



Institute of Management Accounting  
and Simulation

# Beyond the Classroom: Immersive Learning in Virtual Labs

# immersive virtual labs #agent-based modelling #constructionist learning

The Controlling seminar was innovated with an immersive virtual lab using agent-based simulations to strengthen conceptual understanding. Evaluation revealed learning gains, demonstrating that virtual labs can effectively bridge theory and practice.

## 1. INITIAL SITUATION

- Course: Controlling (Management Accounting) Seminar
- Study Program: International Management and Engineering (M. Sc.)
- Term: Summer
- Number of Students: 18
- Learning Outcomes:
  - Applying management control concepts
  - Designing and interpreting key performance indicators (KPIs)
  - Integrating management accounting into business decision-making
- Learning Activities:
  - Scientific research and critical literature review
  - Business planning and case-based exercises
  - Quantitative modelling and simulation
- Assessment: Exercises, article reviews and presentations, and exam

## 2. CHALLENGES & GOAL

- ❖ Comprehensive course design: Students struggle to assess both quantitative (e.g., KPIs) and qualitative (e.g., social norms) concepts.
- ❖ The previous teaching evaluation highlighted that the course has an excessive scope and workload.
- ❖ Weak exam performance on conceptual questions, e.g., explaining the fraud triangle (see Figure 1)

We aim to leverage an immersive lab to strengthen conceptual understanding.

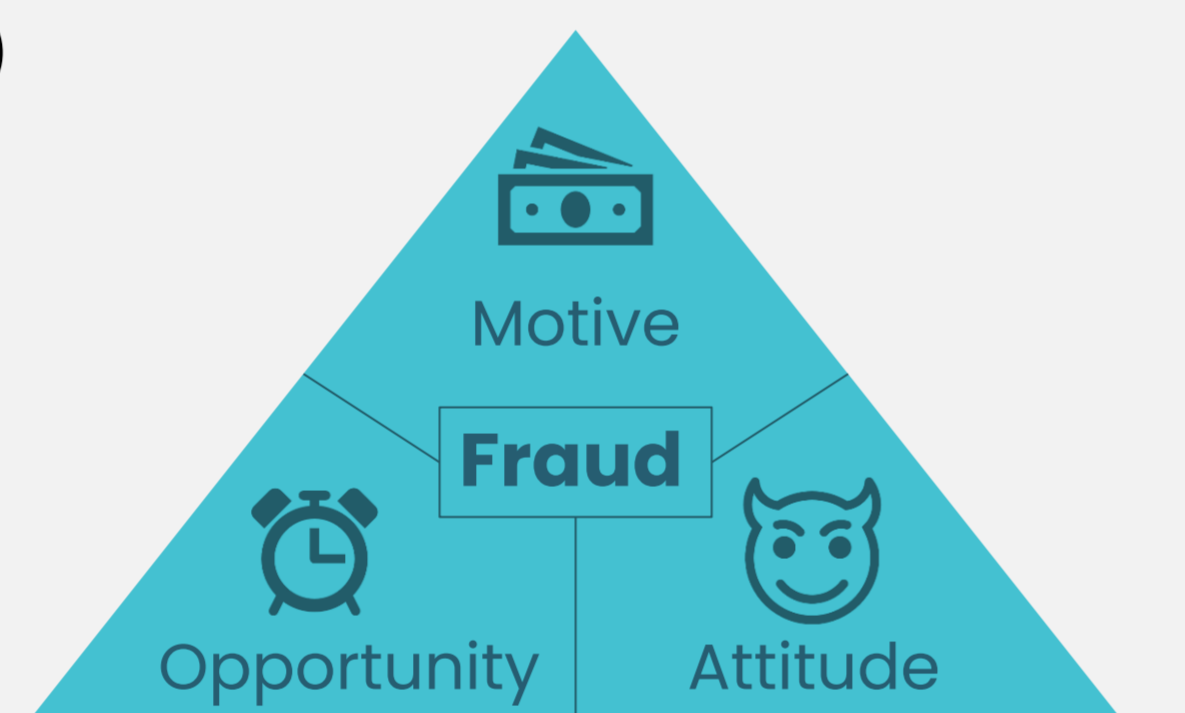


Fig. 1: Fraud Triangle (based on Cressey, 1953)

## 3. PEDAGOGICAL CONCEPT

- Traditionally, many academic disciplines abstractly convey concepts and theories. This poses a particular challenge in fields with limited practical elements (e.g., we can not easily observe fraud in the classroom) (Stummer & Kiesling, 2021).
- An immersive virtual lab with agent-based simulations in NetLogo with an interactive graphical interface allows students to manipulate parameters and explore theories and concepts (Blikstein & Wilensky, 2010; Stummer & Kiesling, 2021).
- Thereby, we support constructionist learning (active engagement, experimentation, reflection) (Blikstein & Wilensky, 2010).
- Qualitative content can be directly applied in immersive virtual labs, similar to practice exercises for quantitative topics.

