

Learning Outcomes



**Teaching &
Learning
Activities**

Assessments

Aligned

Aligned

Aligned

Module 2: Constructive Alignment

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Bloom's Taxonomy

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2. T&L

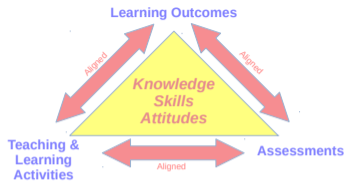
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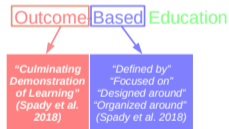
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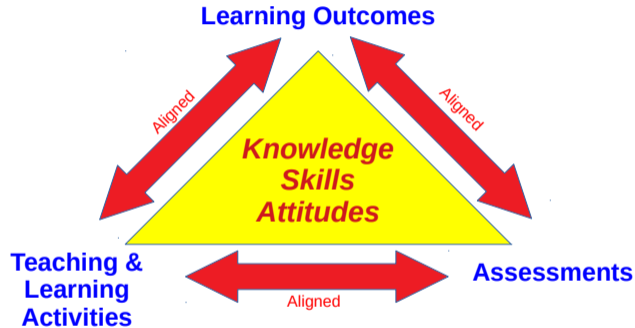


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"Constructive Alignment" [3] - Crux of the Matter



"In constructive alignment, we start with the outcomes we intend students to learn, and align teaching and assessment to those outcomes" [3]

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What is "Constructive Alignment"

- "an example of outcome-based education (OBE)" [3]
- "If you write learning objectives and use them appropriately, your course will be in constructive alignment (Biggs, 1999) with lessons, class activities, assignments, and tests all pointing toward the same knowledge and skills" [8]
- "constructively aligned teaching seems to produce high quality learning outcomes and student satisfaction" [2]

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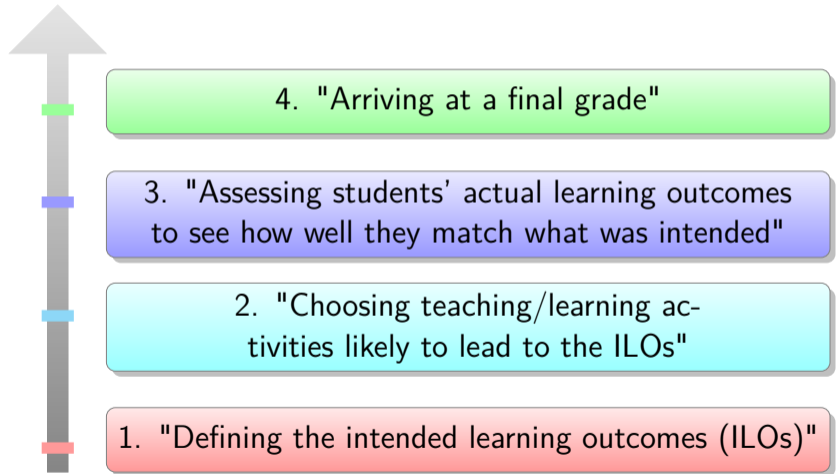
Constructive Alignment



- "the model is based on the psychology of constructivism"
- "knowledge is constructed through the activities of the learner" (Biggs, 2014)

- "both teaching and assessment need to be aligned to the intended learning outcomes" (Biggs, 2014)

The Four Major Steps for Constructive Alignment [?]



