Is a Teacher's Role a Coach or a Protector?

By Ed Meyer

A coach is fully aware of the relationship between hard work and success. A good coach will challenge the team to work hard and excel. As a result, the team will develop a fundamental understanding of the connection between hard work and success. Of course, it is not always true that hard work leads to success, but hard work certainly increases the chance of success.

A football coach will be happy to see his team struggling mightily in the weight room. A cross country coach will be pleased to see his team sweating and breathing heavily during practice. It is difficult to imagine a coach requesting that the team "take it easy" to avoid sweating and struggling. Coaches understand that it is the only thing that works. If you want to be a contributing member of the cross-country team, you have to run the miles. If you want to be a contributing member of the swim team, you have to swim the laps. If you want to be a contributing member of the football team, you have to work out hard.

Here is a link to a great clip (less than three minutes) of Kara Lawson, the women's basketball coach at Duke University, addressing her team.

https://www.youtube.com/watch?v=oDzfZOfNki4

If the team is asked to do hard things, they will be better equipped to handle hard things.

Makes sense, right? If you want to get better at something, you must practice.

The same this is true of education. If we challenge the students with hard problems, they will be better equipped to handle hard problems.

From my position as a professor of physics for twenty-four years, many teachers choose the role of "protector" over the role of coach.

Teachers that are protectors do not want their students to struggle. They do not challenge their students with new, complex, and challenging problems, because they are concerned with the mental health of the student while at the university.

Teachers that are coaches want their students to struggle because they care about the success of the student in the playing field of real life. They understand that there is no progress without struggle. They want to transform the students from dependent children to responsible adults.

Teachers that are protectors offer extra credit, accept late assignments, and understand if the student come to class because they – for one reason or another – were not able to make it to class.

Teachers that are coaches do not put up with irresponsible behavior, and they hold the students responsible for their actions.

Teachers that are protectors want to relieve the students of thinking hard to solve complex problems and make their own decisions, so they assume the responsibility of telling the students what to believe. "It is obvious that his viewpoint is right and that viewpoint is wrong and if you believe otherwise, something must be wrong with you."

It is difficult to see how we can recover from this. The students don't want to struggle. Their parents don't want them to struggle. The university administrators do not want them to struggle.

As a parent, it is tough to be both a protector and a coach. Certainly, parents need to be protectors, but as the child matures, they need to struggle with challenging problems without help.

If you are a parent that thinks your child needs to struggle with a challenging problem, similar to a Grand Challenge, we have experienced coaches available. Send me an e-mail at emeyer@bw.edu.

We turn young children into gritty, crafty, determined problem solving beasts.

Making Progress on Grand Challenge TWO – Part I

By Ed Meyer

Grand Challenge TWO is

Six standard dice are rolled. What is the probability that exactly four of the possible numbers appear? Note that a gambler in the 1700s knew that the result was very close to 50%, but he nor any mathematician he asked could calculate it. Can you?

To start, let's take inventory so we are confident that we understand the problem.

There are six dice, and each has six different ways to land. Each of the six possibilities, 1, 2, 3, 4, 5, and 6 are equally likely and the number shown on one die is completely independent of the number shown on a different die. To help us think about this, let's consider six different dice.

Since each die has six equally likely outcomes, and there are six dice, the total number of possible outcomes is

$$6 \times 6 \times 6 \times 6 \times 6 \times 6 = 46{,}656$$

We should be careful here and define what we mean by "outcome." Mathematicians have useful technical terms here, and we see no reason not to use them. There are 46,656 permutations of six dice. A particular permutation is shown above. That is the green die is a one, the blue die is a one, the red die is a one, the orange die is a two, the yellow die is a three, and the purple die is a four. The combination of three ones, a two, a three, and a four has many different permutations.

To solve this problem, we have to determine how many of the equally likely 46,656 permutations have exactly four of the six possible numbers.

To make some progress on this problem, let's consider how many different ways there can be four of the six possible numbers.

After some thought, it can be seen that there are two general ways that four of the six possible numbers can appear. One of them is to have a triple and three singles. One permutation of a triple and three singles is shown below.

Green	Blue	Red	Yellow	Orange	Purple
					

There are three ones, a two, a three, and a four. The five and the six do not appear, resulting in four of the six numbers appearing.

The only other way that four of the six numbers can appear is if there are two doubles and two singles. An example of a roll of this type is

Green	Blue	Red	Yellow	Orange	Purple
					

There are two ones, two twos, a three, and a four. The five and the six do not appear, resulting in four of the six numbers appearing.

