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AI-Driven Adaptive Simulations for Management Education: Student Perceptions from Classroom Deployments in Philippine Higher Education

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Abstract. This paper reports an exploratory classroom deployment study of instructor-authored AI-generated business simulations used in undergraduate management education at a Philippine higher education institution. Using an in-house developed natural-language, chat-based simulator authoring interface, instructors generated lesson-specific simulations aligned with course objectives, refined them within the same interface, and deployed them to students through a shared web link. During classroom use, the simulation implemented a bounded, within-session form of adaptivity in which student decisions shaped subsequent scenario conditions, feedback, and later developments in the activity. The simulation was deployed across four undergraduate courses. Data collection used a pre-session/post-session survey design, yielding 82 pre-session responses, 70 post-session responses, and 68 matched response pairs, alongside open-ended post-session reflections. Students evaluated the simulation positively in terms of applied learning, engagement with evolving scenarios, and overall classroom experience. Matched responses also showed higher post-session self-ratings in understanding, application, confidence, reasoning, and preparedness. Qualitative responses suggest that the simulation's perceived value was tied to realistic framing, visible consequences of decisions, and the need to respond to changing conditions. Pacing, instructional clarity, and technical reliability also emerged as important implementation conditions. The study contributes exploratory evidence on how a decision-contingent, instructor-authored adaptive system was experienced in authentic classroom use within Philippine higher education.

Keywords: Artificial intelligence in education · Adaptive learning · Educational simulators · Simulation-based learning · Management education · Student engagement · Philippine higher education

1 Introduction

Artificial intelligence (AI) is increasingly being integrated into higher education for assessment, personalization, and learner support [11,5]. However, empirical evidence remains limited on how AI-supported learning systems function in actual classroom settings, particularly when their value depends on how students experience and respond to system-generated feedback during instruction. This gap is especially relevant in simulation-based learning. Simulations are often described as interactive, dynamic, or immersive, yet these qualities do not necessarily indicate adaptivity. Learners may participate actively while scenario progression, feedback, and consequences remain largely fixed. The instructional value of adaptive simulation lies in whether learner decisions shape later developments in ways that are visible, interpretable, and relevant to the learning task. This distinction is prominent in management education, where students are expected to reason through ambiguity, weigh trade-offs, and make decisions under changing conditions. In such settings, simulation is most useful when students can observe the consequences of their choices, revise their reasoning, and respond to evolving circumstances. AI-generated simulation may be particularly valuable here because it can support scenario progression and feedback that changes during use. Even so, empirical work on AI-generated adaptive simulations in authentic classroom deployment remains limited, especially when adaptivity takes the form of decision-contingent scenario change rather than long-term personalization based on learner profiles or historical data [5].

These conditions are also relevant in Philippine higher education, where interest in AI-enabled teaching continues to expand alongside concerns related to ethics, academic integrity, and unequal digital access [6,1]. In this context, the practical value of AI-supported learning systems depends on how they function within situated instructional settings. This study, therefore, examines the classroom deployment of an instructor-authored AI-generated business simulation in undergraduate management courses at a Philippine higher education institution.

Using an in-house developed natural-language, chat-based authoring interface, instructors described the lesson topic and intended simulation in a prompt, generated a simulator, refined it iteratively within the same interface, and deployed it to students through a web link. During classroom use, students accessed the simulation on their laptops either individually or in assigned groups. Although the student-facing simulation varied by lesson, it followed a common structure in which students encountered a scenario, made decisions, received feedback and consequences, and proceeded through updated conditions shaped by earlier choices. The system implemented a bounded, within-session form of adaptivity centered on decision-contingent consequence generation rather than individualized learner modeling.

The paper then examines how students experienced the simulation during classroom use. It focuses on perceived usefulness for applied learning, engagement with evolving scenarios and decision-linked feedback, and shifts in students' self-reported understanding, confidence, application, reasoning, and preparedness following participation.

1.1 Objectives and Research Questions

This study investigates student perceptions and experiences of an AI-generated adaptive simulation activity in undergraduate management education. It addresses the following research questions:

RQ1) How do students perceive the usefulness of the AI-generated adaptive simulation for supporting applied learning in undergraduate management education?

