

Cómo Diseñar un Currículo Basado en Resultados de Aprendizaje (Designing an Outcomes-Based Curriculum)

Día 1: Estudios de “Benchmarking” y Validación
(Day 1: Benchmarking and Validation Studies)

Universidad Católica de la Santísima Concepción



Doris R. Brodeur, Ph.D.

dbrodeur@mit.edu

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UNIVERSIDAD CATOLICA
DE LA SANTISIMA CONCEPCION

 **LASPAU**

Affiliated with Harvard University



Objetivos

- Definir el aprendizaje basado en resultados e indentificar sus aspectos relevantes
- Alinear los resultados de aprendizaje con la misión, visión, objetivos y valores de la USCS
- Analizar las características del currículo existente, incluyendo las destrezas que se enseña, los métodos de enseñanza y valoración utilizados por los profesores así como los espacios físicos donde los estudiantes aprenden



Your Questions and Expectations

- As we begin the workshop, what **questions** do you hope the workshop will answer? Write each question on a separate Post-It note.
- What are your **expectations** for this workshop? In other words, what do you hope to learn about, or learn how to do, or form an opinion about. Write 2 or 3 expectations on a index card.
- If time permits, share your questions and expectations with the person sitting next to you.





Vision of a Renewed Curriculum

An education that stresses disciplinary knowledge set in the **context of professional practice**:

- A curriculum that is **centered on students**, multidisciplinary, and based on specified **learning outcomes**
- Featuring **active and experiential learning**, including a variety of project-based learning experiences
- Set in both classrooms and modern learning laboratories and **workspaces**
- Constantly improved through robust **assessment and evaluation** processes



Three Premises

1. Underlying needs are best met by
 - o making **professional practice the context** of the education
 - o defining **program learning outcomes** that stress the fundamentals
2. Program learning outcomes should be
 - o set through **stakeholder involvement**
 - o met by constructing sequences of **integrated learning** experiences that expose students to situations that professionals encounter
3. Integrated learning activities have dual impact
 - o facilitating student learning of critical **personal, interpersonal, and professional skills**
 - o simultaneously enhancing the learning of fundamental **disciplinary knowledge**

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

The Learning Context: Professional Practice

- A focus on customer, client, and patient needs
- Delivery of products, processes, and services
- Incorporation of inventions and new technologies
- Stewardship of the environment
- A focus on solutions
- Working with others
- Communicating effectively
- Working efficiently within resources



Danmarks Tekniske Universitet

A Learning Context for Engineering: CDIO



Duke University



Conceive: customer needs, technology, enterprise strategy, regulations; and conceptual, technical, and business plans

Design: plans, drawings, and algorithms that describe what will be implemented

Implement: transformation of the design into the product, process, or system, including manufacturing, coding, testing and validation

Operate: the implemented product or process delivering the intended value, including maintaining, evolving and retiring the system

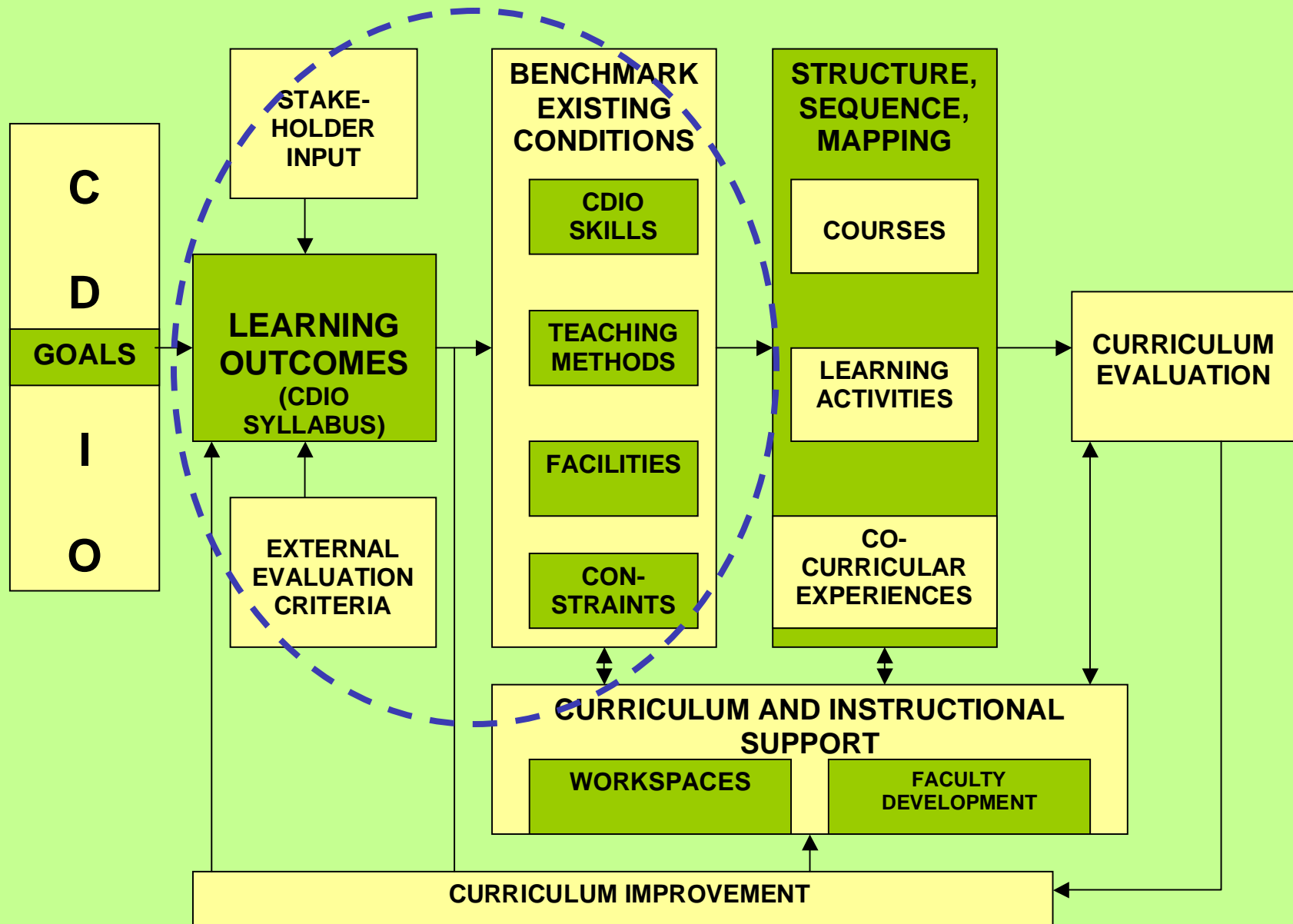
Benefits Of Learning In Context

- Increases retention of new knowledge and skills
- Interconnects concepts and knowledge that build on each other
- Communicates the rationale and relevance of what students are learning
- Enables students to build their own frameworks for learning

