Blooms Taxonomy

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Blooms Taxonomy

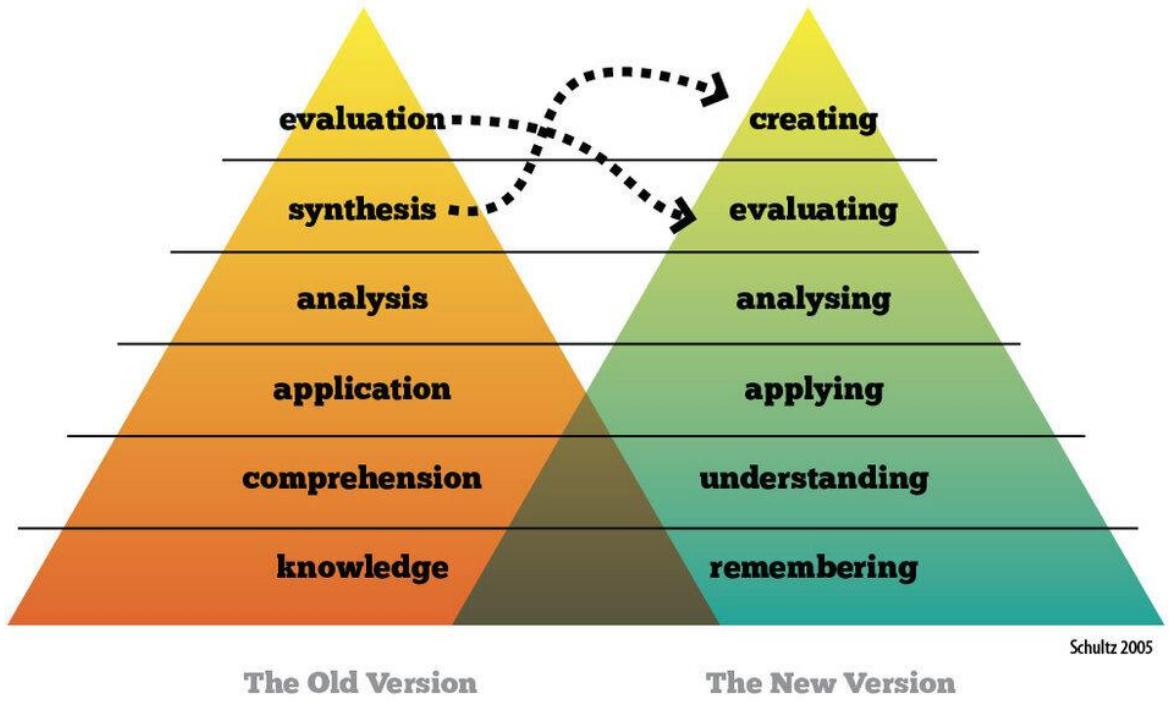
Definition

- In brief, Bloom's taxonomy is a series of cognitive skills and learning objectives arranged in a hierarchical model.

Bloom's Taxonomy Levels Background

- Nouns were replaced by much more action-oriented verbs to reflect the idea that learning is not just passive acquisition, but an engaged, active participation. The figure below compares an old Bloom's Taxonomy model created in 1956 which was later replaced by a newer version in 2001.

Comparison of Blooms Taxonomy Models



Why Should Teachers Use Bloom's Taxonomy?

- Bloom's taxonomy is a great tool for helping teachers to develop higher order critical thinking abilities in students. Referring to the taxonomy's concepts during the planning process helps teachers to focus in on appropriate objectives for groups and individuals and to plan for their progression in the short, medium, and longer term.
- The taxonomy provides a clear framework or system of organization for classifying lesson objectives, as well as a coherent starting point to build lessons from.

How Can Teachers Use Bloom's Taxonomy?

- The starting point of any planning process should be the consideration of the level of the students. Luckily, Bloom's provides a very convenient framework within which to begin this process.
- When creating objectives you can move from the simple to complex, the concrete to abstract, according to the ability of your students through reference to the taxonomy.
- For example, knowing that *Remember* refers to the lowest level of cognitive rigor means you can design your objectives with this in mind.
- Likewise, *Create* references the highest level of cognitive rigor and this will inform the objectives you create for the most sophisticated of your students.