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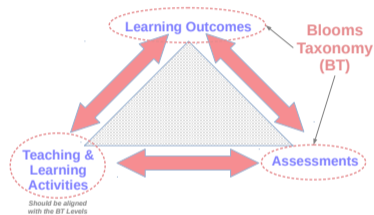
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Historical Perspective

- **1956** - "*Taxonomy of Educational Objectives: The Classification of Educational Goals: Handbook 1, Cognitive Domain*" by Bloom et al. [5]
- **1964** - "*Taxonomy of educational objectives: The classification of educational goals - Handbook II: Affective Domain*" by Krathwohl et al. [10]
- **1966** - "*The Classification of Educational Objectives, Psychomotor Domain*" by Elizabeth J. Simpson
citepSimpson1966
- **1968** - "*Learning for Mastery*" by Benjamin S. Bloom [4]

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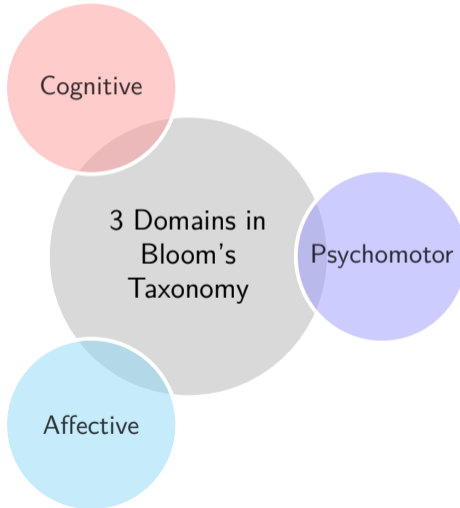
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Levels of 3 Learning Domains [6]



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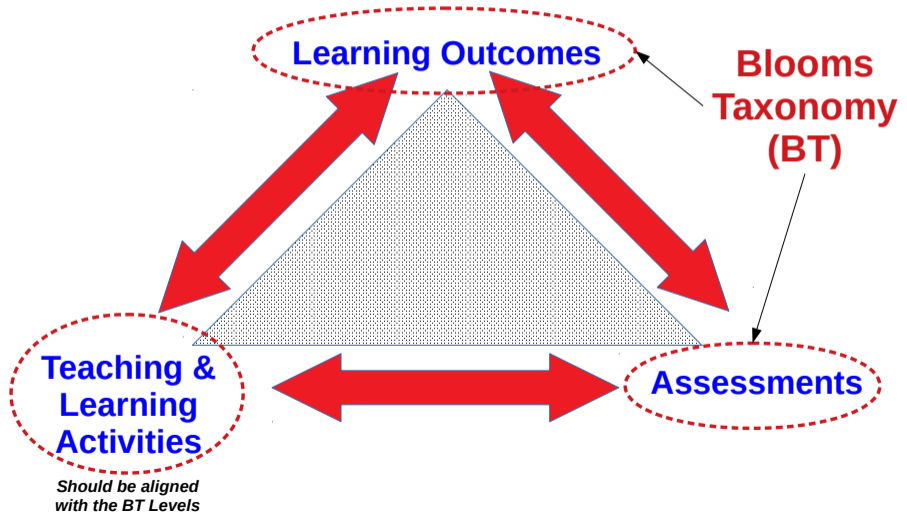
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Application of Bloom's Taxonomy in OBE



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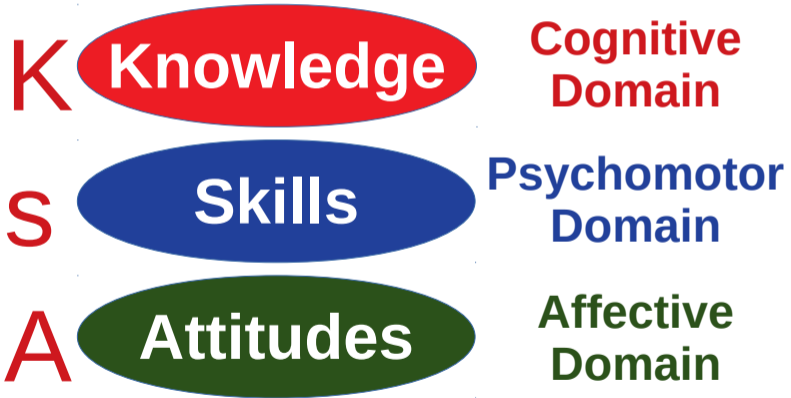
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Knowledge - Skill - Attitude



