

# Hands on Solutions to Everyday Teaching Challenges in Medical Physics



Mariela A. Porras-Chaverri, PhD  
University of Costa Rica  
Laura Padilla, PhD DABR  
Virginia Commonwealth University  
Lonie R Salkowski, MD PhD  
University of Wisconsin-Madison

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**Which is the best car?**



**A**



**B**



**C**

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**Based on.... ?**

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No criteria



No scale descriptors



**CONFUSION**

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### Session Objectives

1. Distinguish between the **contents and topics** of a course and its **learning objectives**.
2. Define **appropriate** learning objectives for a course.
3. Demonstrate how **rubrics** can be used to clearly present goals and expectations for assignments

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How do Content/Topics differ from Learning Objectives?



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Content/Topics

- Units for the course
- Broad or specific topics to be covered
- Projects/tasks to be done

Learning Objectives/  
Outcomes

- What the student will accomplish during the course
  - 'Student will be able to....'
- Learning goals
- Focuses on the 'end' rather than the 'means'

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"You need to **know this material** for the test"

"I want you to **do a good job** on this assignment"

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What is "know"? – No criteria

"You need to **know** this material for the test"

"I want you to **do a good job** on this assignment"

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What is "know"? – No criteria

"You need to **know** this material for the test"

"I want you to **do a good job** on this assignment"

What is "good"? – No scale descriptors

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Criteria



Learning Objectives

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### Learning Objectives

What do you want **your students to achieve** through your class?

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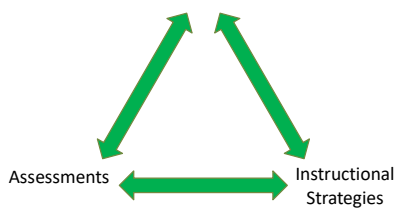
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Learning Objectives



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**Learning Objectives**

Communication of expectations

1. Clear
2. Specific
3. Measurable outcomes

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**Learning Objectives**

~~List of concepts~~

~~Vague/general statements~~

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**Learning Objectives**

Action Verbs

- Descriptive
- Aligned with level of learning

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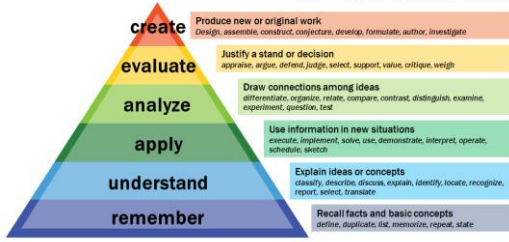
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# Bloom's Taxonomy



Vanderbilt University Center for Teaching

Figure from Vanderbilt University Center for Teaching (CC BY 4.0). <https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/>

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## Example format

By when, who will do how much/how well of  
what

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Designing and assessing courses and Curricula, 3<sup>rd</sup> edition by Robert M. Diamond

## YOUR TURN!




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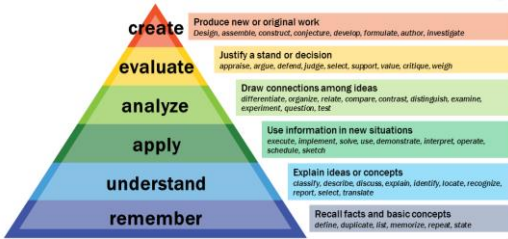
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Guide: By when, who will do how much/how well  
of what




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By when, who will do how much/how well of what

By the end of this session, attendees will create a set of  
**well-designed** learning objectives for their course

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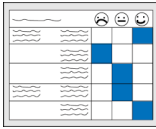
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## Rubrics



Objective assessment  
of our learners

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Explicit Criteria with Clear Scale Descriptors



- Better intra/inter-grader consistency
- Well defined expectations

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Explicit Criteria with Clear Scale Descriptors

**RUBRICS!**



- Better intra/inter-grader consistency
- Well defined expectations

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- When we clearly state expectations and assessment criteria we allow our students to **thrive** as learners
- Providing them with **structure** frees up student's mental bandwidth to focus on their learning and pursue the higher cognitive levels



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### Assessment

- What do you want...
  - Transmit information?
  - Develop their high order cognitive and professional skills?

