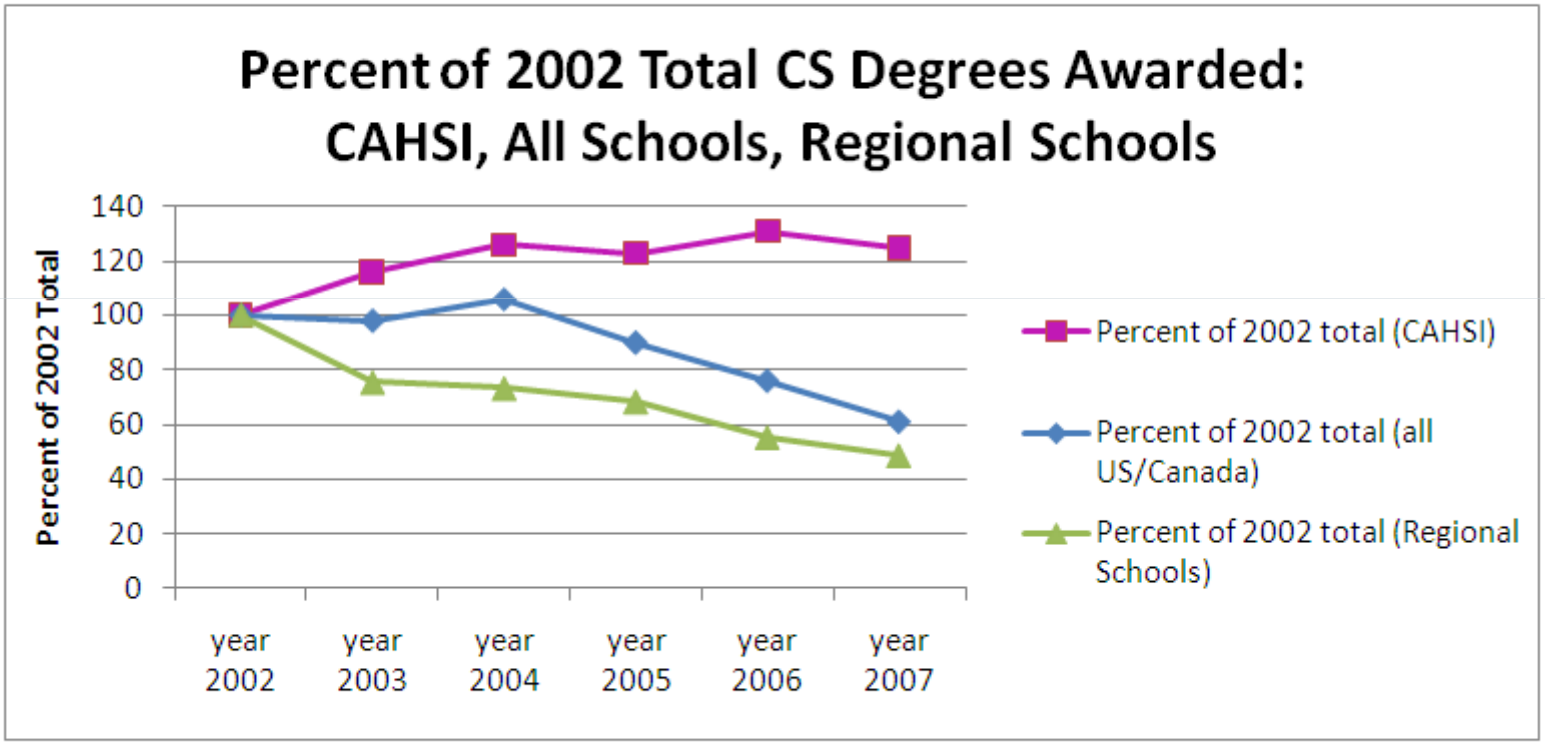
Is this different than traditional research models?

- ARG
  - Members concerned
    - Progress of team's project
  - Heterogeneous groups encouraged
  - Shared leadership among group members
  - Professional skills developed
  - Cooperative environment, encouraged
  - Process improvement part of the model
- Traditional
  - Members concerned
    - Progress individual project
  - Best and brightest, graduate students
  - Professor leads grads, PhDs lead MS --- chain
  - Professional skills assumed
  - Environment controlled by leader, competitive
  - Process improvement not practiced or ad hoc.

How effective has ARG been?

