

# Rethinking Biology Exams: Creating Inclusive Assessment Through Question Choice and Environment

## Abstract

This case study demonstrates how concerns about AI-generated content led to a fundamental rethinking of examination design in a biology module, resulting in an innovative approach that better supports neurodivergent students and different learning styles. By implementing a range of question types within a controlled on-campus environment, the approach aims to create more equitable assessment while maintaining academic rigor. The design process shows how addressing technological challenges can lead to more inclusive assessment practices.

## Keywords

Exam design, Neurodiversity, Question choice, Digital equity, Inclusive assessment, Online examination

## Overview

Dr. Mirko Pegoraro has developed an innovative examination approach for a Level 5 developmental biology module that transforms traditional memory-based exam essay questions into a choice of different question types that test understanding and application. The approach combines the benefits of online assessment with a controlled campus environment to ensure equitable access while supporting different ways of presenting information.

## The Challenge

The original motivation came from concerns about AI-generated content in online examinations, but deeper investigation revealed several key challenges:

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- Inequitable student access to technology and suitable study environments at home
- Different learning styles and neurodivergent needs not supported by traditional essay formats
- Over-reliance on memorization rather than understanding in existing exam design
- Technical support needs during online exams
- Need to maintain academic standards while increasing accessibility

Despite widespread assumptions about online exams creating equality, Mirko argues they actually amplify inequities: some students work from phones, others have poor internet, and many lack suitable quiet study spaces - "We do it online so everybody is the same... but it's not true really because of all these reasons." He makes a case that bringing students back to campus for electronic exams provides the equitable environment they need - with consistent technology, technical support, appropriate facilities, and the same quiet conditions for all students.

## The Innovation

The approach combines several key elements:

### Question Design:

- Eight prototype questions testing different skills and abilities
- Students choose 2 questions from 5 options
- Question types include:
  - Text comprehension with embedded scientific errors to identify
  - Scenario-based application questions
  - Use of images such as a graph which student interpret and analyse
  - Process explanation questions

### Environment and Access:

- Campus computer rooms provide:
  - Consistent technology access
  - Quiet study environment
  - Technical support if needed
  - Familiar computer systems
- Access to Canvas materials during exam
- Staff present to support technical issues

**Question design:** Rather than testing simple recall, the assessment provides multiple ways for students to demonstrate their understanding through different types of problem-solving and different ways of displaying information:

The focus is firmly on application of knowledge rather than recall: "You don't need to remember every gene... Just remember the concept. You can look at your notes. I don't care if you don't remember the name of the gene, as long as you remember what's going on in that process," explains Mirko.

Key to this approach is that many questions don't have single "correct" answers. Instead, they present puzzles that require students to apply their understanding in logical ways: "It doesn't really matter that the answer is precise... what is testing is the ability of the students to come up with a logical possible answer." For example, when presented with a scenario about a new frog species with unusual characteristics, students must construct plausible developmental explanations drawing on their understanding of biological principles rather than reciting facts.

**Question.** During an expedition in Brazil at the famous Iguaçu falls (Fig. 2) you discover a new species of frogs. The bizarre characteristic of this species is that they present extremely short zeugopod and only 2 digits. How can you explain these amazing features from a developmental biology perspective? Words limit: 300 +- 30 words.



Figure 2. Areal picture of the Iguaçu falls ([https://en.wikipedia.org/wiki/Iguazu\\_Falls](https://en.wikipedia.org/wiki/Iguazu_Falls))

Example Question

## Implementation Plan

The initial implementation involves:

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- 70 Biology and Zoology students
- Hybrid approach comparing traditional and new question types
- On-campus computer rooms
- Staff present for support
- Access to course materials via Canvas

Mirko acknowledges this is "a work in progress... I'm thinking about some changes for next year already, even before running the examination. Just talking with students about it and talking with colleagues about it."

## Challenges and Considerations

Several key challenges are being addressed:

1. Supporting Neurodiversity:
  - a. Recognition of wide spectrum of needs
  - b. Focus on choice rather than single solution
  - c. Flexible approach to different abilities
2. Physical Space Requirements:
  - a. Need for appropriate computer facilities
  - b. Accommodation for students requiring separate rooms
  - c. Staff supervision and support

"It is our duty as an organization to provide these to the students instead of send them away in the wind and forget them," argues Mirko regarding on-campus provision.

## Impact and Future Development

While the approach is yet to be implemented, expected benefits include:

- More equitable assessment experience
- Better support for different learning styles
- Reduced anxiety around memorization
- Improved testing of understanding
- More authentic demonstration of knowledge

The design will continue to evolve based on student feedback and implementation experience, with Mirko noting "it will be a work in progress. It will not be like 'OK, now I'm done.'"

# Transferability

While developed for developmental biology, the core principles could be adapted for other subjects:

- Multiple question types supporting different abilities
- Focus on understanding over memorization
- Controlled but supportive environment
- Access to course materials
- Choice-based approach to questions

The success of this approach could provide a model for other programs seeking to develop more inclusive examination practices while maintaining academic standards.