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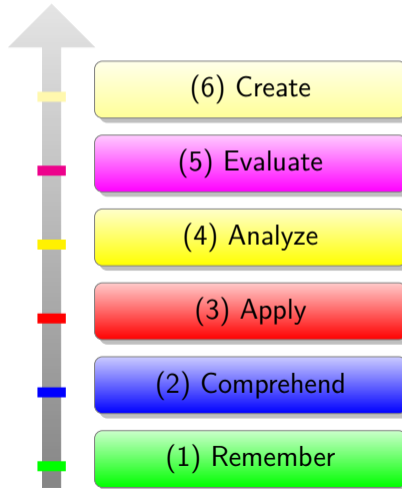
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6 Levels of Cognitive Domain



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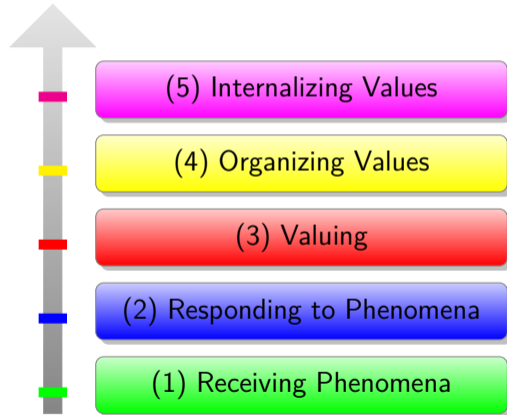
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5 Levels of Affective Domain



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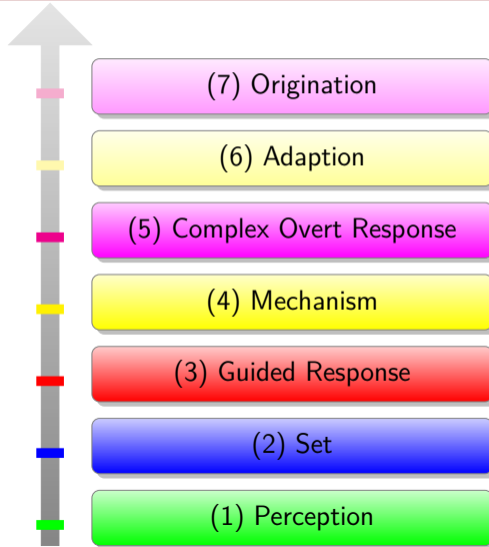
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7 Levels of Psychomotor Domain



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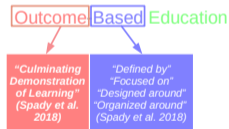
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- **"Learning outcomes are statements on what students should learn and be assessed for"**
- *"They reflect what a student can do upon the completion of a period of study, as in a course, semester, year or a program (qualification or a part of it)"*

"Outcomes need to 'stick' and 'last', and they need to make a beneficial difference in people's lives, not just while they're students in school"

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What is meant by Culminating?

Outcome

"Culminating Demonstration of Learning" [11]

- "Culminating means AT or AFTER "The End""
- "involved competence building that could take years, especially if it were a complex ability"

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What is meant by Demonstration?

Outcome

"Culminating Demonstration of Learning" [11]

- "Demonstration means that students will DO something that is tangible, visible, and observable"
- "It is an ACTION that is defined by WORDS, not numbers and scores"
- "'Domonstrating the Outcome' requires students to DO/EXECUTE the exact VERB(S) and all the other Words that define it. That exactness and direct matching are the meaning of ALIGNMENT"

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Learning Outcomes / Course Outcomes

