Bloom's for Computing

Agenda

- About the CCECC
- Bloom's Revised Taxonomy Refresher
- Discussion: Writing Learning Outcomes
- Bloom's for Computing
- Activity: Writing Learning Outcomes
- Share Out and Wrap Up

About the CCECC

- Subcommittee of the ACM
  - Focus on curricular guidance for community colleges
  - Most recent project was Bloom's for Computing
  - Current project is curricular guidance for Data Science
  - Members who developed the Bloom's for Computing product:
    - Adeleye Bamkole, Passaic County Community College, NJ
    - Markus Geissler, Ph.D., Cosumnes River College, CA
    - Koudjo Koumadi, Ph.D., Prince George's Community College, MD
    - Christian Servin, Ph.D., El Paso Community College, TX
    - Cara Tang, Ph.D., Portland Community College, OR
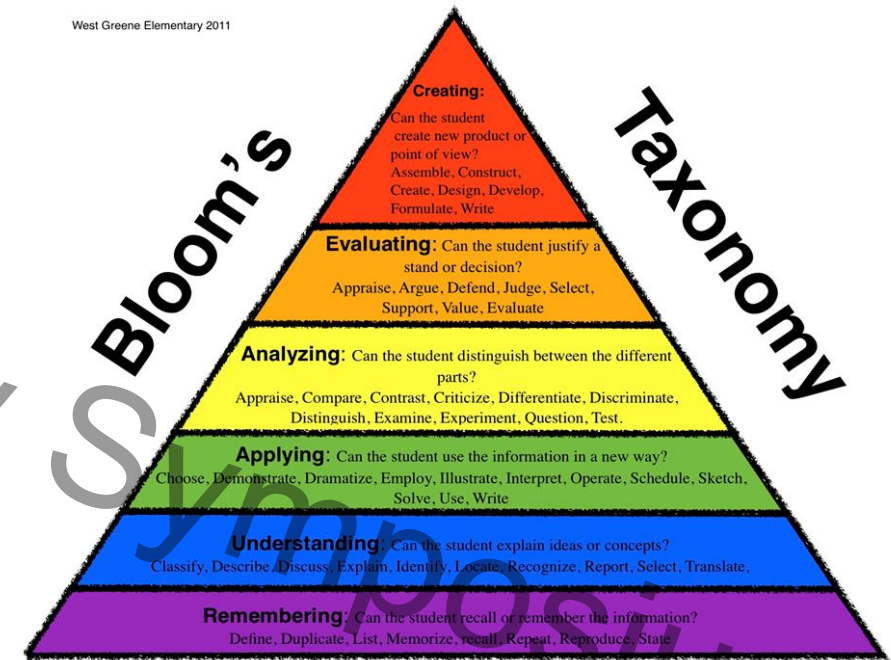   - Cindy S. Tucker, Bluegrass Community and Technical College, KY

Bloom's Revised Taxonomy Refresher

6 levels of cognition

- Creating   Ex: Develop
- Evaluating   Ex: Assess
- Analyzing   Ex: Distinguish
- Applying   Ex: Illustrate
- Understanding   Ex: Explain
- Remembering   Ex: List

Verbs associated with each level, used in crafting learning outcomes and competencies.

West Greene Elementary 2011

Bloom's Taxonomy

Creating: Can the student create new product or point of view? Assemble, Construct, Create, Design, Develop, Formulate, Write

Evaluating: Can the student justify a stand or decision? Appraise, Argue, Defend, Judge, Select, Support, Value, Evaluate

Analyzing: Can the student distinguish between the different parts? Appraise, Compare, Contrast, Criticize, Differentiate, Discriminate, Distinguish, Examine, Experiment, Question, Test.

Applying: Can the student use the information in a new way? Choose, Demonstrate, Dramatize, Employ, Illustrate, Interpret, Operate, Schedule, Sketch, Solve, Use, Write

Understanding: Can the student explain ideas or concepts? Classify, Describe, Discuss, Explain, Identify, Locate, Recognize, Report, Select, Translate.