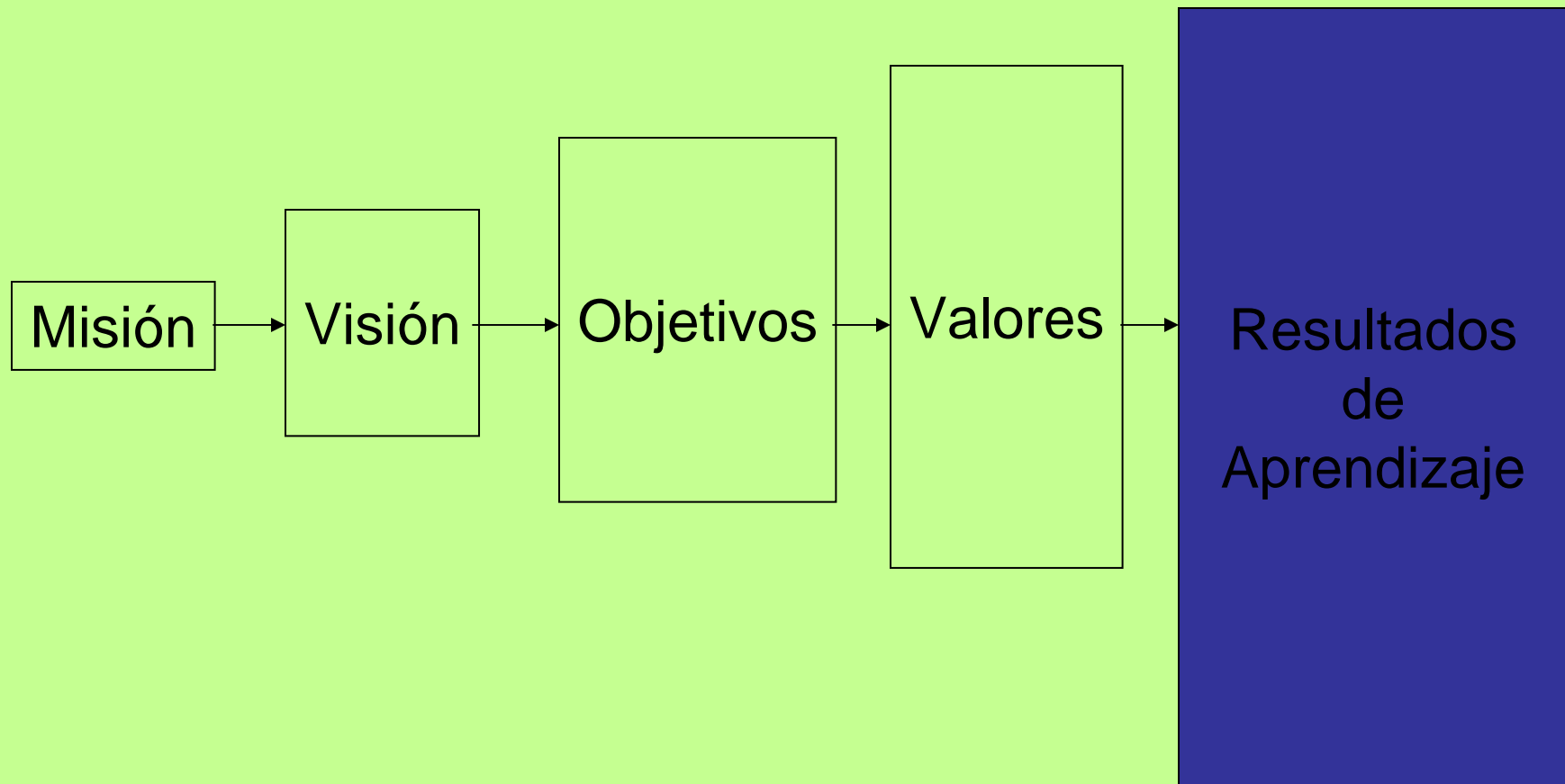


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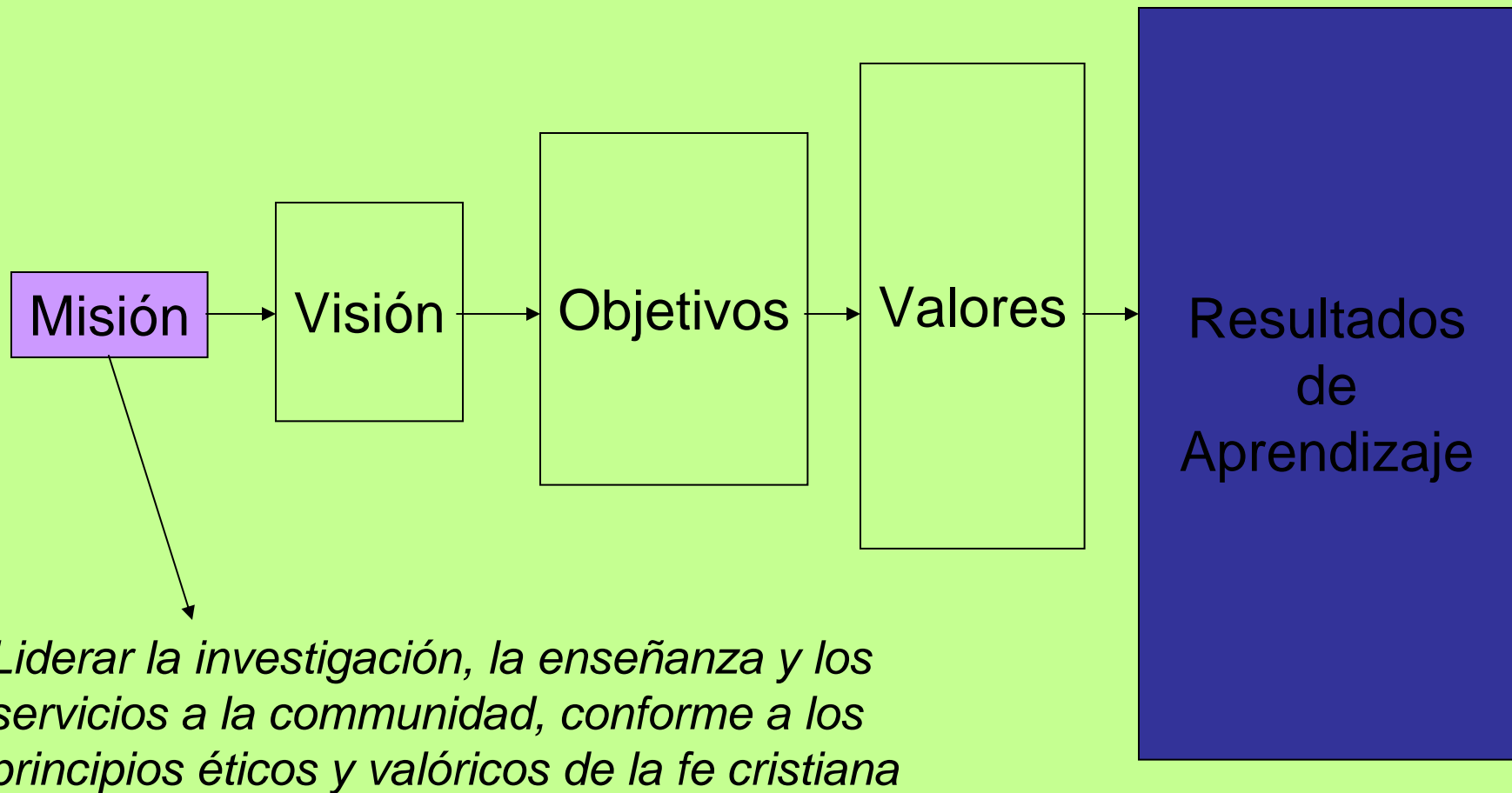
A Curriculum Development Model



