ENHANCING LEARNING THOUGH TESTING

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OVERVIEW

- Why assessment for learning?

- What is mTuner ?

- How we used mTuner in Biol 239

- Impact

- Next steps

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ASSESSMENT FOR LEARNING

- Testing effect/test enhanced learning : retrieval practice using active recall results in to long term retention (review Roediger and Butler, 2011)

- Attempting retrieval (whether successful or not) followed by feedback enhances learning (Kornell et al., 2015)

- Immediate feedback enhances learning (Butler et al., 2008) and prevents incorrect answer from being "cemented" (Roediger and Marsh, 2007)

- Students most receptive to learning in assessment situation (McDaniel et al., 2007)

- Review of literature of learning strategies suggest practice testing and distributed practice (spacing) are most effective (Dunlofsky, 2008)

- How students are assessed dictates what they learn (Biggs, 1999; Mazur, 2014)

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- Online quizzing tool developed by Steve Joordens, UofT cognitive psychology professor.

  » First stage retrieval practice
  » Then question options
  » If incorrect hint (cue) followed by second attempt
  » Feedback given to all

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mTUNER

Some of the cells in a single organism have 22 chromosomes and some have 21 chromosomes and some have 23 chromosomes. How could this situation arise?

Type your answer here...

Submit

Some of the cells in a single organism have 22 chromosomes and some have 21 chromosomes and some have 23 chromosomes. How could this situation arise?

nondisjunction at meiosis I

nondisjunction during mitosis in the first cell division in the embryo

nondisjunction at meiosis II

nondisjunction events during mitosis in some somatic cells

If the signal sequence of a protein destined for the mitochondria were deleted where would the protein end up?

in the nucleus

randomly localized to any organelle

secreted by the cell

in the cytosol

Explanation

The normal diploid 2n number must be 22, and the haploid n=11. Chromosome numbers of 21 and 23 are aneuploids. This pattern of aneuploidy in a single organism indicates it could not have happened in meiosis. Non-disjunction events in meiosis would have produced gametes of 10 OR 12, resulting in aneuploid offspring of numbers 21 OR 23, not both in the same individual. Nondisjunction events during meiosis always create organisms that are entirely aneuploidy. This points to a problem in mitosis during early embryo development. The majority of the cells will remain at 22, but nondisjunction events in one (or a few) of the cells during mitosis can cause the resulting daughter cells to have an abnormal chromosome number (of 23 and 21). These chromosome numbers will be faithfully maintained by normal mitosis throughout the cell generations, causing the whole organism to be affected.

Close

Some of the cells in a single organism have 22 chromosomes and some have 21 chromosomes and some have 23 chromosomes. How could this situation arise?
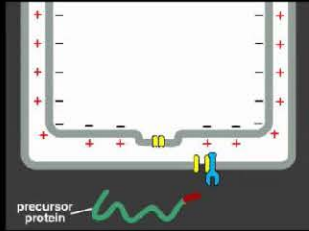
nondisjunction at meiosis I

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nondisjunction at meiosis II

nondisjunction events during mitosis in some somatic cells

Hint

precursor protein

Close

LEARN – HINTS AND FEEDBACK

Question 4 (1 point)

Which of the following represents a hydroxyl group?

○ R-SH

○ R-NH₂

○ R-OH

○ R-CH₃

∨ Hide hint for Question 4

O represents oxygen
C represents carbon
N represents nitrogen
S represents sulfur
R represents the carbon backbone

Question 4

Which of the following represents a hydroxyl group?

○ R-SH

○ R-CH₃

✓ ● R-OH

○ R-NH₂

∨ Hide Feedback

The hydroxyl group is composed of one hydrogen atom bonded to one oxygen atom. Its chemical formula is written as **-OH**.

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PROJECT DESCRIPTION

- large (~1000 students) introductory Biology course – Biology 239

- used mTuner prior to midterm for self-assessment

- activity was introduced in class and on LEARN

- "mock" mTuner quiz made available to test student access and give them a sense of how mTuner worked

- class divided into two randomly generated student groups of ~ 500

- questions set up in LEARN and mTuner designed to be as equivalent as possible in format

- surveyed students after midterm – incentive provided

A CLASS DIVIDED

Course 1: ~400 students

19 questions in mTuner to practice concepts taught in the first ¼ of the course (Mendelian genetics, probability and mitosis)