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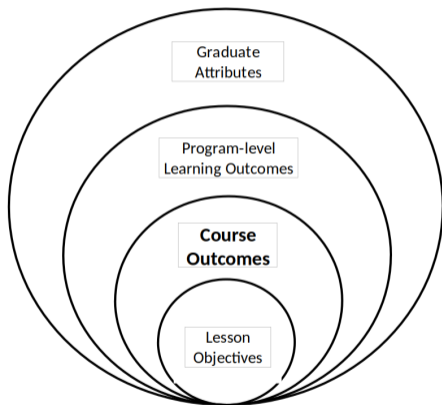
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- *"Course outcomes are statements of what students should be able to accomplish after completing the course" [7]*
- *"Learning outcomes are the knowledge and skills engineering students should have by the time they graduate" (Richard Felder, email communication Feb 27, 2018)*
- *"a general statement that summarizes and integrates the learning achieved in several related goals or objectives by the end of a program or course" [1]*
- *"describes what a learner may "get out of" a program or course" [1]*

The Big Picture



Adapted from Figure of [6]

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Course Outcomes

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- *"They should be concise" [7]*
- *"be written as something the student may achieve" [7]*
- *"By sharing course outcomes with students, they can create a roadmap of the course and discover purpose for specific objectives." [7]*

Verbs to Avoid [7]

- *"Know"* [7, 8]
- *"Learn"* [8]
- *"Understand"* [7, 8]
- *"Appreciate"* [6, 8]
- *"Gain an appreciation for"* [6]
- *"Have an awareness of"* [7]
- *"Perceive"* [7]
- *"Become familiar with"* [6]

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SMART Criteria for Course Outcomes [7]

When writing course outcomes, one method to ensure a strong outcome is to apply the SMART criteria. If one or more elements of the SMART criteria are missing consider revising the outcome.

- S** **specific** and **student** focused
- M** **measurable** in terms of student success
- A** **attainable** by students (given their knowledge and skill level after learning takes place)
- R** **relevant** to focus of the course
- T** **time** frame for completion is realistic (consider the depth of knowledge required by students)

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Suggested Steps for Writing COs using Bloom's Taxonomy

- 1 Critically analyze the course description
- 2 Use a clear-cut stem
- 3 Avoid certain verbs, particularly "AKLU":
 - A* Appreciate
 - K* Know
 - L* Learn
 - U* Understand
- 4 Apply "SMART" Criteria:
 - S* Specific and student focused
 - M* Measurable in terms of student success
 - A* Attainable by students
 - R* Relevant to focus of the course
 - T* Time frame for completion is realistic

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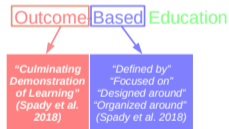
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Teaching & Learning-related Resources

- "Active Learning" [8, pp. 111 to 129]
- "Nontechnological Alternatives to Lecture" [12, pp. 114 to 142]
- "Teaching with Technology" [12, pp. 143 to 167]
- "Instructional Techniques, Purpose and Examples" [1, p. 79]
- "Teaching and Learning Activities" [7, p. 52 to 56]
- "Lectures" [12, pp. 89 to 113]
- Brainstorming [1, p. 71]
- Buzz Groups (Small Groups) [1, pp. 71 to 72]
- Think-Pair-Share [1, p. 69]
- Case Study [1, p. 72]
- Demonstration and Practice [1, pp. 73 to 74]
- Field Trip [1, p. 74]
- Group Discussion [1, p. 75]

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A Design Framework for Online T&L Activities

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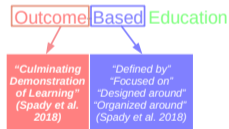
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T&L Activity	Bloom's Taxonomy Level			Required Resources	Workload for Facilitation (Hours per Week)	Related Best Practice #	CoI Framework		
	C	P	A				Cognitive	Social	Teaching
				Hardware: Software: Network (bandwidth): Media:					

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Assessment-related Resources

- *"Student Assessment"* [7, pp. 38 to 51]
- *"Testing, Homework, and Grading"* [12, pp. 213 to 234]
- *"8.1.1 Multiple-Choice questions"* [8, pp. 156 to 159]
- *"8.1.2 Short-answer questions"* [8, pp. 159 to 160]
- *"Evaluating Reports and Presentations"* [8, pp. 175 to 182]
- *"Some Non-formal Methods of Assessing Learning"* [1, p. 83]
- *"One-Minute Paper (Half-sheet Response)"* [1, p. 84]
- *"Obtaining Feedback from Learners"* [1, p. 86]

