<table>
<thead>
<tr>
<th>Level</th>
<th>Definition</th>
<th>Sample verbs</th>
<th>Sample behaviors</th>
<th>Reference: <a href="http://chiron.valdosta.edu/whuitt/col/cogsys/bloom.html">http://chiron.valdosta.edu/whuitt/col/cogsys/bloom.html</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>KNOWLEDGE</td>
<td>Student recalls or recognizes information, ideas, and principles in the approximate form in which they were learned.</td>
<td>arrange define describe duplicate identify label list match memorize name order outline recognize relate recall repeat reproduce select state</td>
<td>The student will define the 6 levels of Bloom’s taxonomy of the cognitive domain.</td>
<td></td>
</tr>
<tr>
<td>COMPREHENSION</td>
<td>Student translates, comprehends, or interprets information based on prior learning.</td>
<td>explain summarize paraphrase describe illustrate classify convert defend describe discuss distinguish estimate explain express extend generalized give example(s) identify indicate infer locate paraphrase predict Recognize rewrite review select summarize translate</td>
<td>The student will explain the purpose of Bloom’s taxonomy of the cognitive domain.</td>
<td></td>
</tr>
<tr>
<td>APPLICATION</td>
<td>Student selects, transfers, and uses data and principles to complete a problem or task with a minimum of direction.</td>
<td>use compute solve demonstrate apply construct apply change choose compute demonstrate discover dramatize employ illustrate interpret manipulate modify operate practice predict produce schedule</td>
<td>The student will write an instructional objective for each level of Bloom’s taxonomy.</td>
<td></td>
</tr>
<tr>
<td>ANALYSIS</td>
<td>Student distinguishes, classifies, and relates the assumptions, hypotheses, evidence, or structure of a statement or question</td>
<td>analyze categorize compare contrast separate apply analyze categorize compare contrast separate apply analyze categorize compare contrast separate apply analyze categorize compare contrast separate apply</td>
<td>The student will compare and contrast the cognitive and affective domains.</td>
<td></td>
</tr>
<tr>
<td>SYNTHESIS</td>
<td>Student originates, integrates, and combines ideas into a product, plan or proposal that is new to him or her.</td>
<td>create design hypothesize invent develop arrange assemble categorize collect combine deploy manipulate create design develop devise explain formulate generate plan prepare rearrange reconstruct relate reorganize revise rewrite set up summarize synthesize tell write</td>
<td>The student will design a classification scheme for writing educational objectives that combines the cognitive, affective, and psychomotor domains.</td>
<td></td>
</tr>
<tr>
<td>EVALUATION</td>
<td>Student appraises, assesses, or critiques on a basis of specific standards and criteria.</td>
<td>Judge Recommend Critique Justify Appraise Argue Assess Attach Choose Compare Conclude Contrast Defend Describe Discriminate Estimate Evaluate Explain</td>
<td>Judge Justify Interpret Relate Predict Rate Select Summarize Support Value</td>
<td>The student will judge the effectiveness of writing objectives using Bloom’s taxonomy.</td>
</tr>
</tbody>
</table>
Creating a Course Using Backwards Design

Leah Rineck (lmrineck@uwm.edu) and Hayley Nathan (henathan@uwm.edu)
University of Wisconsin - Milwaukee

At the course level...
What course are you thinking of re-designing?

What do you think your big idea could be? (This takes a while and you can refine it later.)

List two course learning outcomes. Do they fit with your big idea?

Identify your key assessments...
What is one key assignment/assessment you can use to assess one of your course learning outcomes?

