ICBL 2025

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THE HONG KONG POLYTECHNIC UNIVERSITY 香港理工大學

康復治療科學系 Department of Rehabilitation Sciences

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EDC Educational Development Centre 教學發展中心

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Enhance Learner Engagement Through Experiential Learning in a Gamified Simulation: A Longitudinal Study

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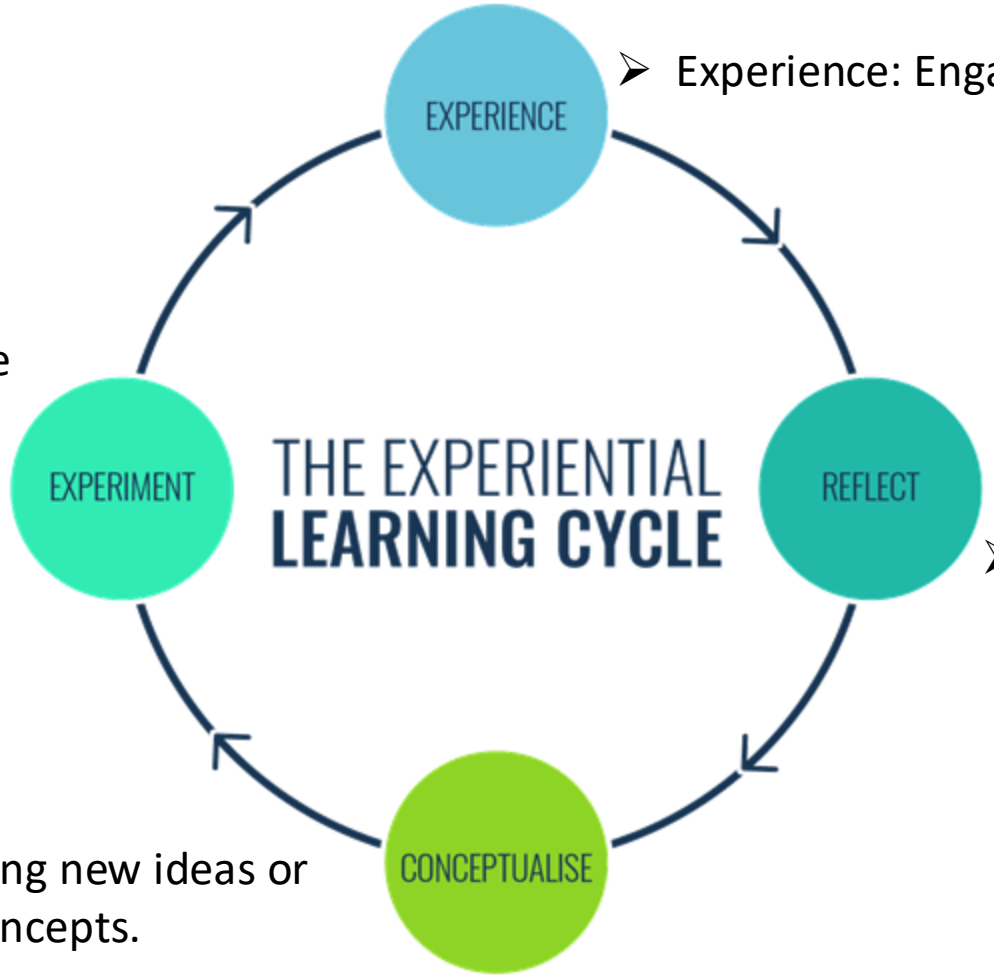
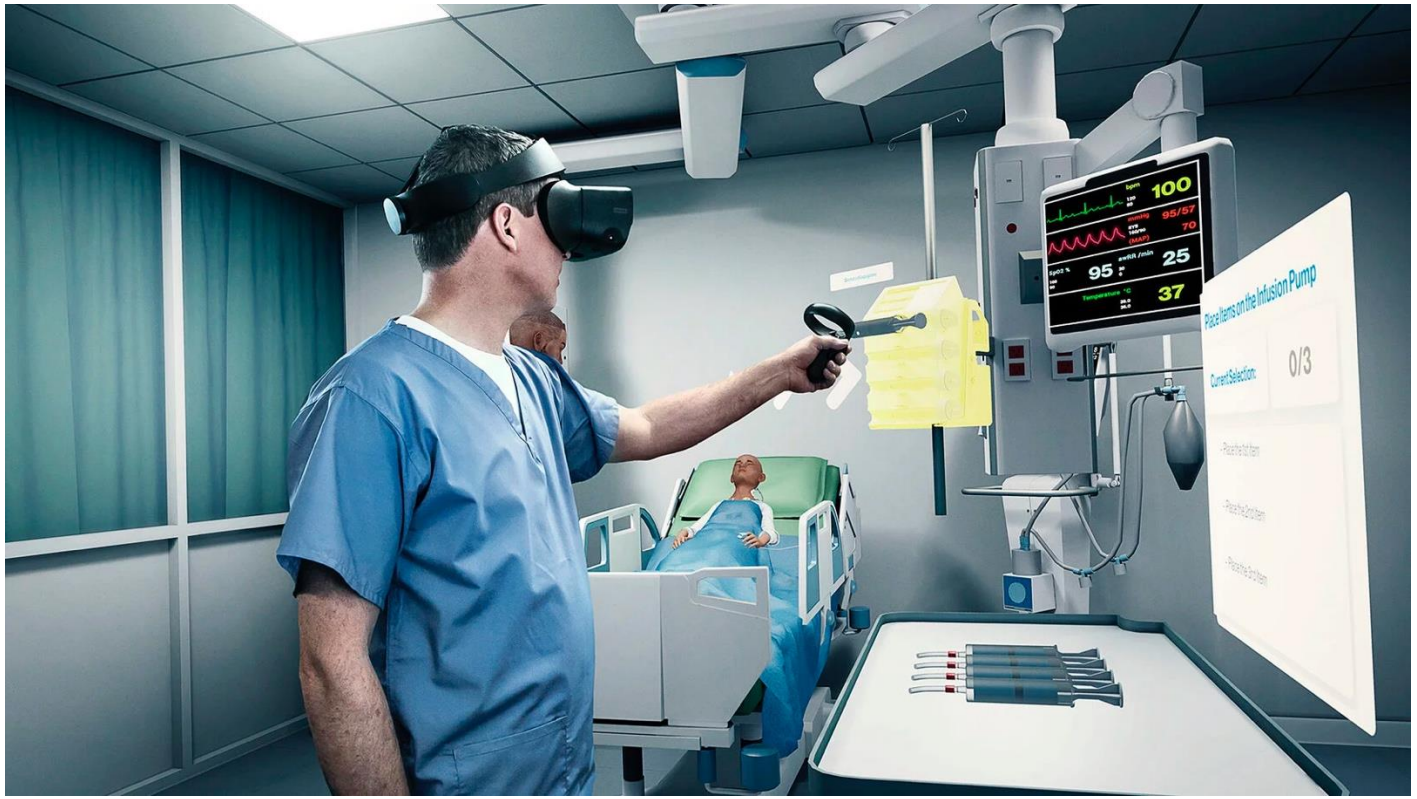