- *"Nearly all ARG students surveyed showed gains/positive values across all of the URSSA constructs, including growth in communication and technical skills, personal/professional growth, ability to work effectively on teams, career preparation, and understanding the computer science research process."*
  - *To appear in* ACM Transactions on Computing Education (TOCE).

How effective has ARG been?



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Have you ever heard…

- "Anything but group projects. I'll work extra hard and do it myself but please don't make me have to work in a group."

Or

- "Groups Suck!"

- Why do you think students may have this opinion?

Question

- Have you ever had a student who did not work well in groups?
- If so, how did you deal with this student?

Working in groups?

- We tell students to work in groups.
  - BUT
  - We do not teach them how to work in groups.
  - How are they going to learn?

- Quote
  - “Putting students into groups to learn is not the same thing as structuring cooperation among students. [1]”

Objective

- To promote the use of cooperative learning in the classroom and in research activities as a tool for increasing student's learning of both technical and non technical skills.
- To define and describe the elements of cooperative learning and how to use them.

Cooperative Learning

- Cooperative Learning is the instructional use of small groups so that students work together to maximize their own and each other's learning*.
- Is working together to accomplish shared goals.
- Outcomes are beneficial to individuals and to all group members.

"Individually, we are one drop. Together, we are an ocean."

--- Ryunosuke Satoro

*Our presentation is based on the model described in Johnson and Johnson's [1] work.

What is the difference between…

Cooperative Learning Groups	Traditional Groups
Positive interdependence	No interdependence
Individual accountability	No individual accountability
Heterogeneous membership	Homogeneous membership
Shared leadership	One appointed leader
Responsible to each other	Responsibility only for self
Task and maintenance emphasized	Only task emphasized
Social skills directly taught	Skills assumed or ignored
Teacher observes and intervenes	Teacher ignores groups
Group processing occurs	No group processing
Mutual assistance	Competitive

AN AFFECTIVE CODE OF COOPERATION
(Smith 2004)

- Help each other be right, not wrong.
- Look for ways to make new ideas work, not for reasons they won't.
- If in doubt, check it out. Don't make assumptions.
- Help each other win and take pride in each other's victories.
- Speak positively about each other and your organization at every opportunity.
- Maintain a positive mental attitude.
- Act with initiative and courage as if it all depends on you.
- Do everything with enthusiasm.
- Don't lose faith.
- Have fun!

Learning together

- Basic Elements of Cooperative Learning: PIGS FACE

Positive Interdependence
Individual Accountability
Group Processing
Social Skills
Face to Face Interactions

Positive Interdependence

- "Sink or swim together"
- Students believe that they are linked with others in a way that one cannot succeed unless the other member of the group succeeds.
- Strategies
  - Role interdependence
    - Positive role interdependence is structured by assigning each student a role.
  - Resource interdependence
    - One copy to the group
  - Reward interdependence
    - If all members score > 90… then…
  - Goal interdependence
    - Share the same goal

Role Interdependence

- Roles
  - Reader – reads the problem to the group
  - Checker – makes sure all members are engaged
  - Encourager – Encourage all members in the group to participate, share ideas, part of the discussion.
  - Time keeper – keeps track of time.

Individual Accountability

- The performance of EACH individual student is assessed and the results are given back to the group and the individual.
  - Who needs assistance in completing work.
  - No one can “hitch – hike” on the work of others.
- Strategies
  - Individual test ---- “eg. Happy Hour”
  - Select one student to represent the group.
  - Small groups

Group Processing

- Group process how well they are achieving their goals and maintaining effective working relationships among their members.
- Focus on group maintenance
- Strategies
  - Ask what is something each member did that was helpful to the group?
  - Ask what is something each member could do to make the group even better tomorrow?
- Reflect on actions of the group [2]
  - Which actions to keep, delete, or change

Processing

- Enables groups to focus on maintenance
- Facilitates learning social skills
- Ensures members receive feedback on their participation
- Reminds students to practice small group skills required for cooperative work.

Social Skills

- Needed skills
  - Leadership
  - Decision making
  - Trust building
  - Communication
  - Conflict management
- Taught as purposefully and precisely as any academic skill.

Face to Face Interactions

- Students help, assist, encourage, and support each other's efforts to learn.
  - Explain each other how to solve a problem
  - Discuss a concept
  - Teach knowledge to each other
  - Exchange ideas.