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Assessment Blueprint

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- An important part in course design [7, p. 50]
- *"This will help you to keep you on track in terms of the level of understanding for the various topic areas, and the amount of course time you devote to particular topics" [7, p. 47]*

A Design Framework for Online T&L Assessments

- 1 Bloom's Taxonomy Level to ensure constructive alignment
- 2 Assessment Method/Strategy
- 3 Required Resources as highlighted in Module 2
- 4 Requirement for Rubrics
- 5 Type of Assessment
- 6 Concerns about Academic Integrity and Possible Mitigation measures
- 7 Workload for Facilitation in terms of hours per week

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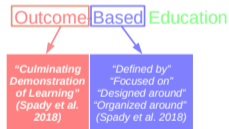
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T&L Activities designed in your Assignment # 4	1 Bloom's Taxonomy			2 Method	3 Required Resources	4 Requirement for Rubrics (Yes/No)	5 Assessment Type (Formative/Summative)	6 Concerns about Academic Integrity and Possible Mitigation measures (if any)	7 Workload for Facilitation (Hours per Week)
	C	P	A						

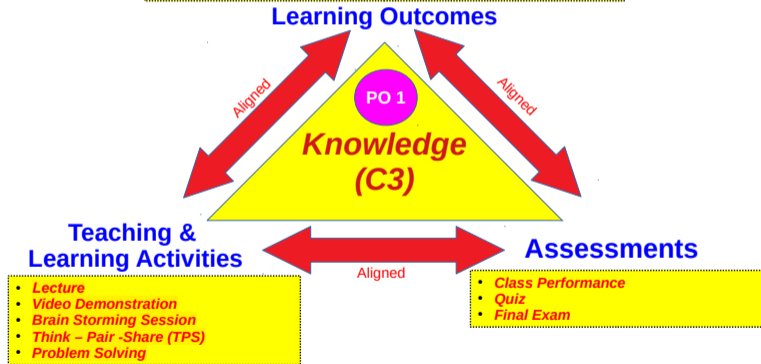
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An Example: PO (Graduate Attribute) 1: "Engineering Knowledge"

"After completion of the course, the students will be expected to apply the fundamental principles and equations related to aerodynamics" [CO1 of Aerodynamic (ME 4019)]



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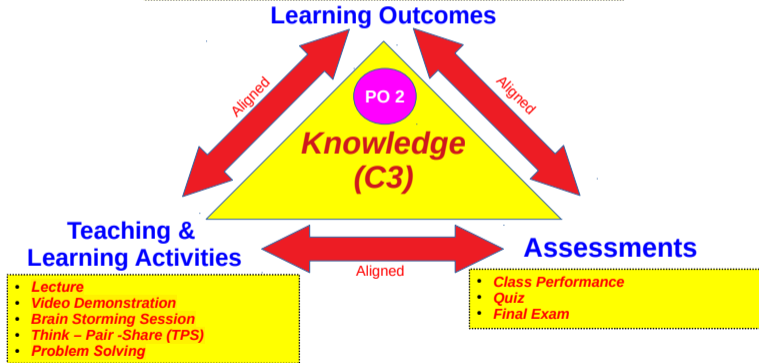
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An Example: PO (Graduate Attribute) 2: "Problem Analysis"

"After completion of the course, the students will be expected to apply proven techniques to assess the resource potentials of renewable energy systems" [CO2 of ME 4011]



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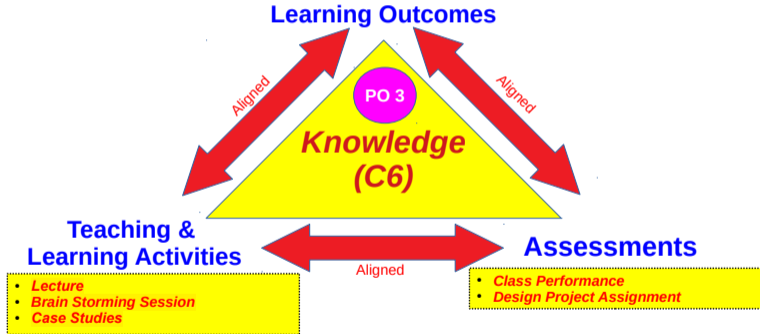
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An Example: PO (Graduate Attribute) 3: "Design/Development of Solutions"