- Experience: Engaging in a hands-on activity.
- Reflect: Observing and thinking back on the experience.
- Conceptualise: Forming new ideas or modifying existing concepts.
- Experiment: Applying these new ideas to future situations.

Kolb, D. A. (1984). Experiential Learning: Experience as the Source of Learning and Development. Englewood Cliffs, NJ: Prentice Hall.

I. Introduction: Gamified Simulation



- **The Goal in Education**:
  - ✓ **More compelling**
  - ✓ **More interactive.**
- **The Ideal Platform- Virtual Reality**
  - ✓ Interactive
  - ✓ Controllable

I. Introduction: Research Gap

- **Applying Learning Theory:** A lack of clear methods for effectively applying learning theories directly into game design.
- **Systematic Integration:** Limited exploration on how to systematically build experiential learning principles into a game's core mechanics.
- **Aligning Gameplay with Goals:** A need for more empirical evidence to ensure game mechanics truly align with and support educational objectives.

II. Research Questions

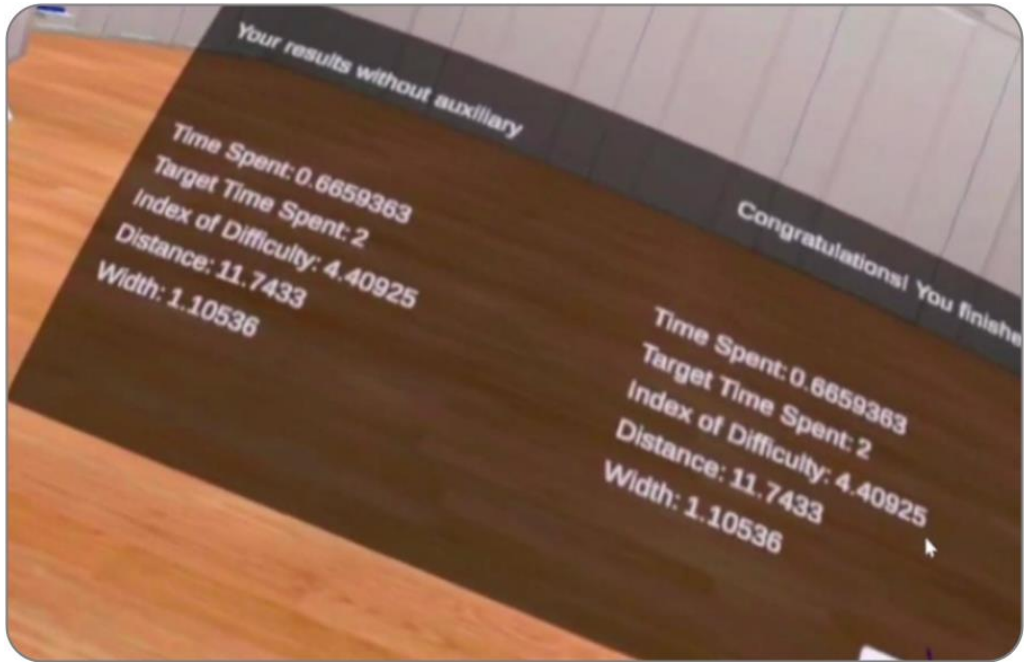
- **RQ1:** Can experiential learning in gamified simulations better enhance learners' behavioural, affective, and cognitive engagement compared to traditional learning methods?
- **RQ2:** Does experiential learning in gamified simulations lead to better knowledge gain and retention compared to traditional learning methods?
- **RQ3:** What factors may influence the observed knowledge gain and retention?