19 questions in LEARN to practice concepts taught in the second ¼ of the course (meiosis, aneuplody, polyploidy/monoploidy, linkage/mapping and DNA)
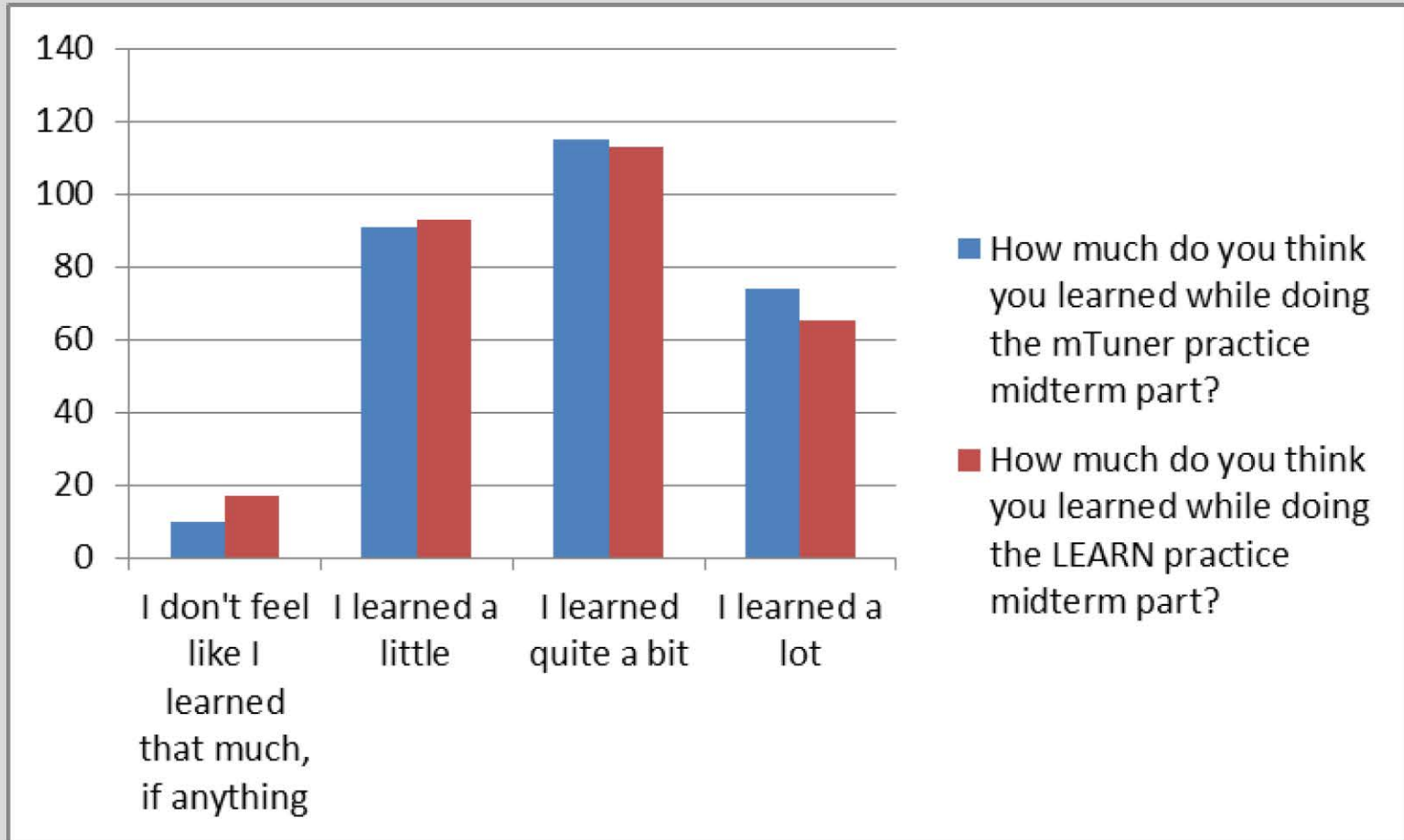
Course 2: ~400 students