Remembering: Can the student recall or remember the information? Define, Duplicate, List, Memorize, recall, Repeat, Reproduce, State

Bloom's Revised Taxonomy Refresher

Assessment Verbs by Bloom's Level

Lower Order Thinking Skills → Higher Order Thinking Skills

Remembering	Understanding	Applying	Analyzing	Evaluating	Creating
Define	Classify	Apply	Analyze	Appraise	Assemble
Duplicate	Convert	Calculate	Attribute	Argue	Construct
Find	Demonstrate	Carry out	Categorize	Assess	Create
Identify	Describe	Edit	Compare	Choose	Design
Label	Differentiate	Diagram	Contrast	Critique	Develop
List	Discuss	Execute	Decompose	Debate	Devise
Locate	Exemplify	Illustrate	Deconstruct	Defend	Formulate
Memorize	Explain	Implement	Deduce	Estimate	Hypothesize

Writing Learning Outcomes

- For a topic in a computing area, find a verb and generate an SLO (Student Learning Objective)
- Use Assessment Rubric: Emerging, Developed, and Highly Developed

Learning Outcome	Assessment Rubric		
SDF. Software Development Fundamentals KA	**Emerging**	**Developed**	**Highly Developed**
SDF/Algorithms and Design Knowledge Unit (see also AL/Algorithm Strategies and AL/Fundamental Data Structures and Algorithms)			
SDF-01. Design an algorithm in a programming language to solve a simple problem. *[Creating]*	Implement an algorithm in a programming language to solve a simple problem. *[Applying]*	Design an algorithm in a programming language to solve a simple problem. *[Creating]*	Design an algorithm in a programming language to solve a complex problem. *[Creating]*

Writing Learning Outcomes

- Identify the level of cognition to achieve
- Find a proper computing area to apply verbs
- Recognize that: Topics ≠ SLO ≠ Competencies
- Recognize one verb for SLO (do not use several)
- Avoid duplication of verbs in same SLO

Bloom's Verbs for Computing – Project Overview

- Bloom's for Computing: Enhancing Bloom's Revised Taxonomy with Verbs for Computing Disciplines
- Enhance the verb lists associated with each cognitive level with verbs to support computing disciplines
- Support clearer and more direct expression of learning outcomes and competencies for computing disciplines

Bloom's Verbs for Computing - Timeline

- Project conceived Summer 2020

- StrawDog: ~90 proposed verbs presented at SIGCSE 2021 & other venues

- Survey feedback incorporated into next round

- IronDog: 76 proposed verbs presented at SIGCSE 2022 & other venues

- Survey feedback incorporated into next round

- Final draft: 57 verbs

- Final publication January, 2023

- Read the full report

Scan code for full report

Bloom's Verbs for Computing - Content

- Example verbs: Configure, Document, Encrypt, Automate, Trace, Debug, Decide, Optimize, Collaborate

- Verb Explanations and Sample Learning Outcomes for each verb

- Reformulating Learning Outcomes Using Enhanced Verbs

- Guidance for Writing Learning Outcomes and Competencies

Sample Learning Outcomes

Backup: Common computing task, especially in system administration and data security [Applying]

- Backup multiple local or remote files and folders to a backup volume.

- Backup marked data to a remote location using an automation script.

Trace: Common task applicable to many computing, system administration, networking, and cybersecurity tasks [Analyzing]

- Trace a variable's value as it changes throughout a code module.

- Trace an activity to detect the condition that creates a deadlock.

- Trace a list attached or linked to personnel who are not allowed access to any part or function of the system.

Reformulating Learning Outcomes

Learning outcomes from CS2013 and reformulated learning outcomes with one of the proposed new verbs

- Example 1:

- ORIGINAL: Give examples that illustrate time-space trade-offs of algorithms.

- NEW: **Compute** time and space costs for two different algorithms that perform the same task, demonstrating the time-space tradeoff. [Applying]

- Example 2:

- ORIGINAL: Explain what is meant by "best", "expected", and "worst" case behavior of an algorithm.

- NEW: **Measure** "best", "expected", and "worst" case behavior of a given algorithm. [Applying]

Revising Learning Outcomes with Bloom's for Computing

Example:

Implement initial settings including passwords, IP addressing, and default gateway parameters on a network switch and end devices.

- Replace the verb with a Bloom's for Computing verb.
- Adjust the LO language as necessary.

Activity: Revising Learning Outcomes using Bloom's for Computing

Use the Bloom's for Computing verbs to improve Learning Outcomes (LOs).

- Review your Bloom's for Computing verbs printout.
- Revise the LOs of one of your own courses or programs.
- Verb list also available for download

Verb List

2024 CAE Community Symposium

Share Out and Wrap Up