III. Methodology

Gamified Simulation of Fitts' Law

$$MT = a + b \cdot ID = a + b \cdot log_2(\frac{2D}{W})$$

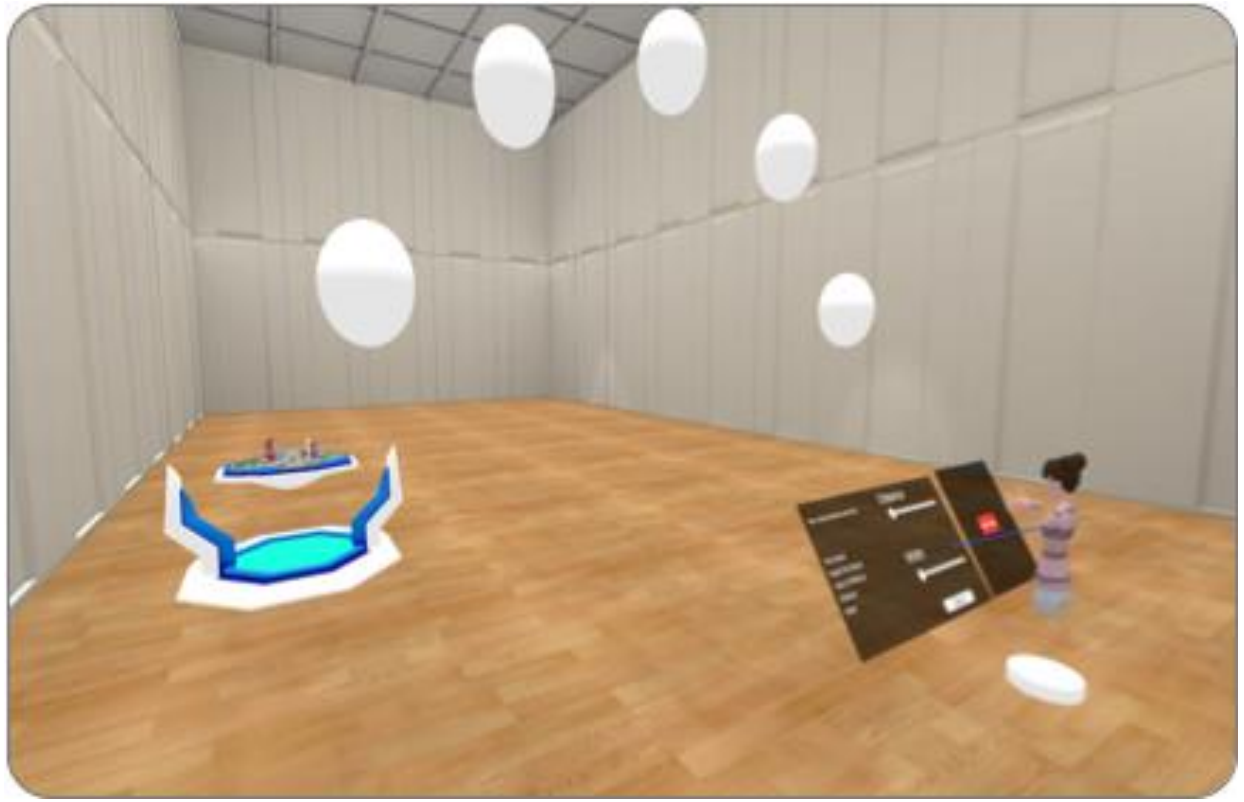
- **MT** is the average time to complete the movement.
- **a** and **b** are constants for input devices
- **ID** is the index of difficulty.
- **D** = distance moved
- **W** = target width or size