19 questions in mTuner to practice concepts taught in the second ¼ of the course (meiosis, aneuplody, polyploidy/monoploidy, linkage/mapping and DNA)
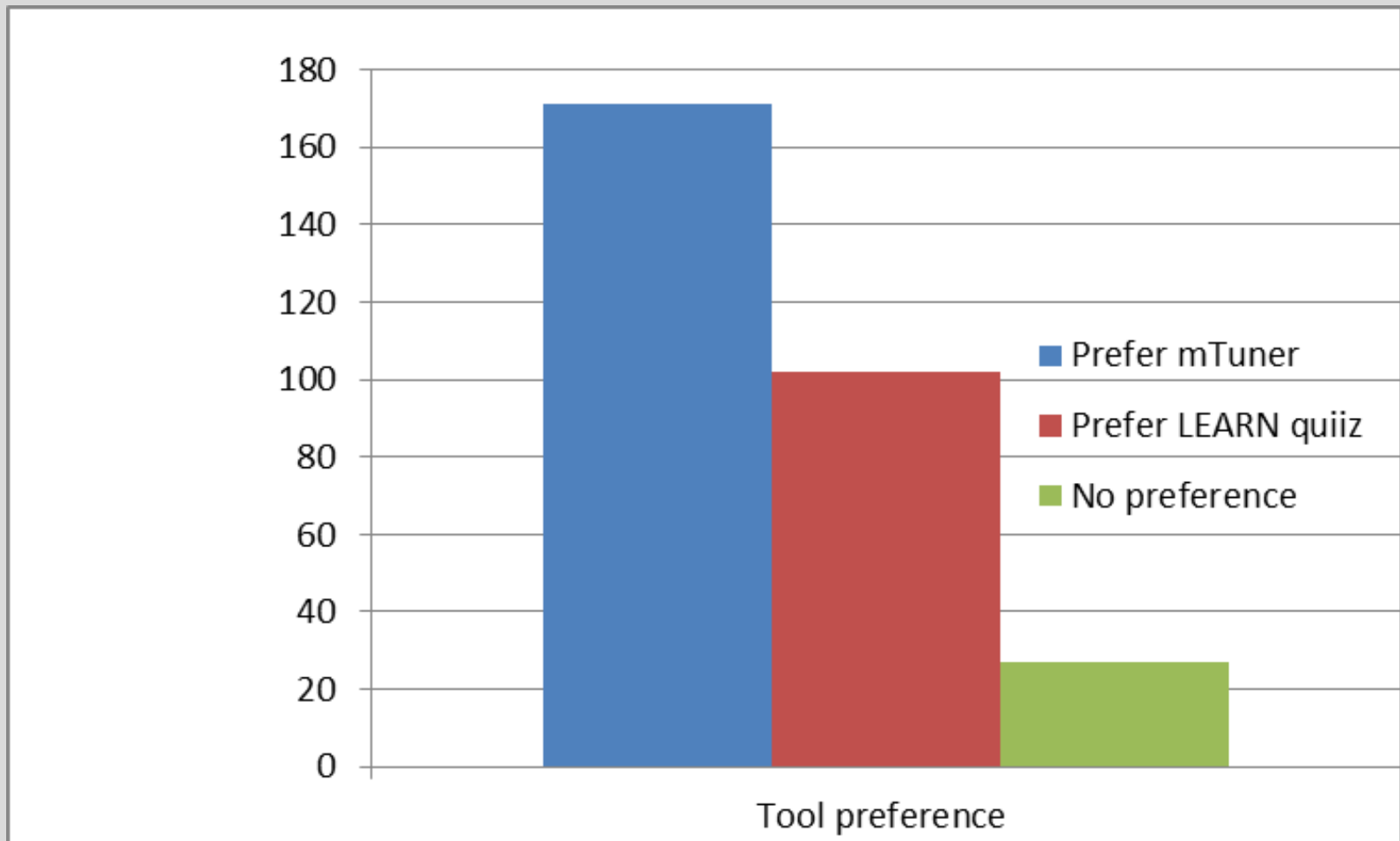
19 questions in LEARN to practice concepts taught in the first ¼ of the course (Mendelian genetics, probability and mitosis)

SURVEY QUESTIONS

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SURVEY QUESTIONS

What aspect(s) of the mTuner practice midterm part were helpful to you ?

- Analyzing the question carefully before answering it (54%)
- Recalling the information before seeing the multiple choice options (55%)
- Recalling and entering the information before seeing the multiple choice options (40%)
- Seeing a hint before the second attempt of the question (58%)
- Having two attempts for each question (45%)
- Getting the explanation at the end of each question (84%)
- Having the chance to do multiple attempts of the test (58%)
- None of the above (4%)

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SURVEY QUESTIONS

What aspect(s) of the LEARN practice midterm part were helpful to you ?