RQ2) How do students experience engagement with evolving scenarios and decision-linked feedback during classroom use?

RQ3) What shifts in students' self-reported understanding, confidence, application, reasoning, and preparedness are associated with participation in the simulation activity?

2 Review of Related Work

Artificial intelligence in higher education has been examined across a wide range of applications, including assessment, prediction, intelligent tutoring, and adaptive learning support [11,5]. Within this literature, adaptive systems are generally characterized by their ability to modify instructional support in response to learner input, performance, or context [9]. Existing reviews suggest, however, that much of this work emphasizes system capabilities and implementation categories more than how adaptive support is structured and experienced in situated learning environments [5]. This leaves a gap in understanding how adaptation is enacted within specific forms of classroom activity.

Simulation-based learning provides a useful context for examining this issue. Grounded in constructivist and experiential learning traditions, simulations allow learners to act within bounded environments, encounter consequences, and reflect on decisions under changing conditions [2,7]. Prior work has found that simulation games can support decision-making in complex situations and may compare favorably with traditional instructional approaches for applied learning tasks [8]. Research on agent-based business simulations similarly points to the value of dynamic environments for experiential learning in organizational and market contexts [10]. Nonetheless, interactivity and dynamism should not be conflated with adaptivity. A simulation may be interactive while still presenting fixed paths, predetermined consequences, or generic feedback. For this reason, AI-generated simulations should not be treated as adaptive by default. Their adaptivity must be examined in relation to how learner decisions shape scenario progression, feedback, and subsequent experience.

This issue is closely tied to student engagement. Educational technology research commonly conceptualizes engagement as multidimensional, encompassing behavioral, cognitive, and affective dimensions [4]. Studies of technology-supported learning, however, frequently rely on behavioral proxies such as participation, clicks, completion, and time-on-task [3]. In the case of AI-supported simulation, this provides only a partial account. Engagement in such settings is

also shaped by how students perceive evolving scenarios, decision-linked consequences, and feedback during classroom use.

Context further shapes how these systems are experienced. Much of the literature on adaptive systems, simulation-based learning, and educational technology has emerged from Western or otherwise high-resource settings, with comparatively limited attention to Southeast Asian higher education [4,11]. In the Philippine context, recent work points to growing institutional interest in AI alongside concerns related to ethics, academic integrity, and responsible use [6]. These concerns intersect with infrastructural conditions that shape technology-supported learning in practice and are an important site of analysis.

In all, the literature points to a gap in understanding how AI-generated adaptive simulation is experienced in actual classroom settings, particularly when adaptivity is enacted through decision-contingent scenario change and within underrepresented higher education contexts. This study addresses that gap by examining student perceptions of usefulness, engagement, and self-reported shifts following the classroom deployment of an instructor-authored AI-generated adaptive business simulation in undergraduate management education.

3 Methodology

This study employed an exploratory classroom deployment design to examine the use of an instructor-authored AI-generated adaptive simulation in an authentic higher education setting. It was conducted across four undergraduate courses in the School of Management of a Philippine higher education institution: *E-Commerce Fundamentals*, *Strategic Management*, *Introduction to Computing* (startup-focused), and *Service Management* (startup-focused). Participants were first-, third-, and fourth-year undergraduate students enrolled in these courses during the study period. Across deployments, three classes completed the simulation individually, while one class completed it in groups of approximately three students. In all cases, the activity took place during regular class sessions, with students accessing the simulation through a web-based interface on their own laptops.

The study examined an instructor-authored simulation system built around a natural-language, chat-based authoring interface. Instructors entered a prompt describing the lesson topic and intended simulator, generated a simulation, and refined it within the same interface until it matched their instructional use. Once finalized, the simulator was shared with students through a generated link. For this study, adaptivity is defined as a bounded, within-session, decision-contingent process in which student decisions influenced subsequent scenario conditions, generated feedback tied to those decisions and their consequences, and shaped later developments within the activity. The system did not perform long-term learner modeling, adaptive sequencing based on historical student data, or persistent personalization based on stored learner profiles. Although the student-facing simulation varied by lesson, it followed a common structure in which students encountered a scenario, made decisions, received feedback and consequences, and

proceeded through updated conditions shaped by earlier choices. The number of decision points varied depending on the scenario designed for the class.