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### Assessment

- What do you want...
  - Transmit information?
  - Develop their high order cognitive and professional skills?
- What are you assessing...
  - Resources ('knowledge')?
  - Handling of complex situations ('analysis')?

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### Assessment

- What do you want...
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- How do you develop exam questions...
  - Going over the course materials?
  - Looking for a detail or exceptional element?
  - Unanswered questions from a past lesson?

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### Assessment

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### Authentic Assessment

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### Authentic Assessment

- Assessing process, product and discourse:
  - Realist
  - Favors creativity, judgement, even innovation
  - Demands students to achieve a goal
  - Simulates a real world or professional situation
  - Complex tasks
  - Favors consultation, feedback and improving

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### Design of Authentic Assessment

- Pair to Learning Objective and Level (Bloom's Pyramid)
- Appropriate method to evaluate
  - question, class activity, project, etc.
    - Authentic situation (simulation of real life professional situation)

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### Design of Authentic Assessment

- Pair to Learning Objective and Level (Bloom's Pyramid)
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- Instructions for students must:
  - Delimitate their responsibility
  - State the Evidence of Accomplishment (product, process, discourse)

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### Design of Authentic Assessment

- Pair to Learning Objective and Level (Bloom's Pyramid)
- Appropriate method to evaluate
  - question, class activity, project, etc. )
  - Authentic situation (simulation of real life professional situation)
- Instructions for students must:
  - Delimitate their responsibility
  - State the Evidence of Accomplishment (product, process, discourse)
- Resources and guidance needed
- How to give feedback

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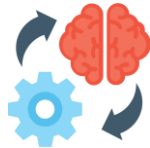
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### Feedback for our students

- Oftentimes:
  - Just a number (grade)
  - Inconsistent
  - General
- Individual feedback (oral or written)
  - Time consuming



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### How can we provide feedback?

- Objective
- Fair, impartial
- Transparent
- Efficiently provide useful information on strengths and weaknesses



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### Analytic Rubrics

- Objective
- Fair, impartial
- Transparent
- Efficiently provide useful information on strengths and weaknesses



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### Analytic Rubrics

What do you want them to do

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<https://www.uow.edu.au/curriculum-transformation/aqc/components/index.html>

### Analytic Rubrics

What do you want them to do and how well do they have to do it

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<https://www.uow.edu.au/curriculum-transformation/aqc/components/index.html>

### Analytic Rubrics

to you want them to do and so they have to do it  
to get a particular grade on the assigned task

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<https://www.uow.edu.au/curriculum-transformation/aqc/components/index.html>

### Analytic Rubrics

What do you want them to do and how well do they have to do it to  
to get a particular grade on the assigned task

	Scale		
Criteria		Descriptors	

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<https://www.uow.edu.au/curriculum-transformation/aqc/components/index.html>

**Short guide to making rubrics**

- Identify the task to assess

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**Short guide to making rubrics**

- Identify the task to assess
- Identify the component to assess and assign a grade percentage to each

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**Short guide to making rubrics**

- Identify the task to assess
- Identify the component to assess and assign a grade percentage to each
- Determine the assessment criteria

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### Short guide to making rubrics

- Identify the task to assess
- Identify the component to assess and assign a grade percentage to each
- Determine the assessment criteria
- Determine a standard scale for the level of achievement

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### Short guide to making rubrics

- Identify the task to assess
- Identify the component to assess and assign a grade percentage to each
- Determine the assessment criteria
- Determine a standard scale for the level of achievement
- Determine the descriptor for each achievement level

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### Example of Rubric:

Standard → ↓ Criteria	Below average (0 point)	Average (1 points)	Above average (2 points)
General analysis of physical situation(10%)	Errors in dimensional analysis	Recognizes spatial symmetry relations	Same as Average AND includes a physical interpretation of the situation
Criterion 2 (and percentage)	...	...	...
...	...	...	...
Criterion N (X%)	...	...	...