"After completion of the course, the students will be expected to design renewable energy systems" [CO5 of ME 4011]



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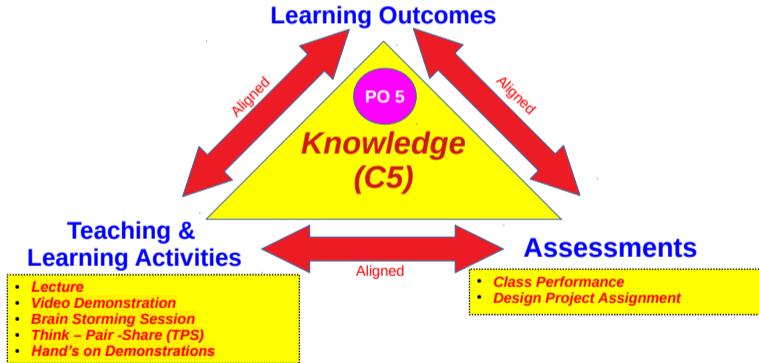
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An Example: PO (Graduate Attribute) 5: "Modern Tool Usage"

"After completion of the course, the students will be expected to evaluate selected renewable energies using modern tools and techniques" [CO4 of ME 4011]



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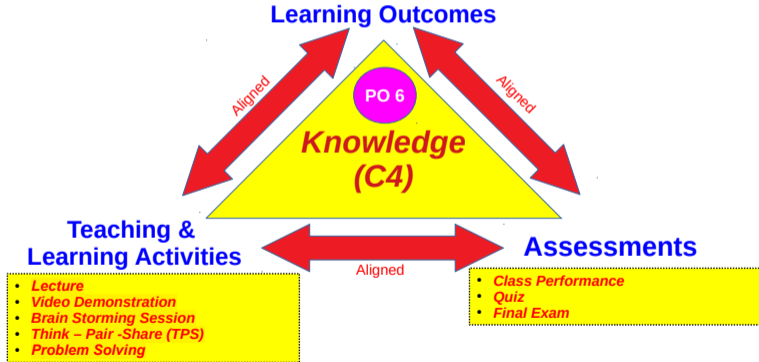
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An Example: PO (Graduate Attribute) 6: "The Engineer and Society"

"After completion of the course, the students will be expected to analyze appropriate renewable energy system for a prospective site considering social, environmental and economic issues" [CO3 of ME 4011]



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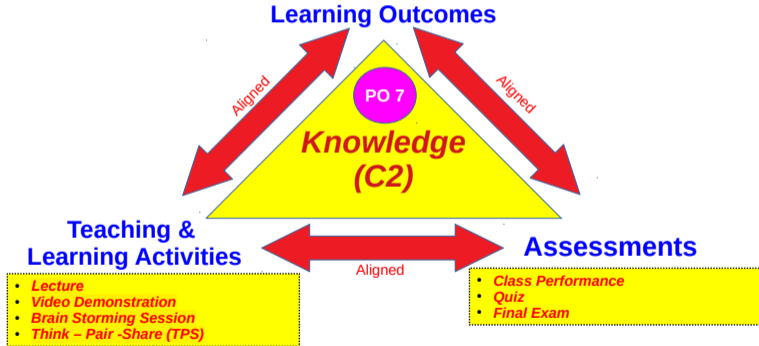
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An Example: PO (Graduate Attribute) 7: "Environment and Sustainability"

"After completion of the course, the students will be expected to comprehend the working principles of the proven renewable energy systems for sustainable development" [CO1 of ME 4011]



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