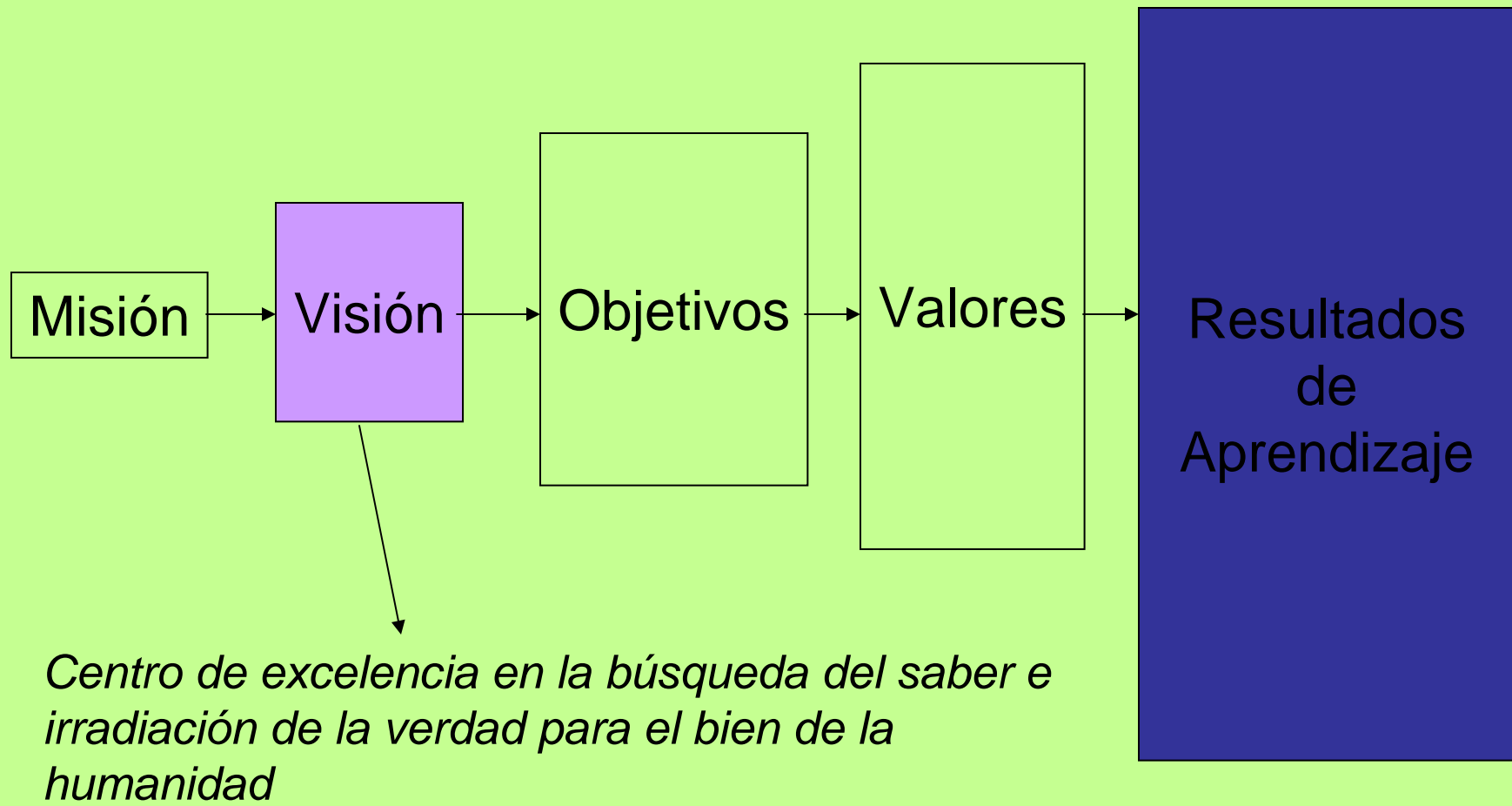
Learning Outcomes Derived From Mission, Vision, Objectives, and Values