Implementation followed a shared classroom structure across deployments. Instructors first delivered a short lesson introducing the topic and framing the activity. Students then completed a pre-session survey intended to capture baseline self-perceptions related to understanding, confidence, application, reasoning, preparedness, and comfort with AI-supported learning. They subsequently completed the simulation either individually or in assigned groups. Sessions lasted approximately 30 to 60 minutes, during which instructors monitored progress and addressed technical or clarification questions without providing direct solutions. After completing the simulation, students presented their outputs, decisions, and experiences in class, then completed a post-session survey evaluating the activity and reflecting on the experience.

Data collection followed a pre-session/post-session survey design. All closed-ended items used a 5-point Likert scale. The survey instruments were researcher-authored and designed directly from the study's research questions rather than adapted from validated scales, and were therefore intended to support exploratory classroom evaluation rather than psychometric measurement. The pre-session survey functioned as a baseline measure of students' self-perceptions prior to the activity. The post-session survey captured both evaluative feedback on the simulation experience and repeated self-report items for comparison with the baseline measures. Open-ended post-session questions asked students what aspects of the simulation helped their learning most, what challenges they experienced, and how the system could better support their learning. Quantitative analysis was primarily descriptive: post-session item means were computed to summarize student perceptions of usefulness, engagement, and classroom experience, while matched pre/post responses were compared to examine directional changes in self-reported understanding, application, confidence, reasoning, and preparedness following participation. As the study was exploratory and relied on researcher-authored self-report items, these comparisons are interpreted as perceived shifts rather than objective evidence of learning gains. Qualitative responses were similarly analyzed inductively by reviewing responses in full, identifying recurring patterns related to helpful features, engagement, challenges, and suggested improvements, and consolidating these into higher-level themes used to interpret the quantitative findings.

4 Results

Responses were collected across four course deployments: *Strategic Management* (pre: $n = 25$; post: $n = 18$), *Service Management* (pre: $n = 21$; post: $n = 20$), *Introduction to Computing* (startup-focused; pre: $n = 18$; post: $n = 15$), and *E-Commerce Fundamentals* (pre: $n = 18$; post: $n = 17$). In total, the dataset included 82 pre-session responses, 70 post-session responses, and 68 matched pre/post response pairs. Predominantly, students evaluated the simulation favorably, and matched responses showed directional increases across all measured

learning-related dimensions. Open-ended responses indicate, however, that the experience depended partly on pacing, guidance, and occasional technical friction.

4.1 Self-Reported Shifts Following Participation

Across the matched pre/post sample ($n = 68$), students reported higher post-session ratings across all measured learning-related dimensions. Mean ratings increased for understanding of key concepts (from $M = 3.81$ to $M = 4.35$), ability to apply concepts to realistic problems (from $M = 3.81$ to $M = 4.13$), confidence in making decisions (from $M = 3.54$ to $M = 4.03$), ability to explain reasoning (from $M = 3.60$ to $M = 4.12$), and preparedness to handle complex scenarios (from $M = 3.32$ to $M = 3.82$). The largest observed increases were in understanding of key concepts and the ability to explain reasoning. Preparedness to handle complex scenarios remained the lowest-rated dimension both before and after participation, despite showing improvement. These patterns indicate more positive self-reported perceptions of understanding, application, confidence, reasoning, and preparedness after participation in the simulation activity, but do not constitute objective evidence of learning gains.

4.2 Perceived Usefulness for Applied Learning

Post-session responses indicated favorable evaluations of the simulation as a support for applied learning. Students agreed that the simulation enhanced their understanding of the lesson topic ($M = 4.37$), helped them apply concepts in realistic contexts ($M = 4.31$), and supported decision-making during the activity ($M = 4.14$). Students also reported that changing simulation conditions encouraged critical thinking ($M = 4.27$), that feedback clarified the consequences of their choices ($M = 4.19$), and that the system adjusted in ways that supported their learning ($M = 4.15$). These responses suggest that students experienced the simulation as a setting in which to apply course concepts to evolving, decision-relevant situations.

