Board 129: Analyzing Student Learning Level for the Authentic Learning Assignment "Design Your Own Problem" Using Bloom's Taxonomy

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Boni Yraguen is a PhD student at Georgia Tech. Her dissertation work is in the field of combustion/thermo./fluids. She studies a novel diesel injection strategy: Ducted Fuel Injection (DFI), which is used to drastically decrease soot emissions during diesel combustion. In addition to her thesis work, Boni is passionate about engineering education. She has led and participated in various educational studies on the impact of student reflections, authentic learning assignments, ad the use of technology in the classroom. Boni hopes to pursue a career in academia with a focus on teaching and engineering education.

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Roxanne Moore is currently a Research Engineer at Georgia Tech with appointments in the school of Mechanical Engineering and the Center for Education Integrating Mathematics, Science, and Computing (CEISMC). She is involved with engineering education inno

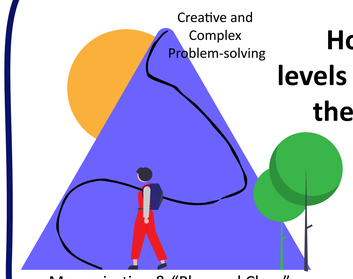
Dr. Katherine Fu, Max Planck Institute for Intelligent Systems

Dr. Kate Fu is the Jay and Cynthia Ihlenfeld Associate Professor of Mechanical Engineering at the University of Wisconsin-Madison. From 2014 to 2021, she was an Assistant and Associate Professor of Mechanical Engineering at Georgia Institute of Technology. Prior to these appointments, she was a Postdoctoral Fellow at Massachusetts Institute of Technology and Singapore University of Technology and Design (SUTD). In May 2012, she completed her Ph.D. in Mechanical Engineering at Carnegie Mellon University. She received her M.S. in Mechanical Engineering from Carnegie Mellon in 2009, and her B.S. in Mechanical Engineering from Brown University in 2007. Her work has focused on studying the engineering design process through cognitive studies, and extending those findings to the development of methods and tools to facilitate more effective and inspired design and innovation. Dr. Fu is a recipient of the NSF CAREER Award, the ASME Design Theory and Methodology Young Investigator Award, the ASME Atlanta Section 2015 Early Career Engineer of the Year Award, and was an Achievement Rewards For College Scientists (ARCS) Foundation Scholar.

Analyzing Student Learning Level for the Authentic Learning Assignment 'Design Your Own Problem' Using Bloom's Taxonomy

Presented by Elisa Koolman in Collaboration with Boni Yraguen, Anna Lummus, Melvin T. Gao, Roxanne Moore, and Kate Fu

Research Question and Motivation



How can we elevate student levels of learning without disrupting the pace and value of a typical lecture-based course?

Use coded reflections to measure the level of student engagement with subject matter material on traditional assessments (quizzes) compared to an authentic learning assignment: Design Your Own Problem (DYOP)

Reflection Prompt

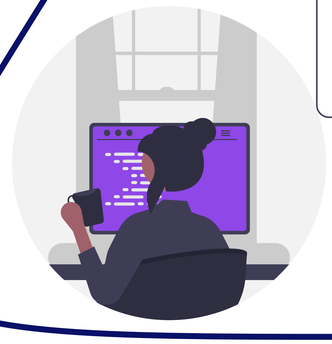
Please reflect on/describe your process for solving quiz problems .

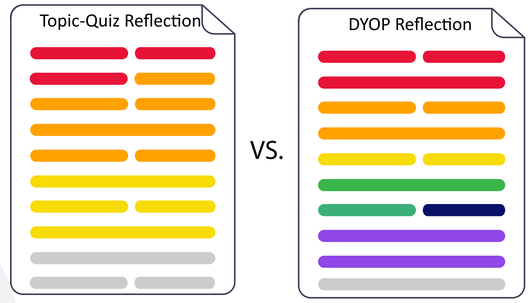
You may use the following questions as prompts for what type of information to include in this reflection:

- How did you decide on a solution strategy for this problem?
- What assumptions did you make while solving the problem? How?
- Were there any parts of the question you found confusing?
- Which parts, if any, of the problem did you get stuck on?
- If you could approach the problem again, what would you do differently to improve your confidence in your answer or answer the question more efficiently?

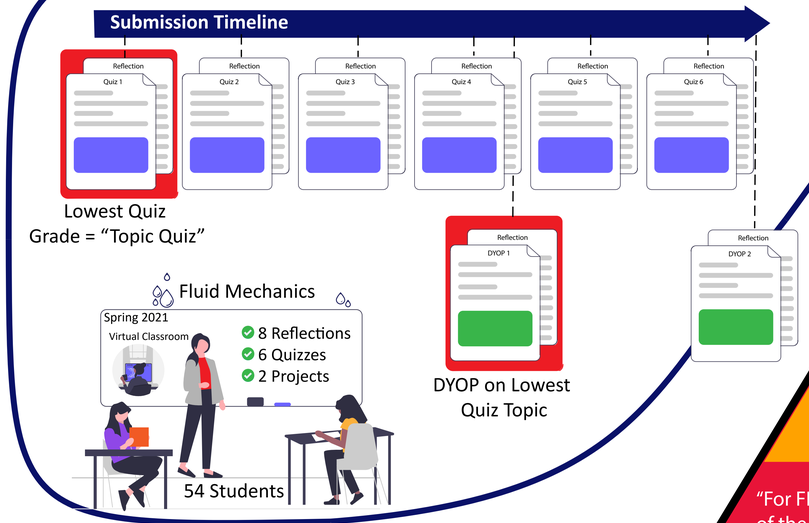
Data Collection and Alnalysis

All reflections are coded for Bloom's Taxonomy.
DYOP reflection is compared to the "topic-quiz" reflection





Study depolyment environment



Conclusion

Significant Differences between DYOP and Topic Quiz:

- Remember
- Understand
- Apply
- Analyze
- Evaluate
- Create

The authentic learning assignment Design Your Own Problem (DYOP) increases the use of higher levels of learning as compared to traditional forms of assessment such as quizzes.