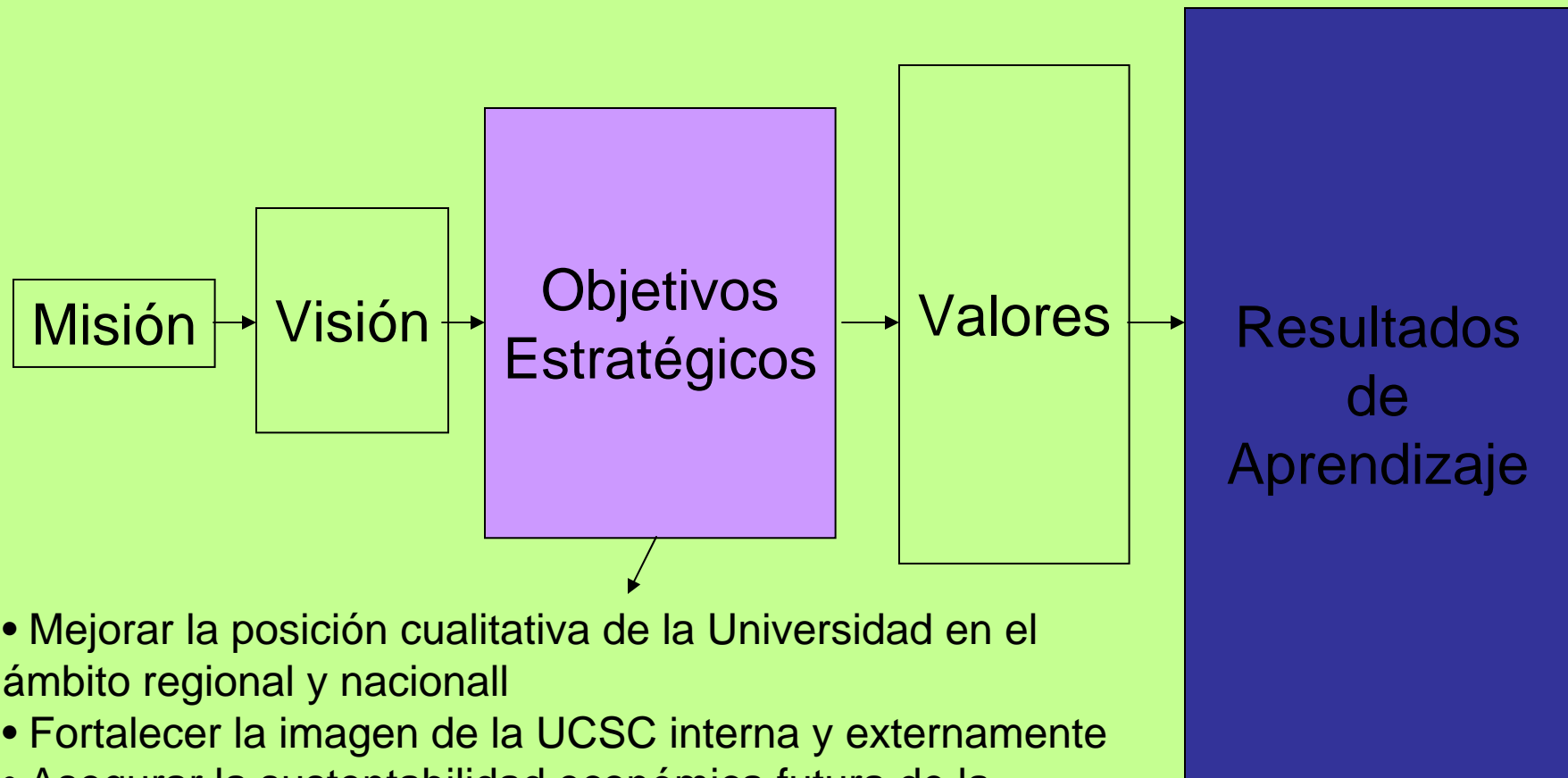
Learning Outcomes Derived From Mission, Vision, Objectives, and Values at UCSC



