

BIOPLAY

An Interactive Platform to Learn Newton's Laws through Biomechanics

BU

INTRODUCTION

UNDERSTANDING NEWTON'S LAWS IS FOUNDATIONAL FOR BIOMECHANICS, YET STUDENTS OFTEN STRUGGLE WITH ABSTRACT CONCEPTS. TO BRIDGE THIS GAP, WE DEVELOPED AN INTERACTIVE WEBSITE COMBINING 3D ANIMATIONS AND QUIZZES TO VISUALIZE:

- LAW 1 (INERTIA): HOW JOINTS MAINTAIN STABILITY.
- LAW 2 ($F=MA$): FORCE IMPACT ON MUSCLE MOVEMENT.
- LAW 3 (ACTION-REACTION): GROUND REACTION FORCES IN GAIT.

"INTERACTIVE TOOLS ENHANCE RETENTION BY 40% COMPARED TO TEXTBOOKS (MILLER ET AL., 2022).

METHODOLOGY

SOFTWARE & DEVELOPMENT:

- TOOLS USED:

- THREE.JS FOR 3D ANIMATIONS (OPEN-SOURCE WEBGL LIBRARY).
- JAVASCRIPT/HTML/CSS FOR QUIZ LOGIC AND UI.
- BLENDER TO CREATE CUSTOM BIOMECHANICS ANIMATIONS.

- USER TESTING:

- 5 PEERS COMPLETED THE QUIZ AND RATED USABILITY.

- DESIGN FEATURES:

1. 3D VIDEO MODULES: SHORT CLIPS EXPLAINING EACH LAW WITH BIOMECHANICAL EXAMPLES.
2. INTERACTIVE QUIZ:
 - 10 MCQS WITH INSTANT FEEDBACK.
 - FINAL E DISPLAYED WITH EXPLANATIONS FOR MISSED QUESTIONS.

RESULTS

- KEY OUTCOME:

- USER FEEDBACK: 4.6/5 AVERAGE RATING FOR "EASE OF UNDERSTANDING."
- QUIZ PERFORMANCE: 85% AVERAGE SCORE AMONG TESTERS (VS. 62% PRE-TOOL BASELINE.)

DISCUSSION

OUR INTERACTIVE WEBSITE EFFECTIVELY SIMPLIFIED NEWTON’S LAWS FOR BIOMECHANICS STUDENTS THROUGH 3D ANIMATIONS AND INSTANT QUIZ FEEDBACK. USERS REPORTED BETTER UNDERSTANDING OF ABSTRACT CONCEPTS LIKE ACTION-REACTION FORCES IN JOINTS, WITH TEST SCORES IMPROVING BY 23% POST-TOOL USE. THE THREE.JS ANIMATIONS PROVED CRITICAL FOR VISUALIZING FORCES (E.G., SHOWING HOW $F=MA$ APPLIES TO MUSCLE MOVEMENT), WHILE THE GRADED QUIZ REINFORCED LEARNING—85% OF TESTERS SAID THEY’D USE THIS TOOL FOR EXAM PREP.

REFERENCES

1. MILLER, T. (2022). "EFFICACY OF INTERACTIVE BIOMECHANICS TOOLS." J. BIOMECH. EDUC. 15(2), 112-120.

2. THREE.JS DOCUMENTATION. (2024). "3D WEB ANIMATION LIBRARY." [HTTPS://THREEJS.ORG/](https://threejs.org/)

SMITH, L. (2021). "NEWTON’S LAWS IN HUMAN MOTION." BIOMECHANICS TODAY, 8(3), 45-50.