At the lesson level...
List two lesson learning outcomes for your course. Do they fit with your course learning outcomes?
Do they fit with your big idea?
Creating a Course Using Backwards Design

Leah Rineck and Hayley Nathan

UW-Milwaukee
Session outcomes

By the end of this session—in the lens of one course— instructors will:

▪ Establish a “big idea” for the course
▪ Establish 1-2 learning outcomes for the course
▪ Brainstorm ways to assess these learning outcomes – perhaps in unexpected ways
▪ Plan for next steps in backwards design
  ▪ Unit to lesson level considerations
Overview of the courses we have designed

MATH 094
- 6 developmental credits
- 4 class sessions and 1 discussion session
- Content ranges from basic math to beginning algebra
- Flipped Classroom
- Custom Curriculum

MATH 98/108
- 3 developmental credits plus 3 credits toward graduation
- 4 class sessions
- Content ranges from beginning algebra to intro to college algebra
- Co-requisite model
- Functions-based approach to studying algebra
MATH 94

- Learn to be a mathematician

MATH 98/108

- Functions!
Think of a big idea for your course
MATH 94

By the end of the course, students will be able to:
1. Utilize varying information to create and solve mathematically relevant problems
2. Justify mathematical statements
3. Determine the most efficient method to correctly solve basic math and algebraic problems
4. Compare and contrast key mathematical ideas
5. Learn the most effective ways to study for mathematics

MATH 98

By the end of the course, students will be able to:
1. Build multiple representations (tables, graphs, algebraic formulas, and word descriptions) of linear, quadratic, power, exponential, logarithmic, polynomial, and rational functions.
2. Apply algebraic operations on functions and solve equations arising from functions
3. Execute algebraic skills such as factoring, rules of exponents, and equivalent expressions to support their understanding of functions
4. Translate between real-world and mathematical concepts
5. Model with functions
Bloom's Taxonomy

- **Remember**
  - Recall facts and basic concepts
    - define, duplicate, list, memorize, repeat, state

- **Understand**
  - Explain ideas or concepts
    - classify, describe, discuss, explain, identify, locate, recognize, report, select, translate

- **Apply**
  - Use information in new situations
    - execute, implement, solve, use, demonstrate, interpret, operate, schedule, sketch

- **Analyze**
  - Draw connections among ideas
    - differentiate, organize, relate, compare, contrast, distinguish, examine, experiment, question, test

- **Evaluate**
  - Justify a stand or decision
    - appraise, argue, defend, judge, select, support, value, critique, weigh

- **Create**
  - Produce new or original work
    - Design, assemble, construct, conjecture, develop, formulate, author, investigate

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Vanderbilt University Center for Teaching
Create 1-2 Learning Outcomes for your course
Creating Key Assignments/Assessments

MATH 94

- In-class activities that are related to the learning outcomes
- Incorporating study skills assignments
- Focus on formative assessment as well as summative
- In progress:
  - Constant evaluation of learning outcomes

MATH 98

- Typical homework and traditional exams
  - Each with problem selection focused on learning outcomes
- Small modeling projects/assignments
- In progress:
  - Desmos explorations
  - Data collection and working with tables
Generate Ideas for 1-2 Key Assignments for your course
What we encountered

MATH 94
- Purposeful content
- Transparency for students
- Meaningful assignments

MATH 98
- Robustness! A fresh take on the "old" algebra
- Deleting surprising elements from the course
- An opportunity to collaborate with peers
- Gaining a long-term perspective
- Challenges with transfer courses
Unit and Lesson level considerations

**BENEFITS**
- Teaching feels purposeful and learning is goal-oriented
- Helpful for addressing the mile-wide-inch-deep syndrome
- Reflecting on and improving the course is easier with a proper lens
- Can trickle into other courses

**DRAWBACKS**
- Time-consuming
- If not clearly communicated with students or other instructors, can appear haphazard
- Textbook selection is tricky
Discussion: Where do you think you'll go?
Additional Resources

- Understanding by Design by Grant Wiggins and Jay McTighe
- Bloom's Taxonomy
- Common Core Standards
- Fink's Taxonomy
Thank you!