Learning Outcomes Derived From Mission, Vision, Objectives, and Values at UCSC

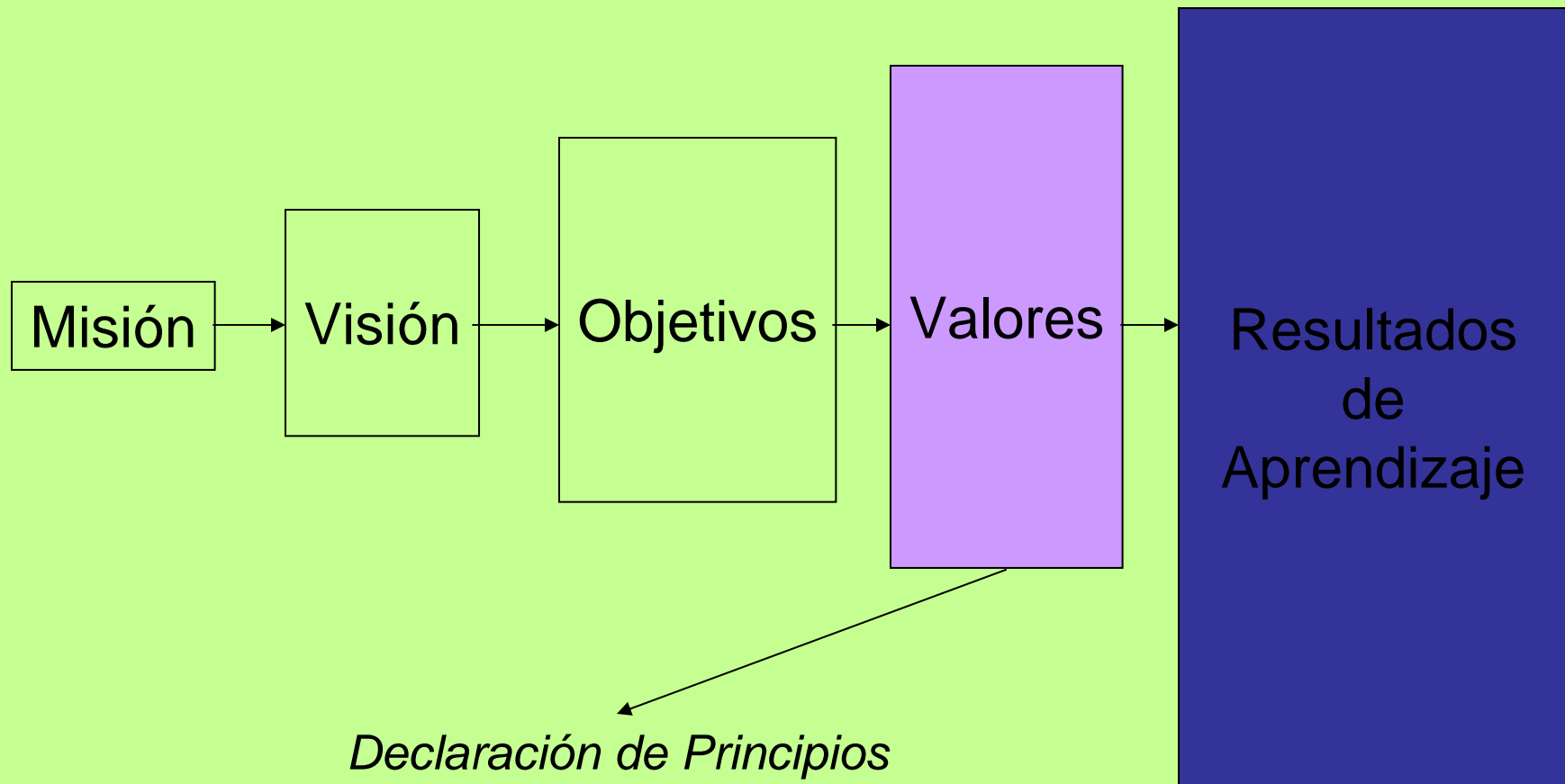


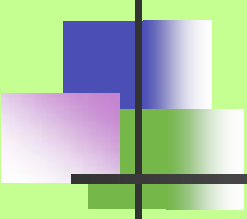
Learning Outcomes Derived From Mission, Vision, Objectives, and Values at UCSC



- Mejorar la posición cualitativa de la Universidad en el ámbito regional y nacional
- Fortalecer la imagen de la UCSC interna y externamente
- Asegurar la sustentabilidad económica futura de la Universidad

Learning Outcomes Derived From Mission, Vision, Objectives, and Values at UCSC





Effective statements of program learning outcomes ...


- 1 Are student-focused
- 2 Focus on the learning resulting from a program
- 3 Reflect the institution's mission and the values it represents, and are in alignment at course, academic program, and institutional levels
- 4 Focus on skills and abilities central to the discipline and based on professional standards
- 5 Are general enough to capture important learning, but clear and specific enough to be measurable
- 6 Focus on aspects of learning that will develop and endure but that can be assessed in some form now



The CDIO Learning Outcomes

<p>1.0 Conocimiento técnico y razonamiento</p>	<p>1.1 1.2 1.3</p>	<p>Demonstrar capacidad de usar los principios de las ciencias básicas</p> <p>Aplicar los principios de las ciencias de la ingeniería</p> <p>Demonstrar capacidad de aplicar el conocimiento de las áreas profesionales de la ingeniería</p>
<p>2.0 Habilidades y atributos personales y profesionales</p>	<p>2.1 2.2 2.3 2.4 2.5</p>	<p>Analizar y resolver problemas de ingeniería</p> <p>Conducir investigación y experimentos sobre problemas ingenieriles</p> <p>Pensamiento systemico</p> <p>Dominar habilidades personales que contribuyan al éxito de la práctica de la ingeniería</p> <p>Dominar habilidades profesionales que contribuyan al éxito de la práctica de la ingeniería</p>

The CDIO Learning Outcomes (cont.)

3.0 Habilidades interpersonales	3.1 3.2 3.3	Liderar y trabajar en grupos Comunicación efectiva Comunicación en idiomas extranjeros
4.0 CDIO 	4.1 4.2 4.3 4.4 4.5 4.6	Reconocer la importancia del contexto social en la práctica de la ingeniería Apreciar diferentes culturas empresariales y trabajar exitosamente en organizaciones C oncebir y aplicar ingeniería a los sistemas D iseñar sistemas complejos I mplementar procesos de hardware y software y gestionar los procedimientos de implementación O perar sistemas complejos, procesar y gestionar operaciones

Program Learning Outcomes: UCSC Engineering

2 HABILIDADES Y ATRIBUTOS PERSONALES Y PROFESIONALES

2.1 ANALIZAR Y RESOLVER PROBLEMAS DE INGENIERÍA [e]

2.1.1 Identificación y formulación de problemas

- Evaluar datos y síntomas
- Analizar suposiciones y fuentes de sesgo
- Demostrar fijación de prioridades de temas en el contexto de los objetivos, g
- numéricas, análisis
- cuantitativo, experimentación y consideración de la incertidumbre)

2.1.2 Modelos

- Emplear suposiciones para simplificar sistemas y entornos complejos
- Escoger y aplicar modelos conceptuales y cualitativos
- Escoger y aplicar modelos cuantitativos y simulaciones

2.1.3 Valoración y análisis cuantitativo

- Calcular órdenes de magnitud, límites y tendencias
- Aplicar pruebas de coherencia y errores (límites, unidades, etc.)
- Demostrar la generalización de soluciones analíticas

2.1.4 Análisis bajo condiciones de incertidumbre

- Extraer información incompleta y ambiguo
- Aplicar modelos de probabilidades y estadísticos de eventos y secuencias
- Practicar análisis de costo-beneficio y riesgos de ingeniería
- Discutir análisis de decisiones
- Listar márgenes y reservas

2.1.5 Resolución de problemas y recomendaciones

- Sintetizar soluciones de problemas
- Analizar resultados esenciales de soluciones y someter datos a prueba
- Analizar y reconciliar divergencias en resultados
- Formular un resumen de recomendaciones
- Evaluar posibles mejoras del proceso de resolución de problemas



Validation With Key Stakeholders

Stakeholders are individuals or groups who share an interest, and have an investment, in graduates of a particular program. They benefit from the program's success, and hold programs accountable for results.