Quick Example

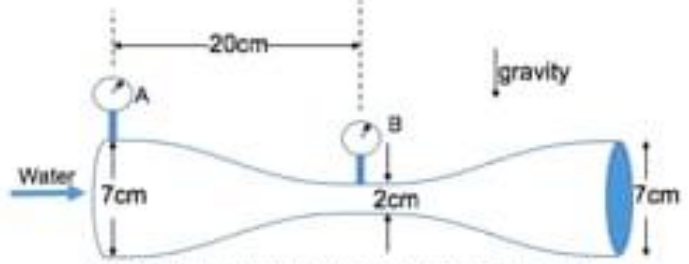
REMEMBER

- **List** and **describe** the assumptions required to apply the Bernoulli Equation to this problem.
- **Identify** what is required for a flow to be considered "incompressible".

UNDERSTAND

- **Summarize** the key ingredients involved in your solution.
- **Explain** the elements of the problem statement that clue you in that this is a Bernoulli problem.

APPLY



Water flows through the contracting pipe as shown. If the pressures at gages A and B are 35kPa and 10kPa, respectively, what is the flowrate Q? Assume steady, inviscid, incompressible flow. Explain your answer.

ANALYZE

- **Predict** how the pressure difference between A and B will change if the flow rate is increased. Explain your prediction.
- **Compare** your solution procedure to this problem to how you would solve problems X and Y. **Find** and describe a common solution procedure for these problems.

EVALUATE

- **Defend** the neglect of elevation changes on the pressures measured at A and B.
- **Assess** the effects of friction on this problem – how would friction effect this problem?

CREATE

- **Invent** and describe a practical use for the device shown.
- **Create** your own Bernoulli Equation problem involving water flow in pipes.
- **Compose** a "solution manual" version of your solution, such that a student with little knowledge of the Bernoulli equation could understand your solution.

Bloom's Taxonomy Levels and Corresponding Verb Lists

- **<u>Level 1:</u> Remember - *To recall facts and ideas***
- At this level, students are challenged to recall and remember the basic facts and information of the story or text.
- **Verb List:** *Cite, Define, Describe, Draw, Identify, Label, List, Match, Memorize, Name, Record, Repeat, State, Write*
- **<u>Level 2:</u> Understand - *To comprehend information and grasp its meaning***
- Level 2 gives the student a chance to show a fundamental understanding of the story or text.
- **Verb List:** *Add, Clarify, Compare, Contrast, Explain, Give, Infer, Observe, Predict, Summarize, Translate*

Bloom's Taxonomy Levels and Corresponding Verb Lists

- **Level 3: Apply** - ***To use information, theories, concepts and skills to solve problems***
- Here, students gain an opportunity to demonstrate their ability to use the information in a new way.
- **Verb List:** *Adapt, Assign, Calculate, Construct, Employ, Express, Illustrate, Modify, Show, Solve, Use*
- **Level 4: Analyze** - ***To make connections; recognize patterns and deeper meanings***
- At this level, students can deconstruct the story into its component parts to better understand it.
- **Verb List:** *Break down, Characterize, Classify, Contrast, Distinguish, Explore, Identify, Investigate, Order, Prioritize*

Bloom's Taxonomy Levels and Corresponding Verb Lists

- **<u>Level 5:</u> Evaluate - *To make and justify a judgement***
- This level gives students an opportunity to develop an opinion and back it up with reasoning and evidence.
- **Verb List:** *Appraise, Assess, Critique, Defend, Determine, Estimate, Explain, Grade, Justify, Rank, Rate*
- **<u>Level 6:</u> Create - *To combine elements of learning to create new or original work***
- This level affords an opportunity for students to take what they have learned and make something new from it.
- **Verb List:** *Abstract, Assemble, Combine, Compose, Construct, Correspond, Design, Develop, Generate, Integrate, Portray, Produce*

Bloom's Taxonomy Levels and Corresponding Verb Lists

- Clearly, the verbs listed above do not represent a comprehensive list of all the possibilities of verbs and verbal phrases available at each level, but they certainly provide a good starting point.
- You may also note that some verbs and phrases will work at more than one level, just be sure to refer to the stated aim of each level to assess what the purpose is in that particular context.
- You can easily differentiate the learning objectives you set by moving up and down levels and by using simpler verb synonyms in those objectives. Using a thesaurus is a great way to achieve this quickly.