Conceptual/ Abstract → **Gamified Dashboard**

III. Methodology

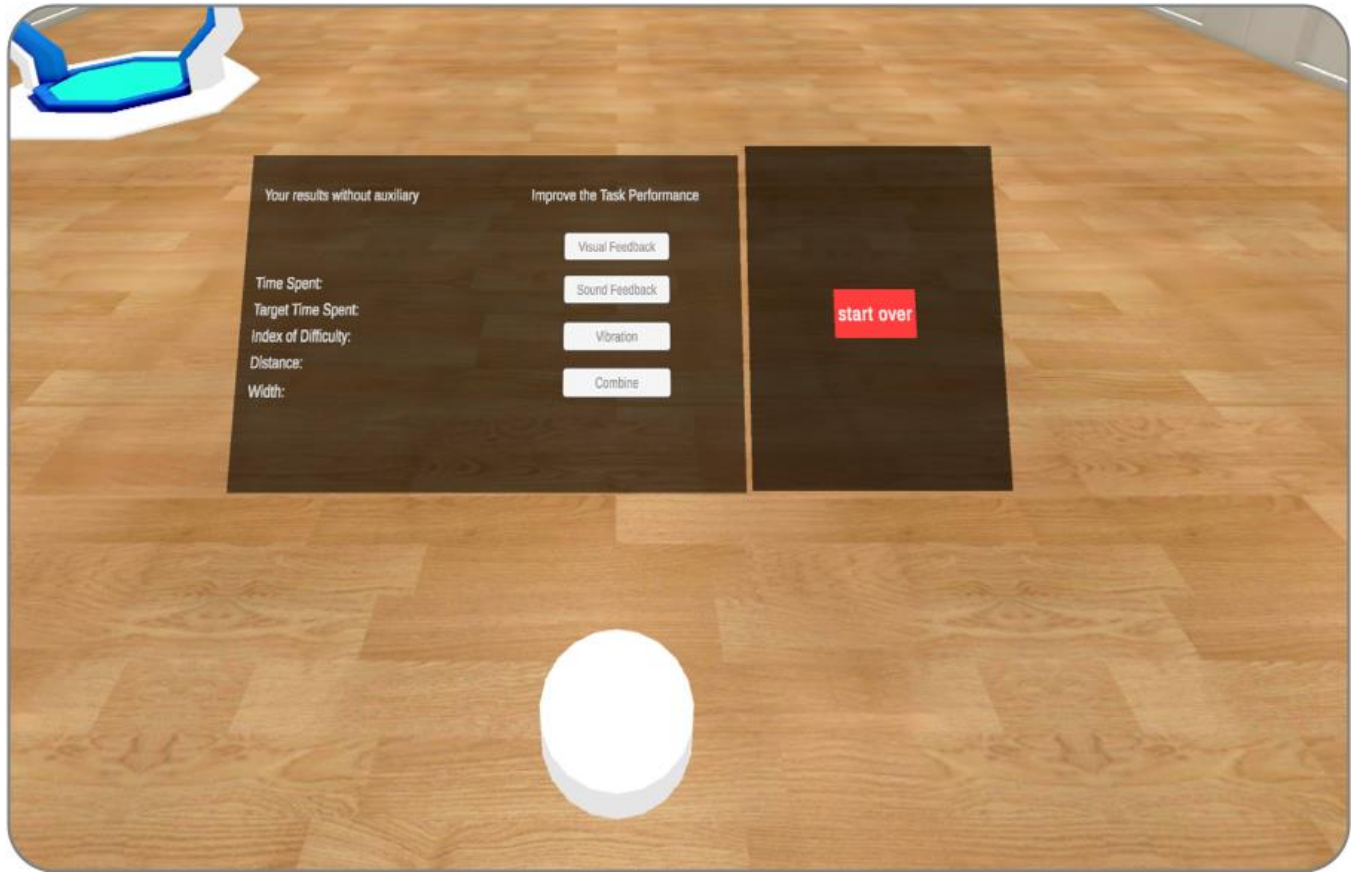
Gamified Simulation of Fitts' Law: Game One Aim Ball



- **Change the width of the balls**
- **Change the distance to the balls**

III. Methodology

Gamified Simulation of Fitts' Law: Game Two UX Improvement Method



- **Add the visual feedback**
- **Add the sound feedback**
- **Mix visual & sound feedback**