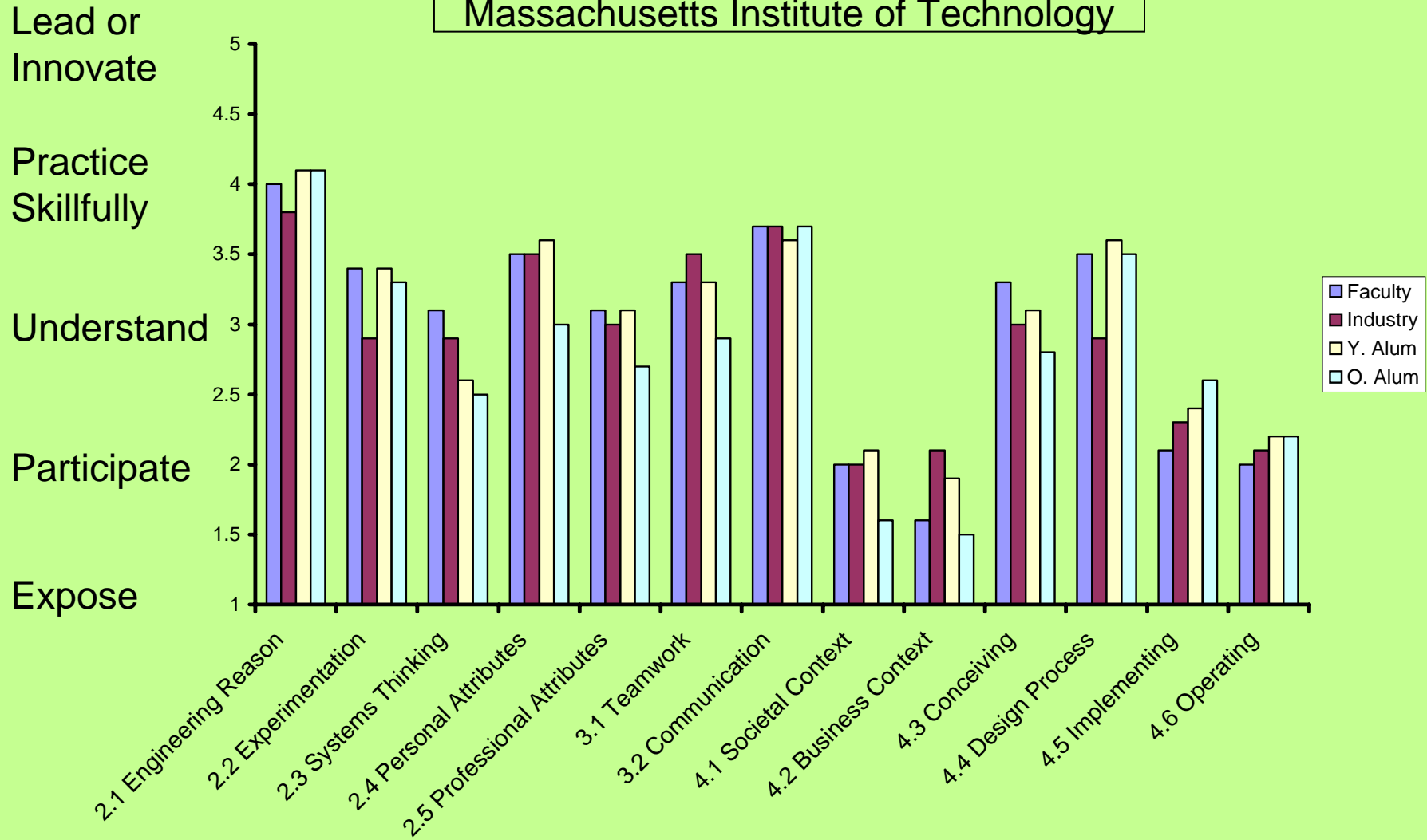
Methods to get stakeholder input and support

- Interviews
- Focus-group discussions
- Surveys
- Peer review
- Workshops



Validation of CDIO Learning Outcomes

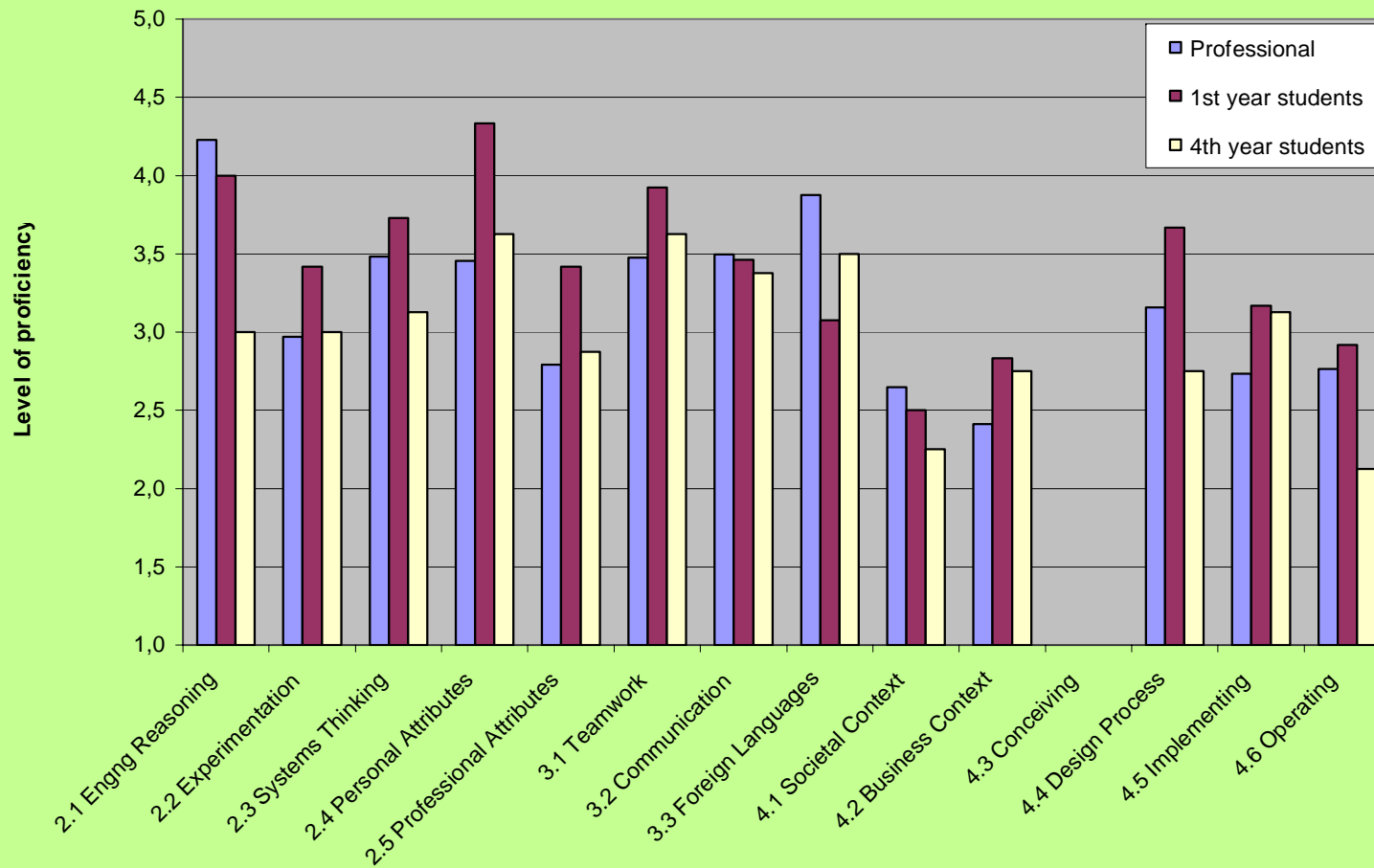
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Validation of CDIO Learning Outcomes

