Enhancing an Asynchronous Medical School Physiology Lecture with Backward Design and H5P Plug-In Technology

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Introduction

- Preclinical medical education is shifting toward active, in-person learning[1,2]
- However, many U.S. medical schools still follow a traditional, lecture-based basic science curriculum[3]
- With an increasingly hybrid (virtual + in-person) curriculum post-pandemic, and decreased classroom attendance from Generation Z (Gen Z) learners, medical educators must move beyond passive prerecorded lectures[4,5]
- **Backward design**, outlined by Wiggins & McTighe, is an instructional model that begins with identifying key learning outcomes (LOs) that students must be able to perform, then working backward to align assessments followed by instructional content[6]
- **H5P** is a virtual teaching tool that educators can use to create interactive online activities[7]
  - Several activities include immediate built-in feedback for students
- Guided by backward design principles, we re-designed an asynchronous physiology lecture and incorporated two H5P activities to increase student engagement and learning

H5P[8]

Hypothesis

Students who received the backward-designed lecture with embedded H5P activities will demonstrate improved performance on assessments and greater engagement

Aims and Objectives

Aim

Determine whether redesigning a traditional asynchronous first-year medical school lecture using backward design and H5P interactive activities improves engagement and understanding

Objectives

- Redesign the lecture using backward design principles
- Create and integrate H5P activities into lecture module
- Provide structured opportunities for formative assessment and immediate feedback

Methods

- The lecture "Hormonal Control of Blood Glucose" was delivered asynchronously to 125 first-year medical students in Fall 2022 and Fall 2023 in their Biomedical Foundations of Clinical Practice (BFCP 2) course at OUWB
- In 2022, the lecture consisted of three self-paced prerecorded videos
- In 2023, the lecture was redesigned using backward design principles with revised learning objectives
- We created two H5P interactive activities, which were embedded into the lesson module
  - drag-and-drop activity
  - clinical case branching scenario
- Student performance was compared between cohorts using four assessment questions.
  - Statistical analysis was conducted using Chi-square testing ($p < 0.05$).
- Student perceptions were evaluated through an optional 5-point Likert scale questionnaire

Results

Table 1. Learning objectives in 2022

2022 Learning Objectives (Traditional)
1.Explain the significance of blood glucose regulation
2.Identify the major hormones that maintain glucose homeostasis
3.Describe the nature, source, and target organs of these hormones
4.Distinguish the action of hormones among various target organs
5.Integrate physiology of blood glucose homeostasis with prior knowledge of biochemistry pathways
6.Develop a differential diagnosis based on foundational concepts learned in this session

Table 2. Learning objectives in 2023

2023 Learning Objectives (Backward Design)
1.Explain the significance of blood glucose regulation
2.Identify the major hormones that maintain glucose homeostasis **and the cell types that secrete them**
3.Describe the nature and target organs of these major hormones
4.Distinguish the hormone action and **GLUT transporters** among target organs
5.Integrate physiology of blood glucose homeostasis with prior knowledge of biochemistry pathways
6.Develop a differential diagnosis based on foundational concepts learned in this session

Results (cont'd)

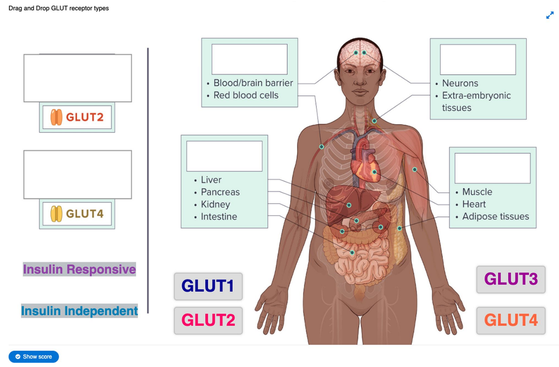

Figure 1. Drag-and-drop activity used to assess students' recall of glucose transporter (GLUT) distribution

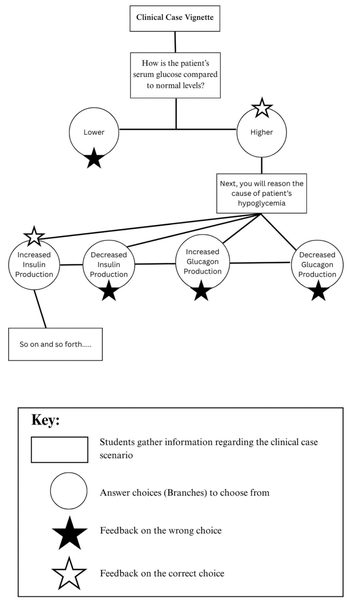

Figure 2. Graphical outline of clinical case branching scenario created using H5P technology

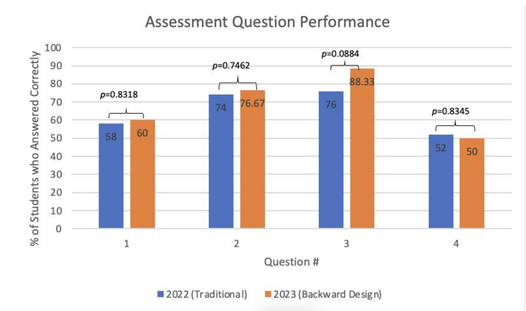

Figure 3. Student performance on the four assessment questions. For 2022, $n = 50$. For 2023, $n = 60$

Results (cont'd)

- Most notable improvement in performance occurred for glucose transporter (GLUT) question (question #3), a topic reinforced by the H5P drag-and-drop activity
  - Percent of students who answered correctly increased from 76% in 2022 to 88.33% in 2023 (p=0.088)
- Increase in average score of students, from 65% in 2022 to 70% in 2023 (*NS*)
- Questionnaire response rates were low (2022: n=5; 2023: n=25), with no significant differences observed

Conclusions

- Students who received the backward-designed lecture embedded with virtual activities demonstrated overall improved performance, though differences were not statistically significant
- Although survey response rates were low and data was not significant, students had overall positive responses to the backward-designed lecture and interactive activities
- These findings suggest that embedding H5P interactive activities into learning sessions may enhance engagement and learning in asynchronous medical education
- Educators can use our project as a guide to convert passive pre-recorded lectures into interactive modules

References

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