## 4. EVALUATION

The evaluation (using a pre- and post-survey, see Figure 2) aims to assess whether the immersive virtual lab improves students' understanding of complex concepts in management accounting, specifically the fraud triangle, and social norms.



Fig. 2: Evaluation Concept

## 5. RESULTS

- Students initially rated their knowledge of social norms between average and good, with a substantial improvement reported following the lab.
- The number of students who correctly stated the fraud triangle rose from 2 (first self-assessment) to 18 (second self-assessment) (see Figure 3).

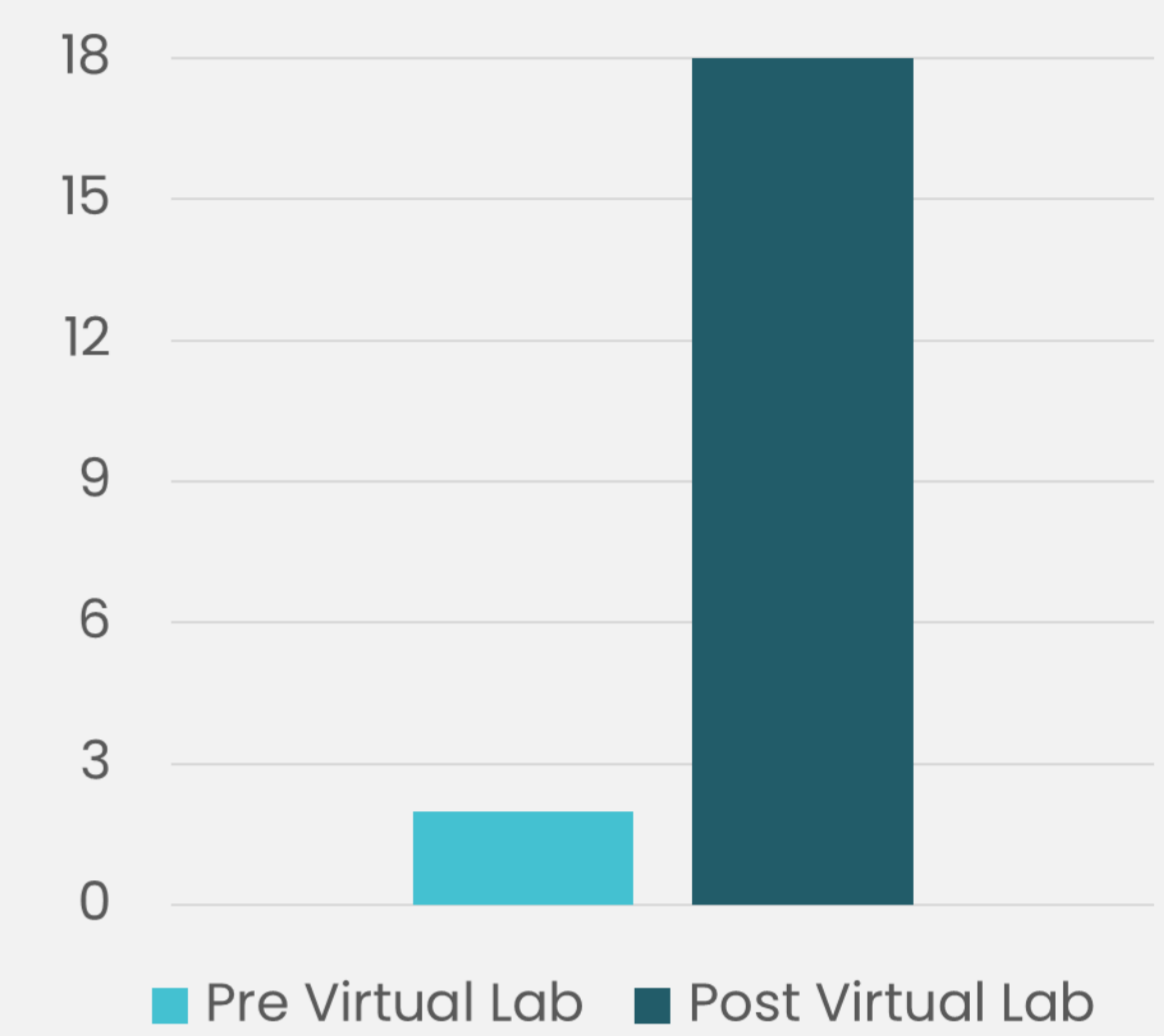


Fig. 3: Fraud Triangle: Correct Answers

## 6. REFLECTION

- Students expressed interest, though it remains unclear whether this was due to the advanced content or the methodology.
- While no comparisons across student groups were possible, students reported improved understanding and better exam preparation.
- Our approach was based on an existing model (see Figure 4). Developing a new model may prove resource-intensive.