Examples of application of Bloom's Taxonomy in Engineering

- **BL1: Remembering**
- Knowledge in this research context refers to the students' ability to recall software engineering concepts that they have learnt in classes. Knowledge level questions include the keywords define, list, arrange, order, and state.
- Below are some sample questions that fall under this level:
- • What is a global variable?
- • State Ohm's Law?
- • List the components of A/D converter?

Examples of application of Bloom's Taxonomy in Engineering

- **BL2: Understanding**
- Comprehension in this research context refers to the students' ability to understand and restate or describe a learnt concept using their own words or explanation. Comprehension level questions include the keywords explain, describe, discuss, identify, review, select, and predict.
- Below are some sample questions that fall under this level:

Question 1

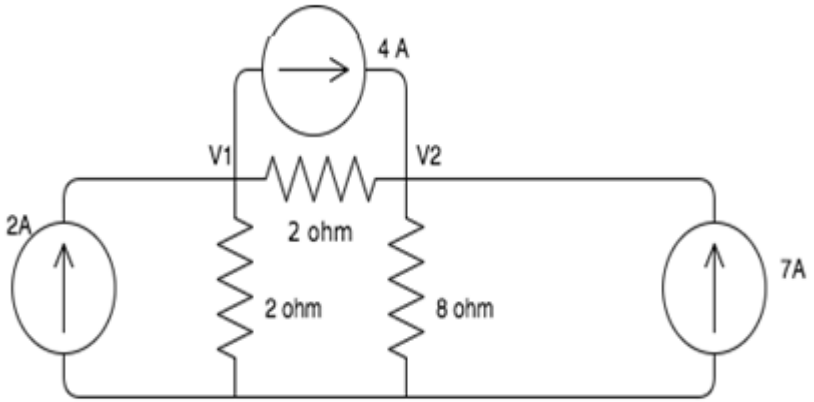
Identify errors in the following program segment and rewrite the correct statements.

```
#include <stdio.h>

int main()
{
   integer x, total, y;
   x = y;
   print("Enter the value for x:");
   scanf("%d", total);
   total += x+y;
   printf("The new value of total is %d");
   return 0;
}
```

- **BL3: Application Level**
- Application in this research context refers to the students' skill in using the theories learnt to solve new problems. Application level questions include the keywords classify, write, apply, choose, and interpret.
- Below are some sample questions that fall under this level:

2. Calculate the node voltages V1 and V2.

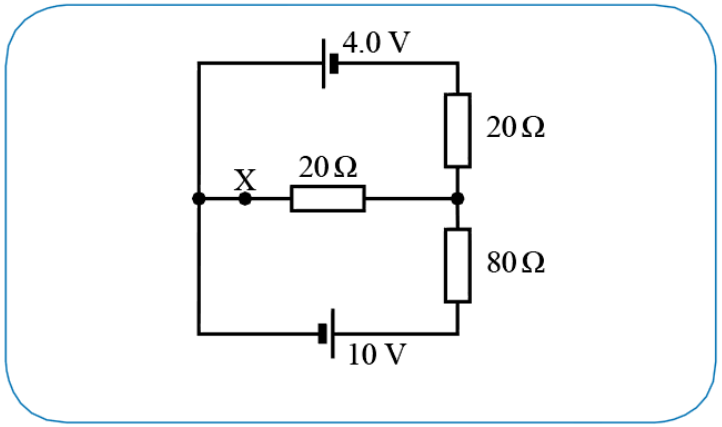


Examples of application of Bloom's Taxonomy in Engineering

- [illegible]

9 Apply Kirchhoff's laws to find the current at point X in the circuit shown in Figure 14.16. What is the direction of the current?

