In Support of Equitable Grading Practices:

A Tool to Auto Generate Multiple Versions of Paper Quizzes

(A Nifty Tool)

Amy Larson

Augsburg University

Computer Science Program

Department of Mathematics, Statistics, and Computer Science

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WHAT IS THE PROBLEM?

Too many students
are not successfully completing
Introduction to Programming (Python)
at Augsburg
and many other institutions.

The DFW rate at Augsburg, it WAS 38% (in 2021).
The average rate nationally is **28%**
for introductory programming courses [*].

[*] J. Bennedsen and M. E. Caspersen, "Failure rates in introductory programming: 12 years later," *ACM Inroads*, vol. 10, no. 2, pp. 30–36, Apr. 2019.

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The GOAL

Increase Student Success in CSC165

BUT

not at the expense of

preparing them sufficiently

for success in the next course*

Student success not just in "grades" but in engagement, in learning outcomes, and a desire to continue in CS.

*Many of CSC165 Students are (or become) Management Information Systems (MIS) majors. This is the only (significant) programming course they take. Arguably, there are different learning outcomes for those students, but we cannot differentiate.

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What (we) hypothesized were relevant factors.

Problematic Course Structure

- Assignments too big to be student-managed over a week.
- Students need much more academic support.
- Missing an assignment (or two) was devastating to grade.
- Assignments insufficiently engaging to encourage investment.
- zyBooks reading not productive.

Things to work around (with) ...

- Limited access to computers and/or low computer literacy.
- Insufficient math preparation.
- Learning to "college" – study habits, time management, commuting, etc.

Note: Active Learning is and has been standard-practice in the department.

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The Solution (or part of it, anyway – we think)

1. Overhauled assessment and adopted **EQUITABLE GRADING PRACTICES**,
2. Redesigned the curriculum to be **MORE ENGAGING** and provide **MORE SCAFFOLDING**,
3. Increased academic support through **PEER INSTRUCTORS**,
4. Fostered **COMMUNITY** through First-Year Experiences and peer tutoring.

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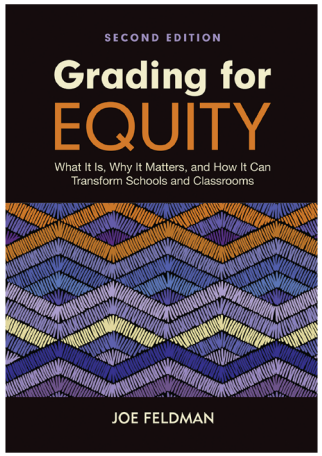

Equitable Grading Practices

The key is flexibility!

It does not matter WHEN students learn, only that they DO learn.

Mastery-Based Learning (Quizzes)

"What does a student need to demonstrate (at a minimum)
to give me the confidence that
they have a chance of being successful in the next course?"

What specifically was done... Course Structure

40% Weekly Programming Assignments (11 total)

30% Weekly Written Mastery Quizzes (11 total)

20% Programming Assessment (4)

10% Technology and Society (semester long participation and reflection paper)

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Mastery Quiz

For each expression below, write that it is equal to after being evaluated.

$(7+6) =$ _____ $(8/2) =$ _____ $(4\%2) =$ _____

$(9>=1) =$ _____ $((6+9)>7) =$ _____ $(not(8<7)) =$ _____

```
1  x = ------
2  y = 6
3  if x <= y:
4      z = x
5      print(x)
6  else:
7      z = y
8      print(y)
```

Consider the code above. State a value for x at line #1 that would result in the execution of code block at line #4 and #5.

```
x = --------
```

Tile(PINK).place(4,6) will place a PINK tile at column 4, row 6.

Write GUpPy code that places 2 tiles next to each other in a row. Place the first tile at column 6, row 6. Place the next tile either to the right or left of the first, depending on the roll. If the user rolls less than 4, place the tile to the left of the first. Otherwise, a roll of 4 or greater means place the tile to the right of the first. Tiles can be any color.

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Mastery Quiz

NOT YET or

For each expression below, write that it is equal to after being evaluated.

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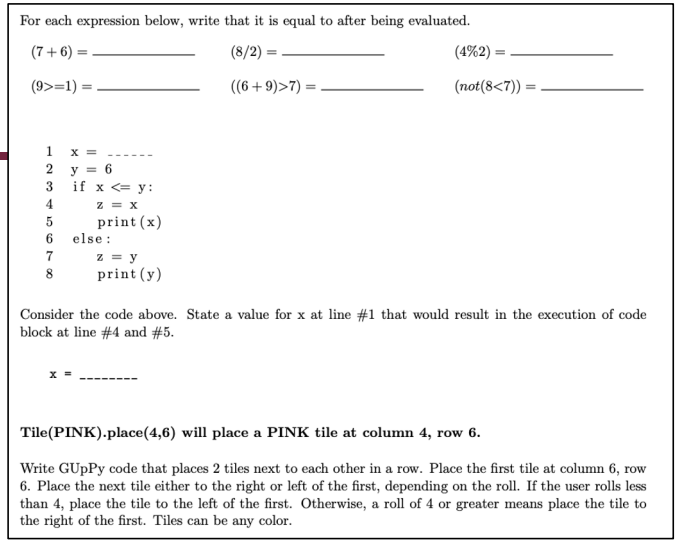
Mastery Quiz



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How many versions does it take?