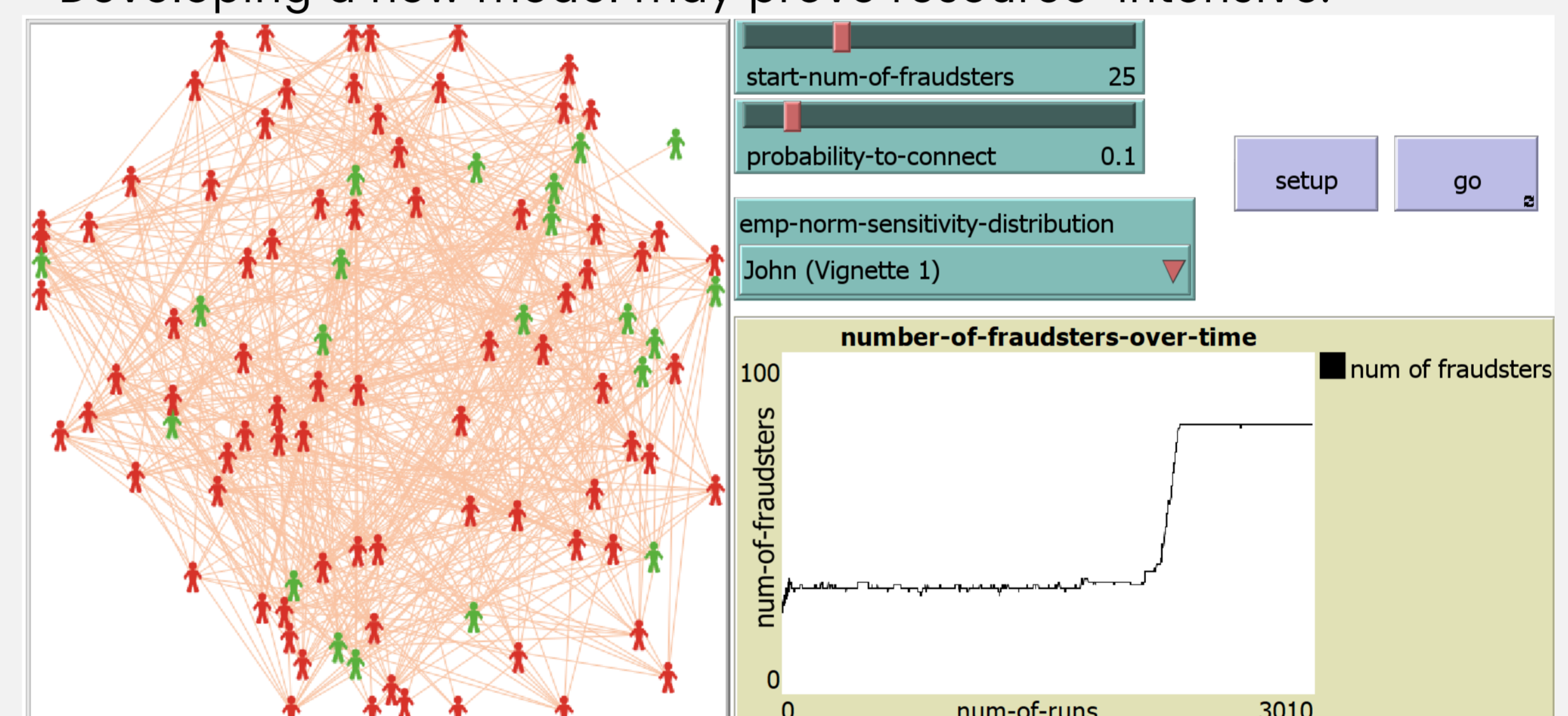


Fig. 4: Excerpt from our Virtual Lab (Eckert et al., 2025a,b)

## 7. CONCLUSION & OUTLOOK

The virtual lab can enhance conceptual understanding by linking theory to practice. Future work may expand its use across disciplines.

## 8. REFERENCES

1. Blikstein, P., & Wilensky, U. (2010). MaterialSim: A Constructionist Agent-Based Modeling Approach to Engineering Education. In M. J. Jacobson & P. Reimann (Eds.), *Designs for Learning Environments of the Future: International Perspectives from the Learning Sciences* (pp. 17–60). Springer US.
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5. Stummer, C., & Kiesling, E. (2021). An agent-based market simulation for enriching innovation management education. *Central European Journal of Operations Research*, 29(1), 143–161.