Design Your Own Problem Reflection Prompt

Students are tasked with designing their own problem, based on personal experience or interest, that leverages topics learned in the course.

Authentic Learning Assignment (DYOP) Rubric

The problem summary should be typed and approximately 300 words in length. If your inspiration came from the news, a journal article you read, or something published, please provide a citation for that reference. (3pts total)

Points	1	0
Summary Length	At least 300 words	Not long enough (<300 words)
Relevance	The problem covers an engineering problem that requires the relevant area of fluid mechanics to solve.	The problem is not an engineering problem, or it does not require the relevant area of fluid mechanics to solve.
Clarity	Well written and organized. Easy to read.	Poorly written, organized, or hard to read.

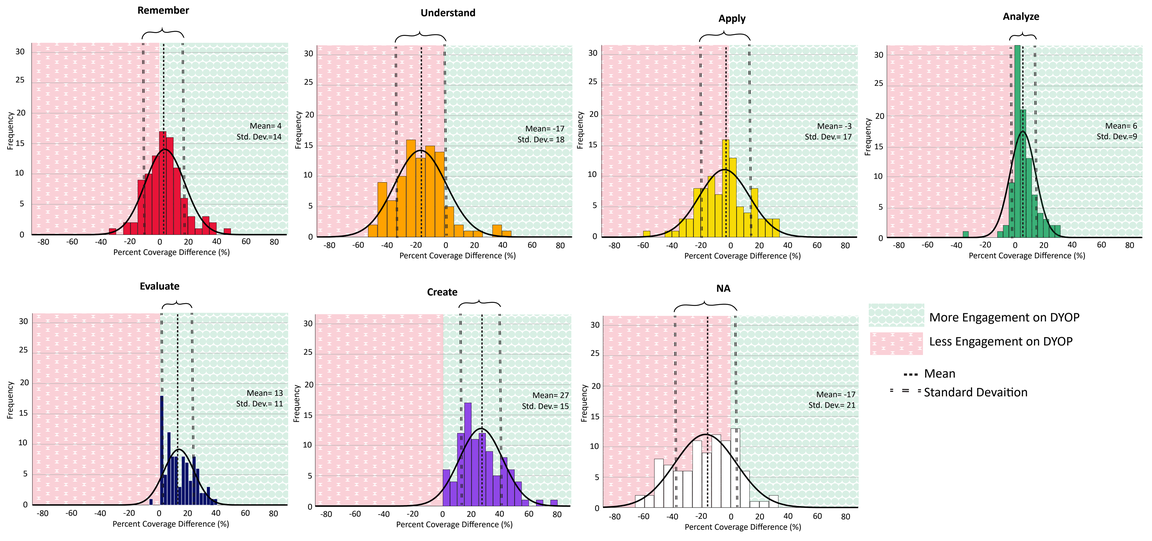
The problem statement should be typed. Problem statement will be graded for clarity and presentation. The figure(s) must be clear and easy to read as well. Hand drawn figures will be accepted, but they must be VERY good. Otherwise, creating figures in PowerPoint, publisher, photoshop, or any figure editing tool of your choice is recommended. (6pts total)

Points	3	2	1	0
Written Statement	1. Clearly written problem statement. 2. Problem is presented with context. 3. All needed variables are presented in a way that is easy to understand. 4. It is not possible to mis-interpret the problem statement and solve a problem that is not intended.	Missing one of the required components	Missing two of the required components	Missing three or more of the required components
Supporting Figure	Figure is easy to read and interpret. All necessary components of figure are properly labeled and cohesive with information given in the problem statement. Figure is very professional.	All necessary figure(s) are included, but it is not very clear or the figure is not professional.	Figure is very difficult to read and creates confusion.	There is no figure.

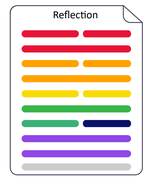
The solution to the problem can be typed or hand-written. You must show all steps needed to solve the problem and provide a defense for the solution/each step taken. (8pts total)

Points	4	2	0
Written Solution	1. Solution is correct. 2. Solution is very clear and easy to read (if hand written it is legible). 3. Solution provides supporting reasoning. 4. Solution includes all needed equations and a reference to where in the text they came from.	Missing one of the required components	Missing two of the required components	Missing three or more of the required components

Points	2	1	0
Problem Complexity	Problem has at least three distinct steps required to achieve the solution. These steps can be written explicitly into the problem statement, or can simply be necessary to solve the problem at hand. A step is considered a significant portion of the solution where you have solved for a value that is required for the next portion of the solution.	Only two steps.	Only one step. Problem is too simple.

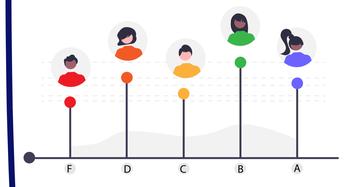


Future Work



What is the impact of refleceting on student levels of learning and engagement?

Are there any demographic diffreences?



Do student quiz grades impact the level of learning demonstrated on the quiz and/or DYOP reflections?

Is there a difference between levels of student learning demonstrated between remote and in-person classes?