III. Methodology

Experiment Design: Between Subject Design

VS

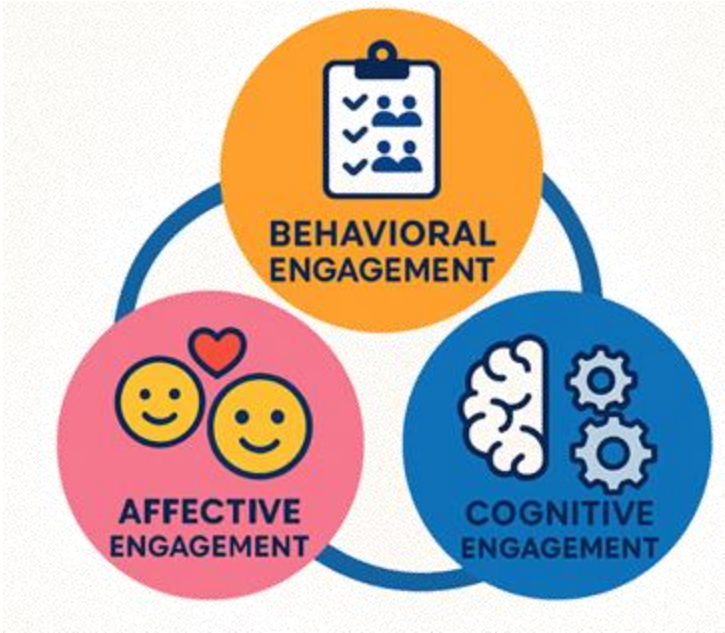
Immersive VR

Wikipedia Document

III. Methodology

Measurement

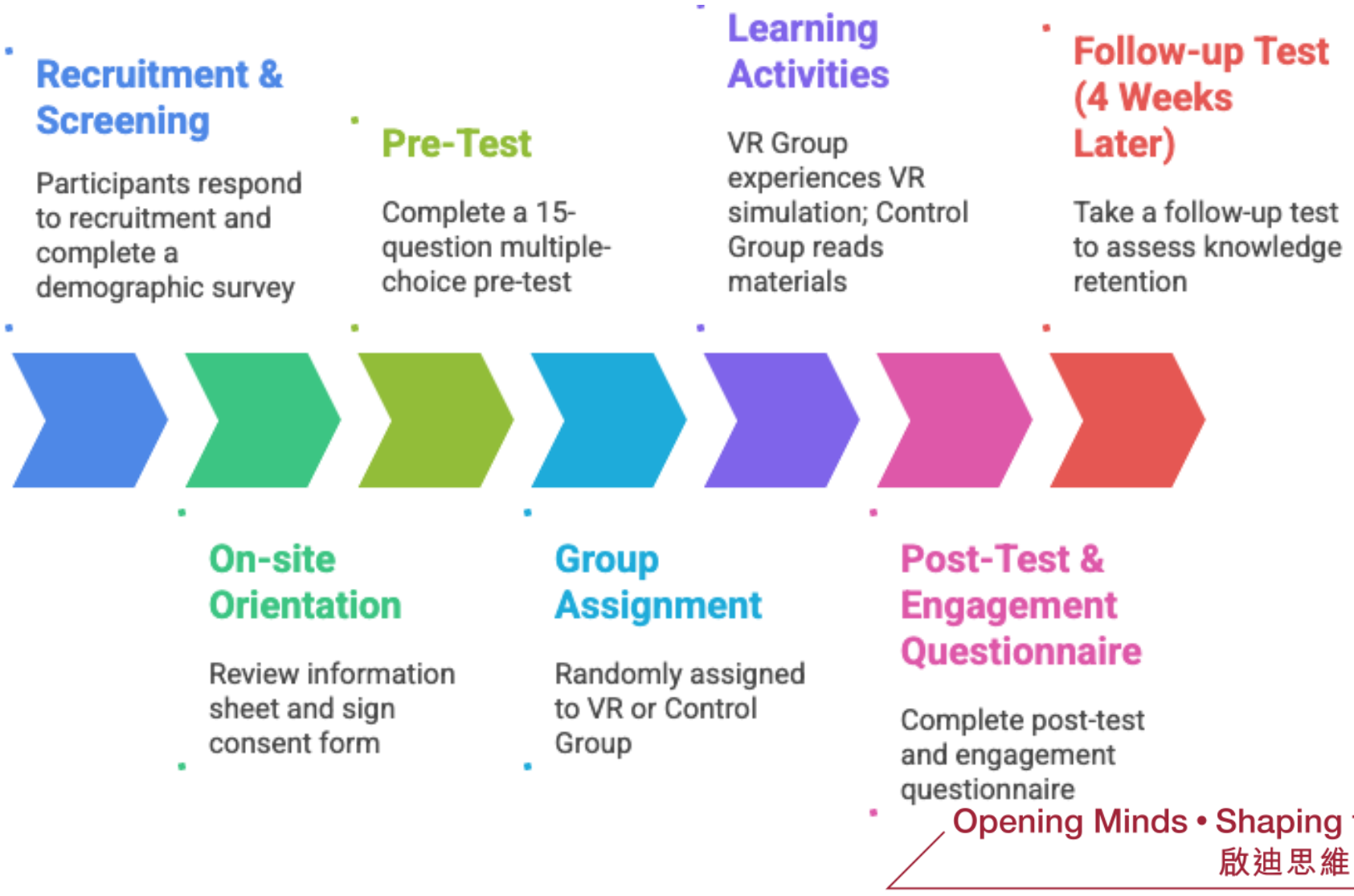
- **Learning Engagement**:
  - ✓ **Behavioural engagement**
  - ✓ **Affective engagement**
  - ✓ **Cognitive engagement**