The task that remains is to "count" the number of permutations of each of these.

One way to do this is to consider the combination 1-1-1-2-3-4 and to count the number of permutations of this combination. Once you do this, you can determine the number of combinations of the three singles when ones are the triplet. In the example above, the singles were 2, 3, and 4. Another possibility is 2, 4, and 6.

Finally, you have to include the fact that there are six different possible triplets.

It is certainly a difficult problem that requires sustained, careful thought. That is why it is called a Grand Challenge.

Part II will appear in the June newsletter.

If you are interested in getting coached through this problem, email emeyer@bw.edu.

Quote Acrostic of the Month

By Ed Meyer

Instructions: Fill in the words at the bottom from the clues. Then write those letters in the grid at the top to reveal an appropriate quote. Black squares indicate the end of a word, and punctuation has been removed. When you're done, the first letters of the answers to the clues, from top to bottom, will be the author of the quote.

QUOTE

1J	2O	3G	4E		5M	6B	7A	8D		9F	10S	11H	12B	13P		
14I	15A	16S	17O	18K	19R	20C	21Q		22L	23D		24S	25E	26B	27F	28N
	29I	30R		31L	32Q	33E	34O	35J	36K	37P	38B	39C				
40I	41A	42Q	43C	44R	45L		46K	47I		48I	49B	50C	51K	52S	53E	54Q
	55M	56F	57R	58I	59G	60J		61E	62G	63I	64H	65N	66R	67D	68P	69J
	70F	71A	72M		73M	74N	75E	76A	77P	78O	79C		80O	81R		
82K	83B	84E	85S	86K		87H	88L		89C	90J	91G					
92N	93K	94Q	95L	96O	97M	98A	99I	100D	101H							

Naked Physics - Thinking Problems for Everyday People.

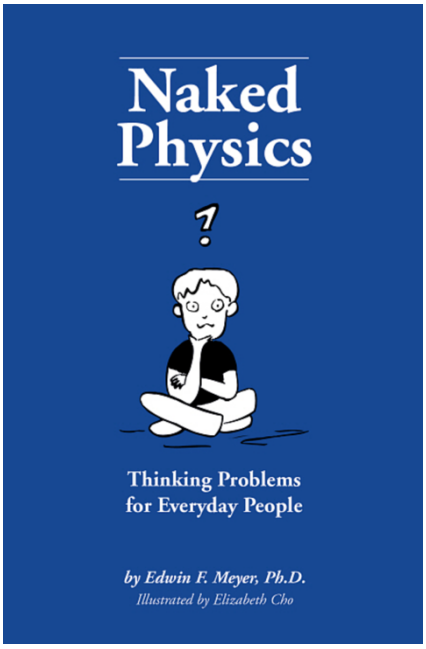
This book contains 64 multiple choice problems with complete answers. The questions involve phenomena such as, sitting in a hammock, riding on a rollercoaster, balancing a pool cue vertically, spilling your drink while taking a sharp turn in a car and filling a watering can with a garden hose. The answers are explained with words, not equations. A great companion for a long airplane flight or summer reading for a future scientist. Here is a sample problem from the book.

When a metal rod is heated, it gets longer and slightly thicker because the atoms in the metal vibrate with a larger amplitude. That is, the atoms simply get a little farther apart from each other, on the average. Scientists call this phenomenon "thermal expansion." Consider a metal disc with a hole in its center, like a metal washer. If the washer is heated does the hole

a) get smaller?

b) stay the same size?

c) get bigger?



Makes a great gift for a future STEM major!

CLUES

A. Like some distributions	98	71	15	76	41	7		
B. Writer of literature	6	12	38	83	49	26		
C. The S in GPS	79	39	20	89	43	50		
D. It should be in the game	100	8	67	23				
E. Boxed set of five	75	33	61	25	53	4	84	
F. Labyrinth	27	9	70	56				
G. Mr. Tulip	3	91	59	62				
H. New Stocks	87	64	11	101				
I. Writer of music	48	29	63	14	58	40	99	47
J. Type of fund	90	35	1	69	60			
K. Common data analysis error	46	36	86	18	51	93	82	
L. Longevity - robustness correlation	31	22	88	95	45			
M. Scrub, as a mission	73	55	72	97	5			
N. These, surprisingly, can be black	28	92	65	74				
O. Boolean transformation	80	2	34	17	78	96		
P. "___ Fragile"	77	68	13	37				
Q. Certain city apartments	94	32	42	54	21			
R. Hard work	19	57	30	81	66	44		
S. Help or encourage	10	52	16	85	24			

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