- Leah Rineck
  - lmrineck@uwm.edu

- Hayley Nathan
  - henathan@uwm.edu
Math 98 Group Project: Modeling Linear Equations

Name: _________________________  Group Members: ________________________________

**Math 98 Group Project: Modeling Linear Equations**

1. Discuss with your group members all the different examples of linear models you created in the previous assignment. *Pick your favorite example of a linear function with a positive slope.* Re-summarize the following:

   Brief description of the situation:

   Define variables:
   
   _____ = ___________________________________________________
   
   _____ = ___________________________________________________

   Equation of the line: ____________________________________________

2. Discuss with your group members all the different examples of linear models you created in the previous assignment. *Pick your favorite example of a linear function with a negative slope.* Re-summarize the following:

   Brief description of the situation:

   Define variables:
   
   _____ = ___________________________________________________
   
   _____ = ___________________________________________________

   Equation of the line: ____________________________________________

**NOW, PICK ONE OF THE ABOVE AND GET YOUR INSTRUCTOR’S APPROVAL TO PROCEED.**

Instructor’s initials: _____________
Math 98 Group Project: Modeling Linear Equations

3. State the equation of your line in slope-intercept form: ______________________________

Interpret the slope in context with proper units:

Interpret the vertical intercept in context with proper units:

—OR—

If you had chosen a constraint equation instead, interpret each of the constants in your constraint equation:

4. For the function you picked, identify 3 coordinate pairs that would lie on the graph of the function.

5. Using one of the points from (4.) and your slope, write an equation of your function in point-slope form.
Math 98 Group Project: Modeling Linear Equations

6. Graph your linear function, and make sure to do each of the following:
   • Label the axes with what they represent.
   • Identify/label the increments you are using on each axis.
   • Plot the 3 points you listed in (4.) on your graph.

SHOW YOUR GRAPH TO YOUR INSTRUCTOR AND OBTAIN APPROVAL TO PROCEED.
Instructor’s initials: ___________
Math 98 Group Project: Modeling Linear Equations

NOW, TURN YOUR SINGLE LINEAR MODEL INTO A SYSTEM OF LINEAR EQUATIONS

7. What is an equation of a line parallel to your original equation in (3.)? What could this represent in your word problem? Explain.

8. What is an equation of a line different from (and not parallel to) your original equation in (3.)? What could this represent in your word problem? Explain.

9. Choose #7 OR #8 above to incorporate into your system of equations in your presentation. Write your system of linear equations below:

\[
\begin{align*}
\end{align*}
\]

10. Go back to the previous page and GRAPH your second equation to complete a graph of the system. Label the point of intersection.

11. Solve your system and interpret its solution.

Solution: ___________ Interpretation:

12. Each individual group member must prepare at least one question to pose to the class about your system of equations. List the question(s) you will ask the class and the answer(s) to the question(s):

Q:

A:
Math 98 Group Project: Modeling Linear Equations

On day 2 you will have the beginning part of class to graph your system on big graph paper and rehearse a presentation of your system to the class. Each presentation will be 3 – 4 minutes per group. You may need to work outside of class before Day 2. Below is the rubric by which you will be graded.

Use the rubric below to estimate your grade based on your progress so far: ____________________

<table>
<thead>
<tr>
<th>Quality of completion of this packet (Day 1)</th>
<th>Excellent</th>
<th>Satisfactory</th>
<th>Poor</th>
</tr>
</thead>
</table>
| 10 points | -All questions are answered correctly in their entirety  
-Student is actively participating in group contributions | < 10 points | 0 points | ANY of the following will result in 0 points:  
-The student is absent  
-The student is not contributing to the group  
-The student is on their phone  
-The student is copying off a peer |

<table>
<thead>
<tr>
<th>Quality of the linear model (Day 1)</th>
<th>10 points</th>
<th>5 points</th>
<th>0 points</th>
</tr>
</thead>
</table>
| A realistic system of linear equations is modeled | The system is any of the following:  
-Incomplete  
-Unrealistic  
-Not actually linear | A system is not produced |

