

Design and Planning of the Implementation of an Educational Escape Room for Teaching Fundamental Electrical Circuit Analysis

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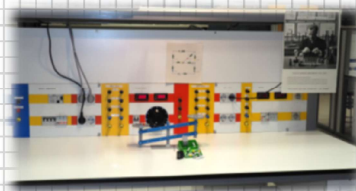
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Introduction



Why do many students struggle with electrical circuit analysis?

Because concepts such as voltage, current distribution and Kirchhoff's laws are abstract and mathematically demanding.



Objective: Transform abstract electrical concepts into an immersive hand-on learning experience.

Can traditional lectures alone ensure deep conceptual understanding?

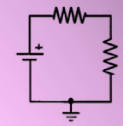
Not always. Many students rely on procedural problem solving instead of conceptual reasoning.

Could educational escape rooms improve engagement and learning?

Educational escape rooms combine active learning, collaboration and gamification to reinforce engineering concepts.



ELECTRICAL ENGINEERING EDUCATION



ACTIVE LEARNING + GAMIFICATION



CONCEPTUAL UNDERSTANDING OF CIRCUITS

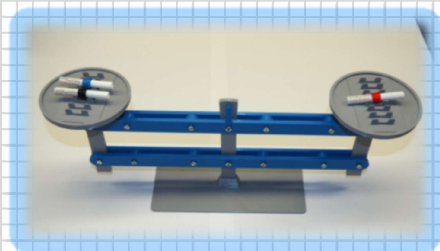


Execution of the educational escape room

1º.- EDUCATIONAL RATIONALE



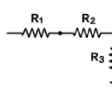
- ✓ First-year Electrical Engineering students
- ✓ Large groups (~ 160 students)
- ✓ Teams of 5 students
- ✓ 30-minute activity
- ✓ Focus on conceptual understanding
- ✓ Collaborative learning
- ✓ Immediate feedback



3D-printed balance used to represent current conservation.

2º.- ESCAPE ROOM STRUCTURE (Sequence of challenges).

1. Series & Parallel Resistances



Compute equivalent resistance

2. Real Circuit Assembly



Measure equivalent values experimentally

3. Inductors



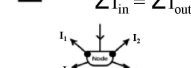
Analyze inductors association

4. Capacitors



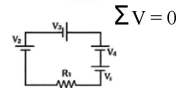
Analyze capacitors association

5. Kirchhoff's Current Law



Physical balance-scale analogy

6. Kirchhoff's Voltage Law



Voltage measurements in real circuits

3º.- RESEARCH METHODOLOGY

A. Experimental design

CONTROL GROUP
(Traditional Teaching)



~ 80 students

ESCAPE ROOM GROUP
(Educational escape room)



~ 80 students

B. Assessment and data collection

Instrument	Purpose
Pre/Post tests	Mesure learning gains
Likert-scale surveys	Assess motivation, engagement and satisfaction
ANCOVA	Validate significance of differences between groups
Qualitative feedback	Analyze student's perceptions and experience

Expected contributions

Improve conceptual understanding



Deeper comprehension of fundamental circuit analysis concepts.

Increase engagement and motivation



Active learning and gamification boost student interest.

Development of teamwork skills



Collaboration is essential to solve challenges successfully.

Transferable instructional framework



A scalable model that communicate to control, engineering subjects.

Conclusions



The proposed educational escape room bridges abstract electrical theory and experiential learning through gamification and collaborative problem-solving.

Future work will focus on implementation and empirical validation to evaluate its impact on learning outcomes.