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**Which is the best car?**



**A**

**B**

**C**

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**How do we define “best”?**

- Small
- Affordable
- Gas mileage




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**Rubric: Which car is the best car?**

	0 points	1 point	2 points
Price	>\$25,000	\$20,000-\$25,000	<\$20,000
MPG	<20	20-30	>30
Seat capacity	2	3 - 5	>5
Size	>200"	150"-200"	<150"

- Small
- Affordable
- Gas mileage



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	0 points	1 point	2 points
Price	>\$25,000	\$20,000-\$25,000	<\$20,000
MPG	<20	20-30	>30
Seat capacity	2	3 - 5	>5
Size	>200"	150"-200"	<150"



	A	B	C
Price	\$18,000	\$19,000	\$32,000
MPG	31	30	19
Seat capacity	2	5	7
Size	Length: 106"	Length: 183"	Length: 198"

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	0 points	1 point	2 points
Price	>\$25,000	\$20,000-\$25,000	<\$20,000
MPG	<20	20-30	>30
Seat capacity	2	3 - 5	>5
Size	>200"	150"-200"	<150"



	A	B	C
Price	\$18,000 <span style="border: 1px solid blue; padding: 2px;">+2</span>	\$19,000 <span style="border: 1px solid blue; padding: 2px;">+2</span>	\$32,000 <span style="border: 1px solid red; padding: 2px;">+0</span>
MPG	31 <span style="border: 1px solid blue; padding: 2px;">+2</span>	30 <span style="border: 1px solid green; padding: 2px;">+1</span>	19 <span style="border: 1px solid red; padding: 2px;">+0</span>
Seat capacity	2 <span style="border: 1px solid red; padding: 2px;">+0</span>	5 <span style="border: 1px solid green; padding: 2px;">+1</span>	7 <span style="border: 1px solid blue; padding: 2px;">+2</span>
Size	Length: 106" <span style="border: 1px solid blue; padding: 2px;">+2</span>	Length: 183" <span style="border: 1px solid green; padding: 2px;">+1</span>	Length: 198" <span style="border: 1px solid green; padding: 2px;">+1</span>

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So this is good for the students...  
but how does this help me as a teacher...



Plan Do Check Action Cycle

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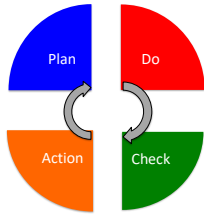
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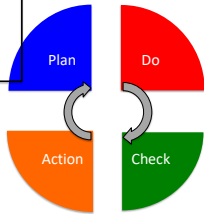
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Rubric

- Clarifies learning goals
- What the student does
- Not what the faculty teaches



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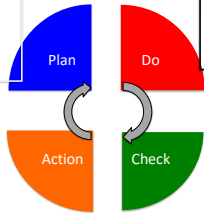
Rubric

- Clarifies learning goals
- What the student does
- Not what the faculty teaches

Self Assessment

- Student checks learning achievement using rubric

ASSESSMENT FOR LEARNING



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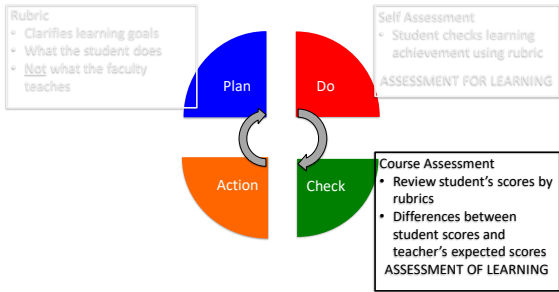
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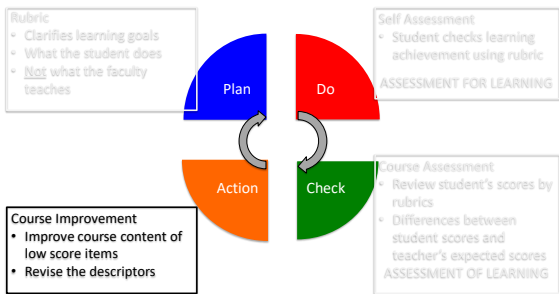
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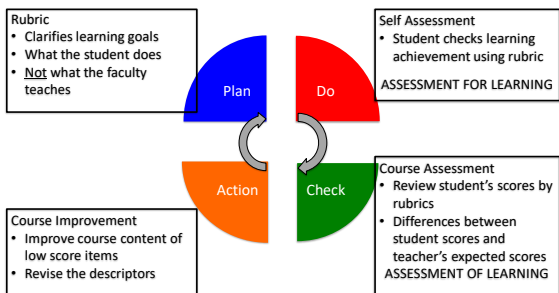
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