<table>
<thead>
<tr>
<th>Presentation: Poster Quality (Day 2)</th>
<th>10 points</th>
<th>&lt; 10 points</th>
<th>0 points</th>
</tr>
</thead>
</table>
| Poster satisfies ALL of the following:  
-Axes are labeled with what they represent  
-Increments are labeled and accurately applied  
-At least 3 points are plotted for each line  
-Linear equations are clear and straight  
-Point of intersection is clearly identified and matches proper solution | For each of the items from the “Excellent” rubric column that are missing 2 points will be deducted | A poster is not created |

<table>
<thead>
<tr>
<th>Presentation: Strength of Individual Contribution (Day 2)</th>
<th>10 points</th>
<th>5 points</th>
<th>0 points</th>
</tr>
</thead>
</table>
| Student demonstrates a strong understanding of their linear system and makes at least one meaningful verbal contribution | -Student does not demonstrate an understanding of their linear system or  
-Student makes a weak or incorrect verbal contribution | -Student did not verbally participate in the presentation or  
-Student is absent or  
-Student is disrespectful towards other presenters |

<table>
<thead>
<tr>
<th>Total:</th>
<th>40 points</th>
</tr>
</thead>
</table>


Portfolio Review, Exam Analysis, Conference with Instructor

Due: At the time of your conference

Note: If you need to take the Exam Retake this needs to be done on October 15 or 16.

First, log into Canvas and make an appointment with your instructor. You can find the appointments in the course calendar.

Before your appointment:

1. Accurately self-assess your organization and note-taking using this chart. Circle one description in each row that accurately describes your organization and note-taking.

<table>
<thead>
<tr>
<th>Organization</th>
<th>4 – Exemplary</th>
<th>3 – Meets Expectations</th>
<th>2 - Developing</th>
<th>1 – Not Yet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accurate organization throughout with sections clearly identified for Course Information, Workbook, ALEKS work, Extra Handouts, Notes from videos and all items are in the correct locations</td>
<td>Your portfolio has all required sections for Course Information, Workbook, ALEKS work, Extra Handouts, Notes from videos. However some items are incorrectly located or may be difficult to identify</td>
<td>Your portfolio has most sections for Course Information, Workbook, ALEKS work, Extra Handouts, Notes from videos. However, several sections and many items are not present, clearly identified or well-organized.</td>
<td>Your portfolio is missing sections, and many items are not organized</td>
<td></td>
</tr>
</tbody>
</table>

The Course information section includes your syllabus, schedule and any assignment information already given out.

All of the Class Workbook is in your portfolio. All graded work is put back in order.

All of the workbook is in your portfolio. Some of the graded work is not put back in order.

Parts of the workbook are missing, or graded work is not put back in the correct order.

Many of the workbook sections are missing, and the workbook sections present are not in the correct order.

Note-Taking

In the workbooks, most of the video note section is filled in. There are questions where you didn’t

In the workbooks, the video notes have some major gaps.

In the workbooks, only the topics discussed in class are written in the video notes.

In the workbooks, no notes are taken.
2. What are the key areas you need to improve your note-taking, organization, etc.?

3. What are the key areas you did well in your note-taking, organization, etc.?

4. On your exam, what areas did you do well? **List the types of problems not the specific problem number.**

5. On your exam, what areas do you need improvement? **List the types of problems not the specific problem number.**
6. Next, look at your gradebook in Canvas:
   a. What is your overall percentage?

   b. According to the class participation, how many classes have you missed?

   c. According to the discussion participation, how many discussion classes have you missed?

   d. What is your current grade for online homework (ALEKS/Knewton)?

   e. What is your current grade for Weekly Written Work?

   f. What was your grade on Exam 1?

7. Do you feel your grade is reflective of the work you have put into the course so far? Why or why not?
To be filled out by your instructor:

1. Did the student come prepared – with portfolio assessed, questions answered, and corrections attempted?

2. Go over the exam corrections, are there any questions? Were the corrections mostly done?

3. Did the student explain the mistakes on the exam?

4. Go over the class organization and note-taking, are there any questions? Was it accurately assessed?

5. How do you feeling the course is going?

6. Are you satisfied with your course performance so far?