Kungliga Tekniska Högskolan (KTH), Stockholm

KTH



Sample Alumni Survey Results

Queen's University Belfast

Proficiency / Importance

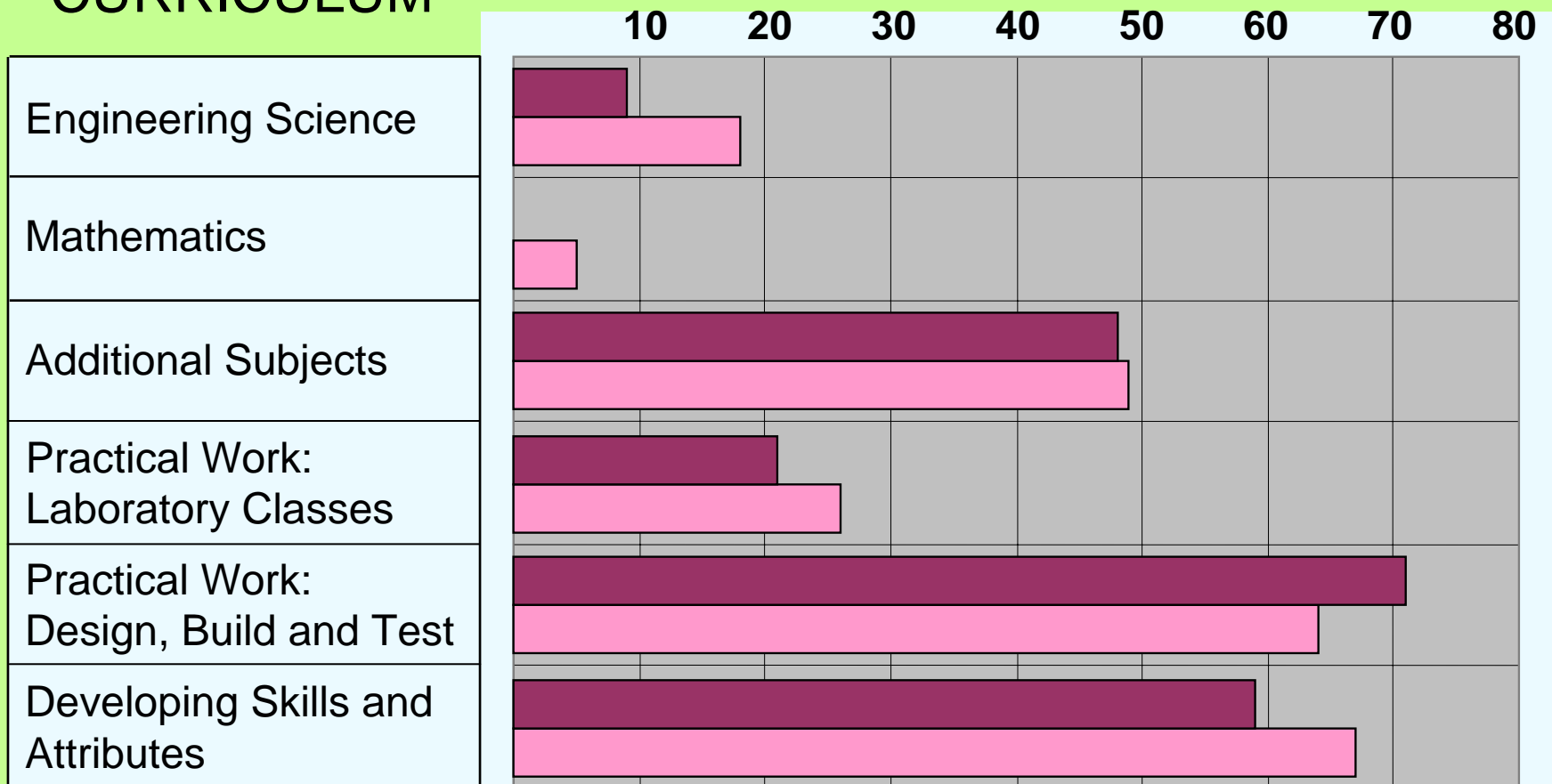


Other Survey Questions

% WANTING MORE TIME DEVOTED TO THIS
AREA OF CURRICULUM

AREA OF
CURRICULUM

Older Alumni Younger Alumni



Validation Studies: UCSC Engineering



Benchmarking Existing Conditions

- Benchmark the existing **curriculum** for the inclusion of desired competencies
- Benchmark existing **teaching, learning, and assessment** practices
- Benchmark the availability and use of existing **learning spaces and facilities**