A LOT OF VERSIONS!

120 Students across 4 sections.

- Students sitting next to each other should not have the same version.
- Sufficient variability across the 4 sections.
- Students have redo opportunities with same style of question but different content.

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exam Latex Package
https://www.overleaf.com/learn/latex/Typesetting_exams_in_LaTeX
https://math.mit.edu/~psh/exam/examdoc.pdf

Latex Tool

Easily Create Quizzes from a Question Bank

Automate Multiple Versions

https://github.com/AugsburgCS/quizwriter

Create Your Own Quizzes

As the USER of this quiz writer, you have 4 jobs ...

1. Create folder for quiz.
2. Create file for each question (with multiple versions).

   Each question has a preamble, postamble, and versions.
3. Create setup file that identifies questions and quiz versions.
4. Set main to refer to quiz folder and quiz setup file

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A Question

https://www.overleaf.com/project/65a01e838eb252278908d7ee

1) For each expression below, write what it is equal to after being evaluated.

(2 + 10) = _____ (19/3) = _____ (4%2) = _____

(6<=4) = _____ ((9 + 3)<17) = _____ (not(6>8)) = _____

```
\qpreamble{
For each expression below, write what it is equal to after being evaluated.
\vspace{8mm}
}

\qpostamble{}
```

latex code to establish shared text for all question versions

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A Question

- https://www.overleaf.com/project/65a01e838eb252278908d7ee

1) For each expression below, write what it is equal to after being evaluated.

(2 + 10) = _____ (19/3) = _____ (4%2) = _____

(6<=4) = _____ ((9 + 3)<17) = _____ (not(6>8)) = _____

```
\qversion{a} {

…
% random numbers to place in expressions
\pgfmathsetmacro{\A}{random(1,10)}
\pgfmathsetmacro{\B}{random(1,10)}

\pgfmathsetmacro{\opr}{random(1,2)}
\ifnum\opr=1 \def\opb{<=}
\else \def\opb{>=}
\fi
```

```
\begin{tabular}{ l l l l l l l }
  % arithmetic 1
  \(({\A}+{\B}) =\) \rule{28mm}{0.25mm} & &
  \(({\C}/{\D}) =\) \rule{28mm}{0.25mm} & &
  \(({\E} \%2) =\) \rule{28mm}{0.25mm} \\

  \(({\F}{\opb}\G) =\) \rule{28mm}{0.25mm} & &
  \((({\H}+{\I}){\ops}\J) =\) \rule{28mm}{0.25mm} & &
  \((not({\K}{\opn}\L)) =\) \rule{28mm}{0.25mm} \\
```

latex code to randomly generate operands and operators

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Another Question

Consider the code below.

```
1  x = roll() + roll()
2  y = roll() + roll()
3  if x < 10:
4        x = x + 2
5  else:
6        x = x - 2
7  if y == 12:
8       y = 10
```

In the code above, circle the lines of code that will be executed if the value x is initialized to 8 and the value y is initialized to 11.

Consider the code below.

```
1 x = _______
2 y = 6
3 if x < y:
4      z = x
5      print(x)
6 else:
7      z = y
8      print(y)
```

Write a value for x in the blank at line #1 that would result in the execution of the code block at line #4 and #5.

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\qpreamble{Consider the code below.}
 	
\qversion{b} {
 	
\vspace{3mm}
\code{
1 x = \rule{28mm}{0.25mm} \\
2 y = 6 \\
3 if x <= y: \\
4 \mytab z = x \\
5 \mytab print(x) \\
6 else: \\
7 \mytab z = y \\
8 \mytab print(y)
}
%\vspace{4mm}
\noindent{Write a value for x at line \#1 that would result in the execution of code block at line \#4 and \#5.}
}
	Consider the code below.
	
	`1 x = _____`
	`2 y = 6`
	`3 if x < y:`
	`4  z = x`
	`5  print(x)`
	`6 else:`
	`7  z = y`
	`8  print(y)`
	
	Write a value for x in the blank at line #1 that would result in the execution of the code block at line
	#4 and #5.