- Seeing a hint before attempting the question (39%)
- Getting the explanation feedback at the end of the test (66%)
- Having the chance to do multiple attempts of the test (57%)
- Having access to look at my attempt(s) of the test (65%)
- None of the above (7%)

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GRADES
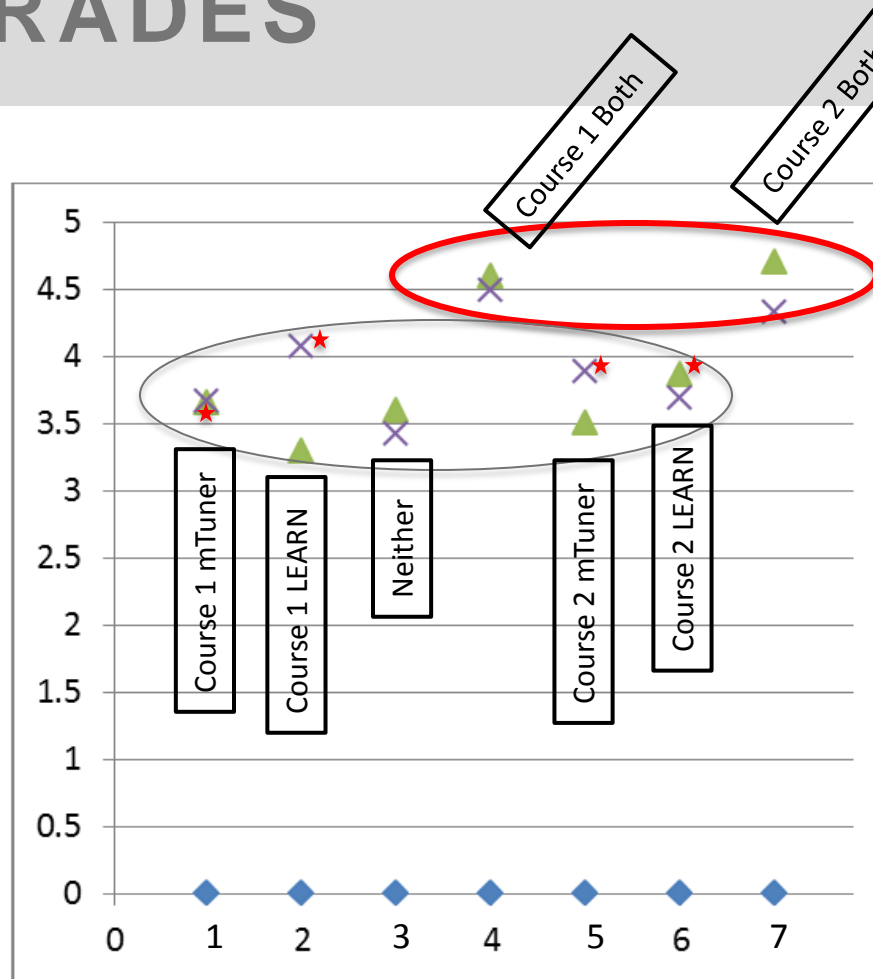
Group 1 - Students from Course 1 who only took the mTuner quiz

Group 2 - Students from Course 1 who only took the LEARN quiz

Group 3 - Students from Course 1 and 2 who did neither quiz

Group 4 - Students from Course 1 who did both quiz types

Group 5 - Students from Course 2 who only took the mTuner quiz

Group 6 - Students from Course 2 who only took the LEARN quiz

Group 7 - Students from Course 2 who did both quiz types

Legend:
◆ Group
▲ Mean score - 1st 7 questions
✕ Mean score - 2nd 7 questions
★ questions practiced

Chart labels: Course 1 Both, Course 2 Both, Course 1 mTuner, Course 1 LEARN, Neither, Course 2 mTuner, Course 2 LEARN

STUDENT PERCEPTIONS

- Students preferred mTuner over LEARN

- Feedback of utmost importance to students, both immediate (did I get it – why was it wrong or right?) and aggregate (looking back over attempts)

- There are no clear patterns of increased success on related questions with the usage of one tool or the other

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NEXT STEPS

Where should we go with this?

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QUESTION FORMATS

Similarities

- questions were pulled from the pool of questions in random order

- questions were presented to the students one at a time

- unlimited time to do both the quiz types

- students could retake the quizzes as many times as they wanted to

- quizzes were made available to each group 3 days before the midterm

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QUESTION FORMATS

Differences

- presentation of hints different as discussed

- why answers were correct was available after each question as in mTuner

- students could access their results and feedback for every attempt of their quizzes in LEARN but only after the test was over

- no time limit on any part of the questioning in LEARN

- by mistake the time for reading and entering the answer for the first part of the question was set to 120 sec but the rest of the parts only 30 sec (Consternation!)