Answer

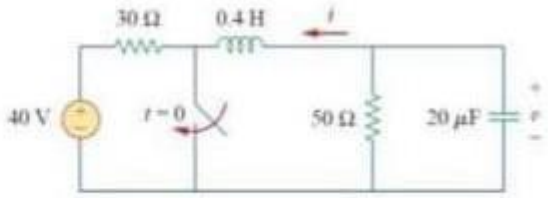


Examples of application of Bloom's Taxonomy in Engineering

- **BL4: Analysing Level**
- Analysis in this research context refers to the students' ability to separate a whole into various component parts. Analysis level questions include the keywords analyse, compare, contrast, distinguish, categorize, calculate, differentiate, and test.
- Below are some sample questions that fall under this level:

(CLO_2): (Cognitive Level C4, i.e., Analyzing) (PLO_2, i.e., Problem Analysis)
Question No. 2: **[10 Marks]**

Analyze $v(t)$ for $t>0$ in the *RLC* circuit



Consider the following CT LTI systems with input $x(t) = sinc(t)$

$(a)\ h_1(t) = sinc(t)$

$(b)\ h_2(t) = sinc^2(t)$

$(c)\ h_3(t) = e^{j2t} sinc(t)$

(i) Find the output of each of the systems above.

(ii) Identify which of the systems above act as low-pass filters (justify your answer)

A CT-LTI system has zero-input response (ZIR) in Frequency Domain as

$$\frac{s+3}{(s+1)(s+2)}$$

The total response (TR) of the system to a unit impulse in Time Domain is given as

$$y(t) = \left(\alpha e^{-t} + \beta e^{-\beta t} - \gamma e^{-2t}\right)u(t)$$

Where α, β, γ are the fifth, sixth, and seventh digits of your student registration number.

(a) Find the zero-state response (ZSR) of the system in Time Domain.

(b) What are the poles of the system? (Hint: when input is a unit impulse, the ZSR gives $h(t)$ in Time Domain).

(c) Is the system stable? (justify your answer).

(d) Can a student at GIKI have registration number that would make the system unstable? (justify).

(e) Assume now that the system is in zero state, and the input applied to the system is $x(t) = log(1)u(t - \alpha - \beta - \gamma)$. What is the output? (justify your answer).

Examples of application of Bloom's Taxonomy in Engineering

- **BL5: Evaluation Level**
- Evaluation in this research context refers to the students' ability to judge, critic and decide on value of ideas or materials. Evaluation level questions include the keywords argue, debate, recommend, prioritize, justify, rate, and decide.
- Below are some sample questions that fall under this level:

Q.No.4	(CLO_3): (Cognitive Level C5, i.e.,**Evaluating**) (PLO_2:Problem Analysis) (23 mar ks)

A) **Evaluate** the Fourier Series of $f(x)=\frac{x^2}{R+2}$ $(-\pi \le x \le \pi)$.

Show that $1+\frac{1}{4}+\frac{1}{9}+\frac{1}{16}+\frac{1}{25}+\ldots.=\frac{\pi^2}{6}$ (Using $f(x)=\frac{x^2}{4}$ $(-\pi < x < \pi)$) . (12 marks)

B) Evaluate fourier series $f(x)=x^R,\ 0<x<1,$ (11marks)

$f(x)=0,\quad 1<x<2\quad p=2L=2$

(CLO_3): (Cognitive Level C5 i.e., Evaluating)
(PLO_3, i.e., Design and Development of Solutions)

Q9. The input output relation of a filter is given by

$4y(n)=4y(n-2)+\frac{3}{4}x(n-1)+\frac{1}{8}x(n-2)+x(n).$

Distinguish whether the given filter is,

(a) FIR or IIR? [3]

(b) High Pass (HP), Low Pass (LP), Band Pass (BP)? [2]

Examples of application of Bloom's Taxonomy in Engineering

- **BL6: Creating Level**
- Creating in this research context refers to the students' ability to relate learnt engineering concepts and produce a new idea. Synthesis level questions include the keywords create, construct, design, develop, manage, organize, plan, predict, and propose.

Below are some sample questions that fall under this level:

- Design a smoke detector.
- Design an autonomous drone that can fly to a given GPS location.

BL6: Creating Level

Q.No.1	(CLO_2): (Cognitive Level C6, i.e., **Creating**) (PLO_1: Engineering Knowledge) **(3 Marks)**

Write a Fourier Series of the function $f(x) = \begin{cases} R & if \ \ 0 < x < S \\ 0 & if \ \ S < x < 2S \end{cases}, \quad p = 2S.$

Take R and S as given in instructions. **(3 Marks)**

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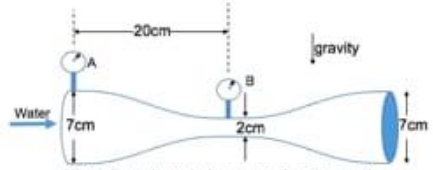

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