- **Knowledge Test**
  - ✓ **15 multiple-choice questions,**

III. Methodology

Procedure



IV. Result

Demographics of the Participants

	Gender male (%)	Age *mean*(*SD*)
VR Group (n=37)	10 (50.00)	23.50 (4.39)
Control Group (n=31)	6 (30.00)	25.55 (7.92)
Total (n=68)	31 (39.75)	25.74 (7.02)

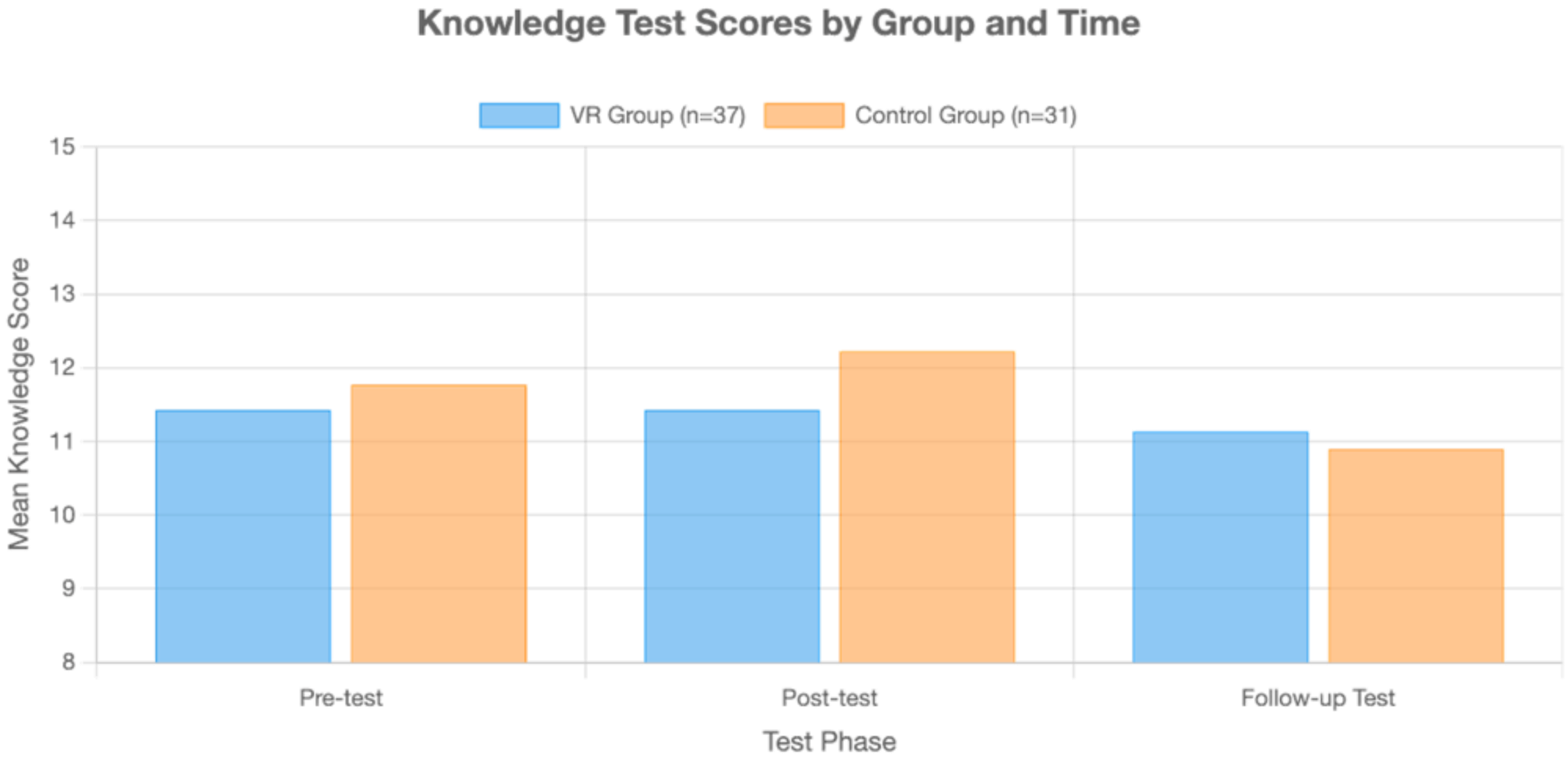
IV. Result

Descriptive statistics of the learning engagement scores

	Group	*Mean*	*SD*
Behavioural engagement	VR Group	18.51	3.185
	Control Group	18.65	2.905
Affective engagement*	VR Group	21.92	3.954
	Control Group	15.65	6.411
Cognitive engagement	VR Group	19.16	3.354
	Control Group	17.84	4.140
Combined*	VR Group	59.59	8.971
	Control Group	52.13	11.254