4.3 Engagement with Evolving Scenarios and Feedback

Students also reported strong engagement during the simulation activity. Post-session ratings were high for active involvement throughout the activity ($M = 4.47$), sustained focus ($M = 4.30$), attention to how decisions shaped subsequent outcomes ($M = 4.31$), and the sense that the evolving nature of the simulation helped maintain engagement ($M = 4.26$). Students also evaluated the activity as productively challenging ($M = 4.27$). These responses suggest that engagement in this context was tied to following changing conditions, interpreting consequences, and adjusting reasoning as the scenario unfolded.

4.4 Classroom Experience and Implementation Conditions

Students likewise evaluated the classroom experience positively. Ratings were high for clarity of feedback ($M = 4.31$), clarity of instructions and objectives ($M = 4.27$), comfort using the AI-based simulation ($M = 4.39$), mental manageability ($M = 4.44$), pacing ($M = 4.30$), and minimal disruption from technical issues ($M = 4.44$). Students also expressed interest in using similar simulations in future lessons ($M = 4.41$).

Open-ended responses added nuance to these ratings. Students most often identified realistic framing, visible consequences of decisions, and the opportunity to work through changing situations as features that supported their learning. Some responses also pointed to areas for refinement, including time pressure, occasional technical friction, and moments where clearer guidance or additional examples would have improved the experience. These comments suggest that the quality of the activity depended on pacing, technical reliability, and instructional clarity during implementation.

5 Discussion

The findings suggest that students experienced the AI-generated adaptive simulation primarily as a support for applied learning. Across the matched sample, students reported more positive post-session self-perceptions of understanding, application, confidence, reasoning, and preparedness **(RQ3)**, while post-session evaluations indicated that the simulation helped them connect lesson concepts to realistic and changing scenarios **(RQ1)**. This pattern is consistent with prior work on simulation-based learning in management education, which has emphasized the value of consequence-driven environments for judgment, decision-making, and reasoning under uncertainty [8,10]. It is also compatible with constructivist and experiential perspectives that position learning as a process of action, reflection, and situated problem-solving [2,7].

The results also suggest that the educational value of adaptivity in this setting lies in decision contingency **(RQ2)**. Students were responding to scenarios that changed in relation to their decisions and receiving feedback tied to those decisions. This helps explain the high ratings for involvement, focus, and attention to outcomes. It also suggests that engagement in this setting derived from having to monitor consequences, interpret changing conditions, and adjust reasoning as the simulation progressed. This interpretation is compatible with work that treats engagement as multidimensional rather than reducible to participation alone [4], while also supporting learner-centered accounts of educational technology use that extend beyond behavioral proxies such as clicks or time-on-task [3]. Moreover, this indicates that adaptive behavior alone is insufficient to make AI-supported simulation instructionally effective. Open-ended responses pointed to pacing, technical friction, and the need for clearer guidance as recurring implementation concerns. The educational value of AI-generated simulation depends on whether students can clearly understand the task, follow the scenario, and connect the experience back to course concepts. In classroom

settings, effectiveness depends on instructional scaffolding and implementation quality alongside system adaptivity. In this context, adaptive simulation functioned as a structured complement to instruction rather than a substitute for it.

This point is especially relevant in Philippine higher education, where AI adoption is shaped by both growing institutional interest and ongoing concerns related to ethics, access, and pedagogical fit [6,1]. In the present study, instructors authored lesson-specific simulations aligned with their own course objectives, refined them through a natural-language interface, and deployed them within existing classroom practice. This configuration suggests a more realistic model for AI-supported learning in such contexts: instructor-authored, classroom-situated, and locally facilitated. More broadly, the study contributes to the literature on adaptive systems and educational technology by examining deployment in a setting that remains less represented in prior work [4,11].