Putting It Together

```
\course[CSC165 Introduction to Programming]
\sem[Fall 2024]
\tdate{\today}
\qtitle{Quiz 03}

\allquestions
{3}                                  ← number of questions on the quiz
{expressions,trace,write}            ← files that contain the questions (appear in that order)
{{a},{a,b,c,d,e,f,g,h},{a,b,c,d}}    ←  versions per question

\quizversions{
   {a,a,a},
   {a,b,c},
   {a,c,b},
   {a,d,d},
```

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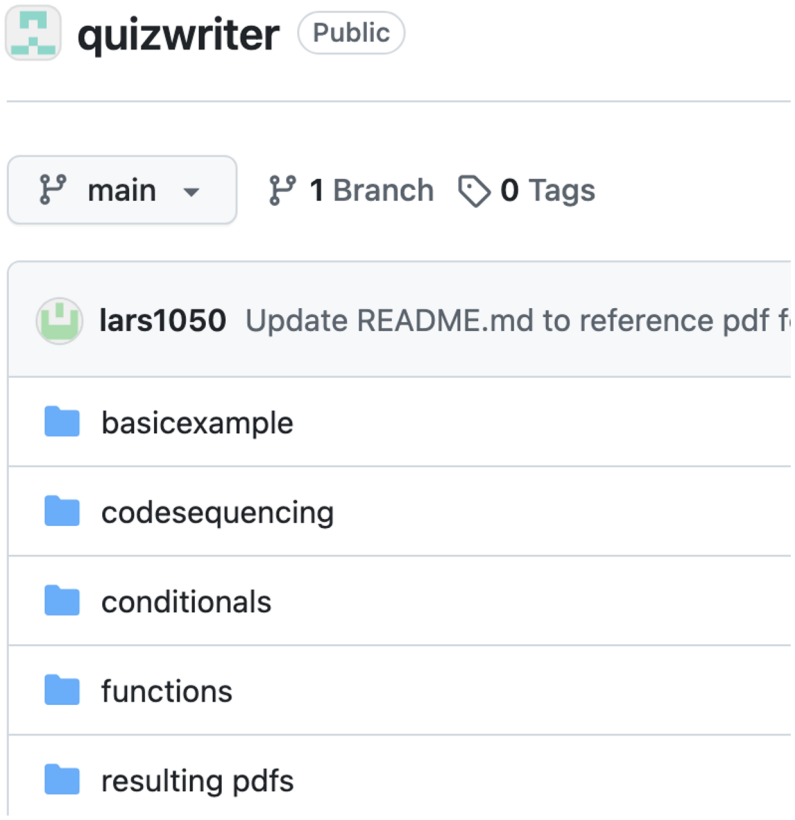
Examples Available



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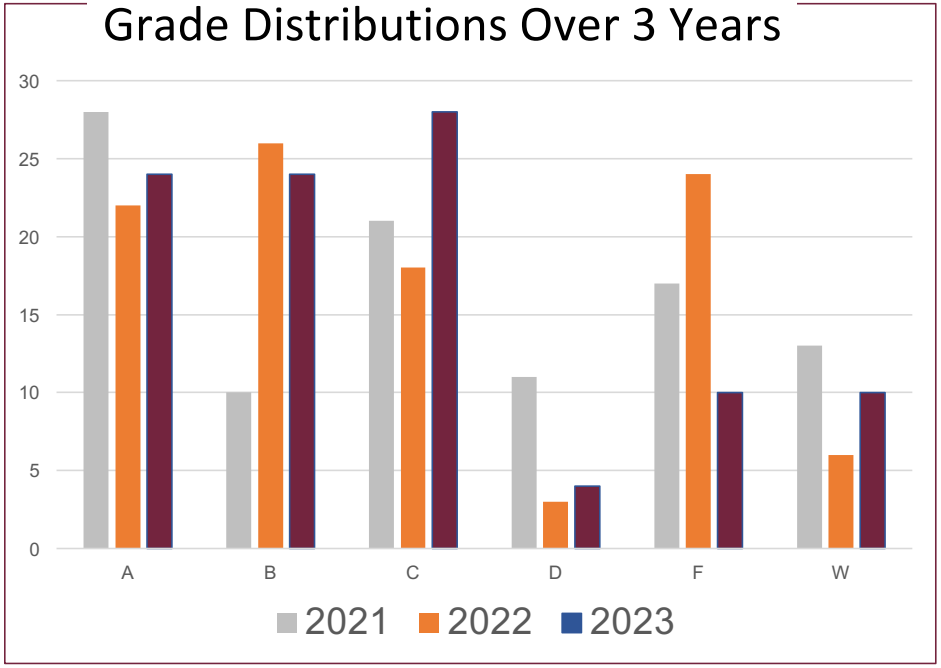
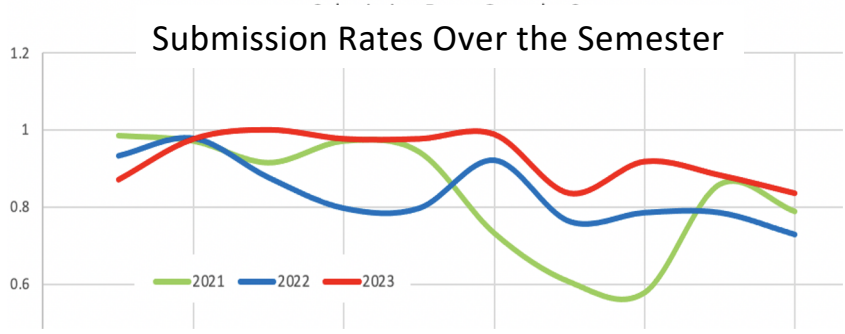
SUCCESS RATES …



	DFW
2021	38%
2022	34%
2023	**24%**



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