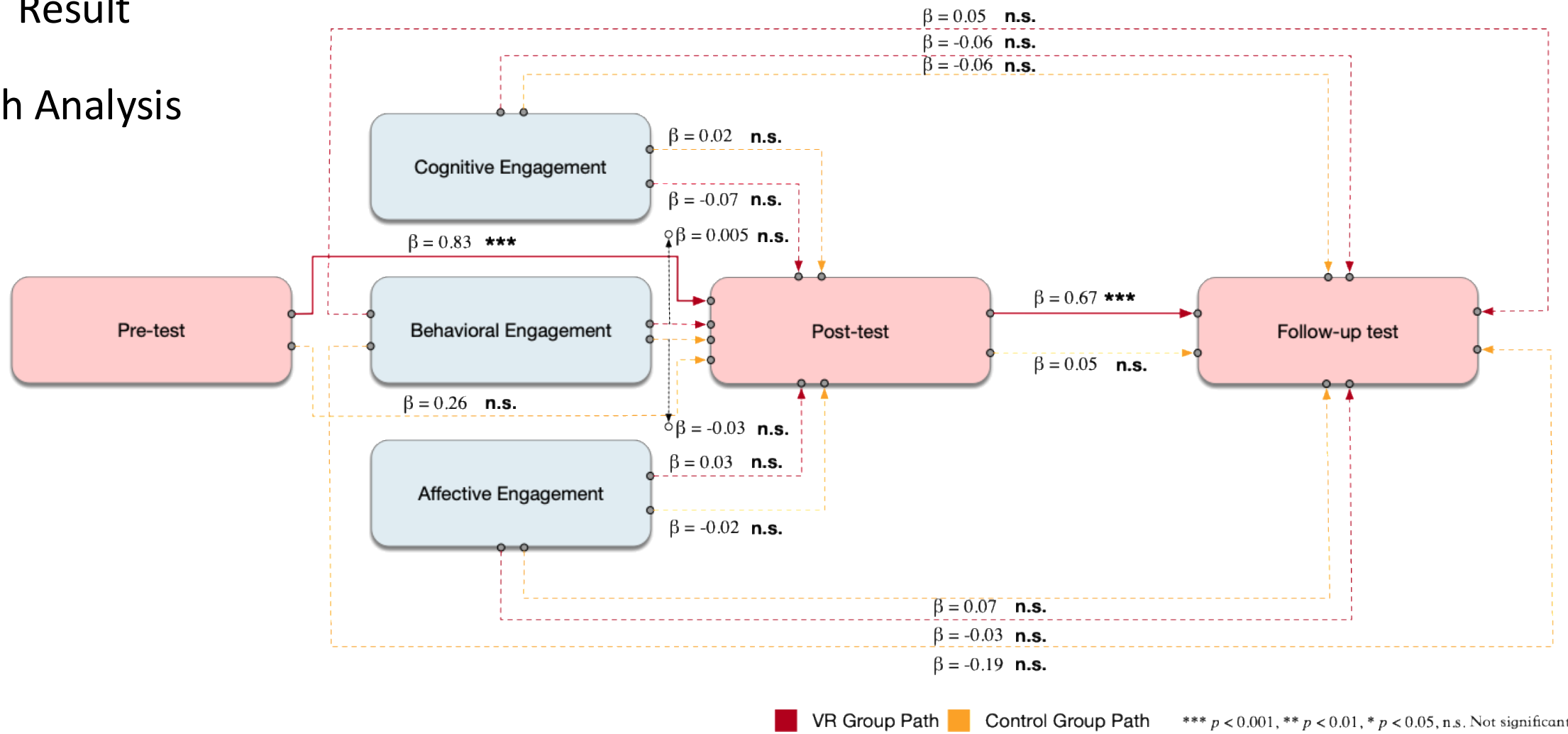
* Significant Difference

IV. Result


Knowledge Test Scores by Group and Time
VR Group (n=37)
Control Group (n=31)
Mean Knowledge Score
15
14
13
12
11
10
9
8
Pre-test
Post-test
Follow-up Test
Test Phase

IV. Result

Path Analysis



IV. Discussion-RQ1

Main Takeaway:

- When the goal is to get learners emotionally invested and interested in a topic, a gamified, experiential approach in VR is a powerful strategy.

Why it Worked:

- The VR experience was more enjoyable and interesting than static text.
- Gamified feedback and challenges strengthened emotional connection.
- This high affective engagement drove the higher overall engagement score.

IV. Discussion-RQ2

Finding 1: No Short-Term Gain.

- ❖ The VR group did not score higher on the immediate post-test.

Possible Cause:

- ❖ The test may have been too easy ("ceiling effect").
- ❖ Different media often yield similar cognitive outcomes.

Finding 2: Better Long-Term Retention.

- ❖ The Control Group showed a "cram-and-forget" pattern.
- ❖ The VR Group's knowledge was more durable and stable over time.

IV. Discussion-RQ3

Main Takeaway:

- There was NO direct link between how engaged a student was and their knowledge test score..

Why the Disconnect?

- Engagement is the foundation for learning, not the final outcome
- The "novelty effect" of VR boosts excitement but not necessarily learning.
- Learning requires "pedagogical bridges" (e.g., reflection) to convert engagement into knowledge.