Lets practice…

- Divide audience in groups of three
- One of the members is the time keeper, one is checker and the last one is recorder.
- Record actual examples of groups working as cooperative teams/ groups not working as cooperative teams
  - Do not criticize others ideas.
  - Do not provide names. (Di el crimen pero no el santo)
- Share with the rest of us.
- Group processing
    - What worked well in the activity?
    - How would you change the activity?

Research

CAN THESE IDEAS BE INCORPORATED INTO RESEARCH GROUPS?

YES

Lets look at example activities

Goals of research

Research project definition

Student orientation

GOALS OF RESEARCH

BRAINSTORMING QUESTIONS

Students

1. What are the goals of research?

2. What activities are involved in doing research?

TIME: 6 minutes

Mentors

1. What are the benefits of involving students in research?

2. What activities or techniques do you use to develop students' research skills?

TIME: 6 minutes

DISCUSSION PROCEDURE

As a group, discuss and prioritize ideas for each question.

Be prepared to share top ideas with large group.

Time: 6 minutes

Turn to your team mates and say “Thank you!”

STUDENTS REPORT OUT

GOALS OF RESEARCH

- Advance knowledge/expand one's knowledge
- Solve problems
- Innovate
- Improve society/human life
- Find better solutions to problems
- Understand the world
- Discovery
- Test hypothesis
- Others?

EXAMPLE RESEARCH ACTIVITIES

- Applying scientific method
- Running experiments
- Collecting data
- Analyzing data
- Testing
- Verifying results of others
- Drawing conclusions
- Conducting literature review
- Publishing and promoting ideas
- Documenting work and results
- Presenting scientific work/disseminating results at conferences
- Participating in peer review
- Conducting needs assessment/feasibility
- Working in teams

FACULTY REPORT OUT

BENEFITS: INVOLVING STUDENTS IN RESEARCH

Students will:

- Increase chances of attending graduate school
- Attain a higher level competence in STEM
- Understand the methods and process of research
- Learn how to communicate and work in teams
- Learn how to make informed judgments about technical matters

ATTRIBUTES OF A DESIRABLE EMPLOYEE

Dept. of Labor

- Ability to learn and apply new concepts
- Competence in listening and communication skills
- Adaptability
- Creative-thinking and problem-solving skills
- Personal management, goal setting, motivation
- Effective team and interpersonal skills
- Organization effectiveness and leadership skills

http://www.jobweb.org/studentarticles.aspx?id=1219

- Communication skills
- Strong work ethic
- Teamwork skills (works well with others)
- Initiative
- Interpersonal skills (relates well to others)
- Problem-solving skills
- Analytical skills
- Flexibility/adaptability
- Computer skills
- Technical skills

ARG FRAMEWORK FOR DEVELOPING STUDENTS

RESEARCH PROJECT DEFINITION

Provide a mechanism for realizing relevance of assignments

Description

- Define mission and goals
- Map tasks to goals
- Define activities and timeline
- Promote project and time management

Benefits

- Understand importance of work
- Understand steps toward completing tasks
- Facilitate setting goals and balancing time

DEFINED DELIVERABLES

Define milestones and deliverables for the project

Description

- Associate deliverable with assigned task
- Provide constructive criticism of deliverable
- Examples: presentation, critical review, summary, literature review

Benefits

- Develop domain expertise
- Hone technical and communication skills
- Contribute tangibly to project
- Structure accountability

WORKSHOPS/LARGE GROUP MEETINGS

Develop research, communication, and higher-level thinking skills

Description

- Targets particular skills
- Provides hands-on activities
- Teach and practice higher-level skills

Benefits

- Foster cooperation
- Develop expertise
- Prepare students for research

GROUP MEETINGS

Refine weekly/bi-weekly goals,
solve problems, and discuss research

Description

- Structured meetings
- Status and problem reporting
- Discussion/presentations
- Teach concepts
- Constructive criticism

Benefits

- Structure accountability
- Practice group and communication skills
- Develop domain expertise
- Evaluate goals, tasks, and methodology

Questions/Reflection

- How would you change this presentation?
- Add ?
- Delete?

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References

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3. Ann G. Gates, S. Roach, E. Y. Villa, K. Kephart, C. Della-Piana, G. Della-Piana, “The Affinity Research Group Model: Creating and Maintaining Effective Research Teams”, IEEE Computer Society, 2008.