Benchmarking the Curriculum

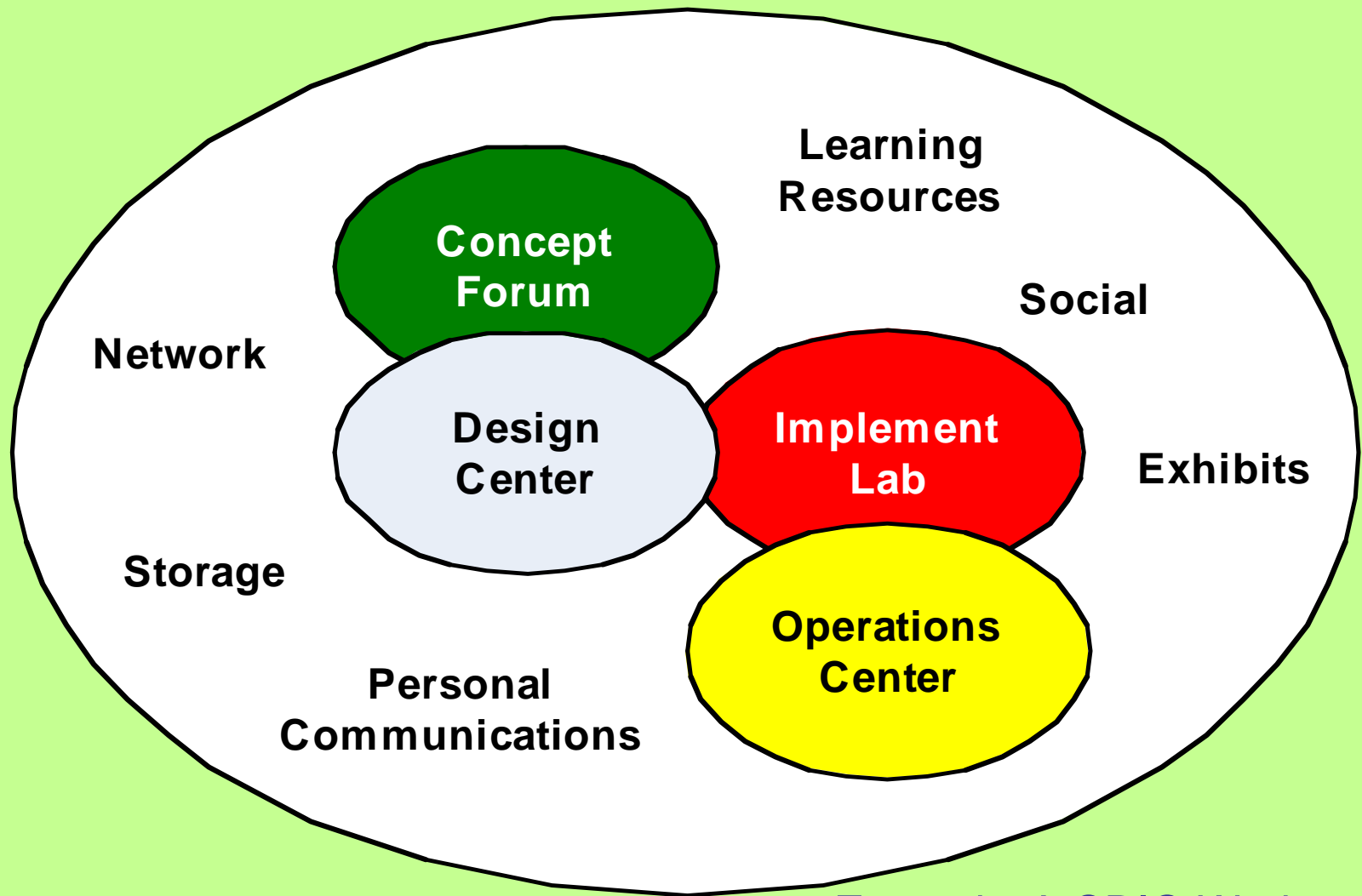
- Seek input from instructors and academic staff about the learning outcomes that are already included in the curriculum
- Classify the extent of inclusion
 - For example:
 - **Introduce (I)**: spend a little time, no explicit learning outcome, assignment or grading
 - **Teach (T)**: include in compulsory activity, there is a related learning outcome, students get to apply and receive feedback (often in assessment)
 - **Use (U)**: assume the students possess this skill, and use it to reach some other competency

Benchmarking Studies: UCSC Engineering

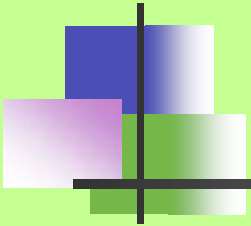
Benchmarking Teaching Practices

Teaching and Assessment Methods - 2002-2003										
(Source: AA Faculty in Reflective Memos)										
	00	01/ 02	03/ 04	05	06	07	100	20	21	221
Pre-Class Homework	X						X			
Lecture	X	X	X	X		X	X	X	X	X
Lecture Notes/ Web	X	X	X			X		X	X	X
Concept Quest's/P RS	X	X	X	X			X		X	
Muddy Cards		X	X	X					X	
Demonstrations		X	X							
Discussions						X		X		X
Recitation		X	X					X	X	
Readings		X							X	
Lab Instruction	X	X			X	X				
Instruct' l Technology	X	X						X	X	
Design and PBL	X	X			X	X	X	X	X	
Team Teaching	X									
TA / Staff Mentoring	X				X					
							X	X		
Subject Pre- Test										
Pre- Post Quest'aire s	X									
PS/ Home work	X	X	X	X	X		X	X		X
Quizzes / Exams		X	X	X	X			X		
Oral Exams		X	X				X			X
Oral Presentations	X									X
Written Reports	X			X			X			
Note book s/P ortfolios	X									
Class Participat ion	X									X
Peer Ass ess me nt				X						
Self-As ses sm en t		X								
Staff Obs er va tions					X			X		
Outsi de In te rac tion								X		

Benchmarking the Learning Environment



Example: A CDIO Workspace



Conceive Space

- Allows students to envision new systems, understand user needs, and develop concepts
- Emphasizes reflections
- Reinforces human interaction
- Largely a technology-free zone



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Design Space



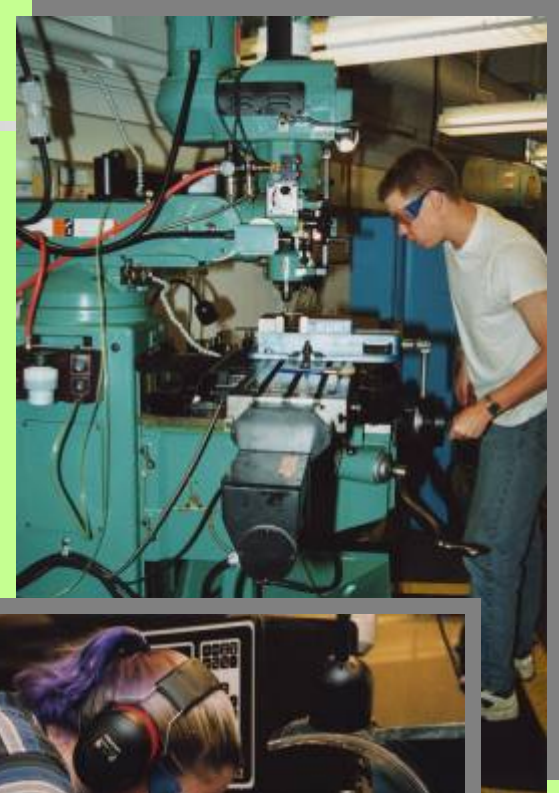
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- Model of cooperative digitally supported design
- Allows students to design, share designs, and understand interactions
- Central room and team breakout rooms
- *Design* space is near *Implement* space to reinforce connections



IMPLEMENT SPACE

- Allows students to build small, medium and large systems
- Mechanical, electronic, and specialty fabrication
- Software engineering and integration
- Safe, yet accessible as much as possible during “student hours”



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Operate Space



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- Opportunities for students to learn about operations
- They can operate their own experiments and projects
- They can operate facility class experiments
- Provides simulated operations of real systems

Summary: How much progress are you making toward the workshop objectives?

	Little or no progress	Some progress	Very good progress
Can explain the meaning and importance of the learning context			
Can align learning outcomes with mission, vision, objectives, and values at UCSC			
Can interpret the results of validation studies with stakeholders			
Can assist in conducting benchmark studies of curriculum, teaching, and workspaces			