V. Conclusion & Future Work

- **VR Enhances Engagement:** Experiential learning in a gamified VR simulation is highly effective at boosting learner engagement.
- **VR Improves Retention:** While it didn't lead to higher immediate test scores, the VR approach resulted in significantly better long-term knowledge retention compared to traditional methods.
- **Engagement Isn't a Direct Path to Knowledge:** A key finding was that high learner engagement, on its own, did not directly translate into measurable knowledge gains in our tests.

V. Conclusion & Future Work

Limitations to Consider:

- **The Knowledge Test:** The assessment may have been too simple, creating a "ceiling effect" that made it difficult to detect short-term knowledge gains.

- **The Type of Learning Measured:** The test focused on declarative knowledge (facts), which may not have captured the procedural or practical understanding developed in the VR simulation.

V. Conclusion & Future Work

Future Research Directions:

- **Design More Complex Assessments**: Develop more nuanced tests to better evaluate the deeper learning that may occur in experiential simulations.
- **Measure Psychomotor and Affective Outcomes**: Future studies should assess if the VR training improves practical skills (the application of Fitts' Law) and has a lasting impact on student attitudes.
- **Investigate "Pedagogical Bridges":** Research how to intentionally design instructional supports (e.g., guided reflection) to effectively convert high engagement into durable knowledge.

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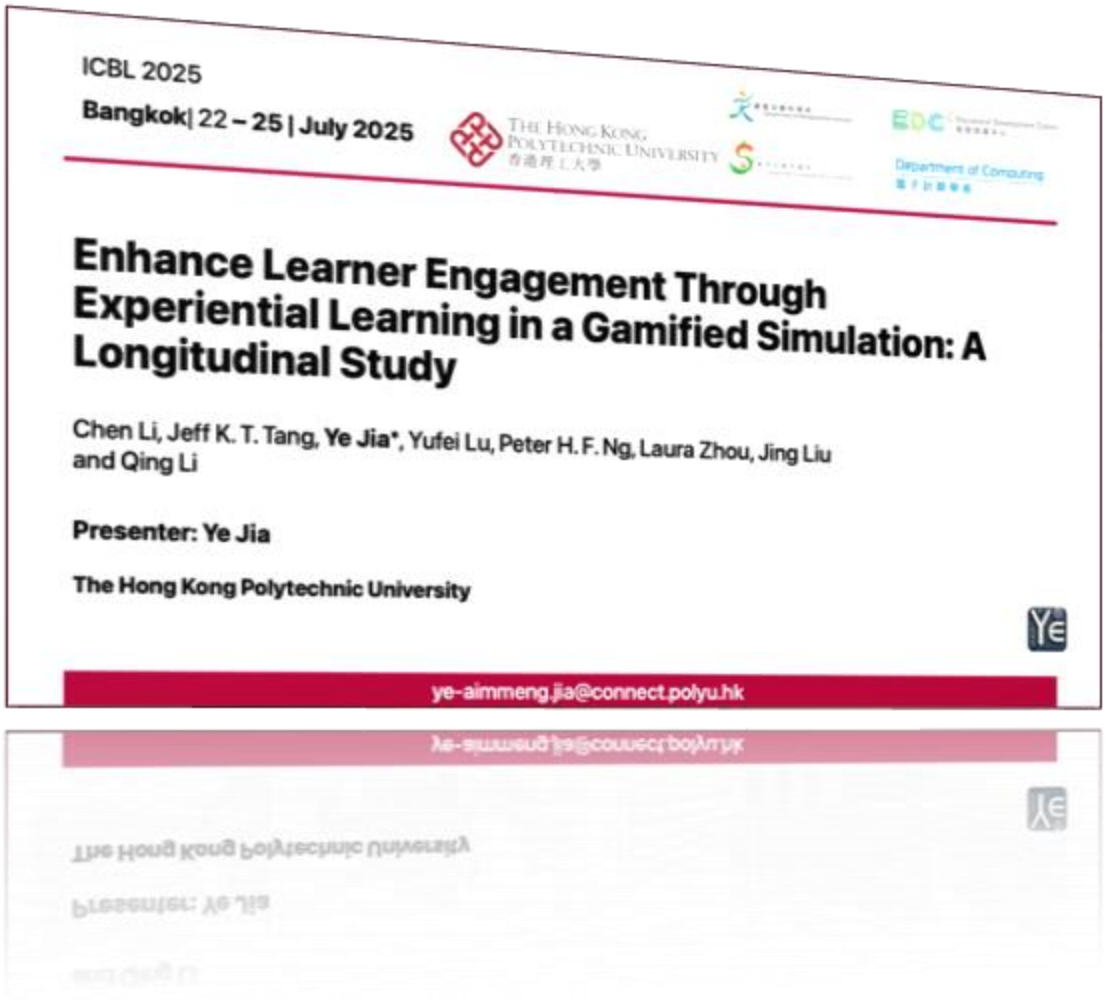

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