In contrast, several limitations should frame the interpretation of these findings. First, the study relied primarily on self-report measures, which are vulnerable to response bias, novelty effects, and post-activity enthusiasm. Second, the survey instruments were researcher-authored and designed for exploratory evaluation rather than validated measurement. Third, the study did not include objective assessments of learning, behavioral interaction logs, or a comparison condition, limiting the strength of claims that can be made about effectiveness. Fourth, while the simulation was deployed across multiple courses, the present analysis was not designed to isolate differences by course type, facilitation style, or implementation format. The findings should therefore be understood as exploratory evidence of student perceptions and self-reported shifts in classroom use rather than as a definitive evaluation of learning outcomes.

6 Conclusion

This study examined the classroom deployment of an instructor-authored AI-generated adaptive simulation across four undergraduate management courses in a Philippine higher education institution. Students generally perceived the simulation as useful for applied learning, reported strong engagement with evolving scenarios and feedback, and indicated more positive post-session self-ratings across multiple learning-related dimensions. Open-ended responses further suggest that realism, visible consequences, and active response to changing conditions were central to the experience, while pacing, clarity of guidance, and technical reliability remained important conditions shaping classroom use.

The findings suggest that AI-generated adaptive simulation may serve as a useful instructional complement in management education, particularly for lessons centered on applied reasoning, decision-making, and consequence-tracking under changing conditions. The study's contribution lies in demonstrating how an instructor-authored, decision-contingent simulation was experienced in authentic classroom use and what this implies for the design and deployment of similar systems in higher education.

6.1 Contributions

This study contributes to emerging work on AI-supported simulation in higher education in three ways.

1. It operationalizes AI-generated adaptive simulation in a classroom setting as a bounded, within-session, decision-contingent process in which student decisions shape scenario progression and feedback during use.
2. It provides exploratory evidence from classroom deployment across multiple undergraduate management courses, showing how students perceived the simulation's usefulness, engagement, and implementation conditions in practice.
3. It contributes localized insight from a Philippine higher education context, where the use of AI in teaching is shaped by both pedagogical opportunity and implementation constraints.

6.2 Implications

Future work should evaluate AI-generated adaptive simulation using stronger outcome measures, including knowledge assessments, rubric-based evaluations of reasoning, interaction logs, and comparative designs involving non-simulation or less adaptive instructional conditions. Further work may also examine how instructor authoring practices, scaffolding strategies, facilitation choices, and system reliability shape student experience and classroom effectiveness across different course settings.

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References

1. Percentage of Households with Internet Connection Increased to 48.8 percent in 2024; Two in Every Three Individuals Aged 10 Years and Over Used the Internet | Philippine Statistics Authority, https://psa.gov.ph/content/percentage-households-internet-connection-increased-488-percent-2024-two-every-three?utm_source=chatgpt.com
2. Almulla, M.A.: Constructivism learning theory: A paradigm for students' critical thinking, creativity, and problem solving to affect academic performance in higher education. Cogent Education **10**(1), 2172929 (Dec 2023). https://doi.org/10.1080/2331186X.2023.2172929, https://www.tandfonline.com/doi/full/10.1080/2331186X.2023.2172929
3. Bergdahl, N., Bond, M., Sjöberg, J., Dougherty, M., Oxley, E.: Unpacking student engagement in higher education learning analytics: a systematic review. International Journal of Educational Technology in Higher Education **21**(1), 63 (Dec 2024). https://doi.org/10.1186/s41239-024-00493-y, https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-024-00493-y

4. Bond, M., Buntins, K., Bedenlier, S., Zawacki-Richter, O., Kerres, M.: Mapping research in student engagement and educational technology in higher education: a systematic evidence map. International Journal of Educational Technology in Higher Education **17**(1), 2 (Dec 2020). https://doi.org/10.1186/s41239-019-0176-8, https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-019-0176-8
5. Bond, M., Khosravi, H., De Laat, M., Bergdahl, N., Negrea, V., Oxley, E., Pham, P., Chong, S.W., Siemens, G.: A meta systematic review of artificial intelligence in higher education: a call for increased ethics, collaboration, and rigour. International Journal of Educational Technology in Higher Education **21**(1), 4 (Jan 2024). https://doi.org/10.1186/s41239-023-00436-z, https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-023-00436-z
6. Giray, L., De Silos, P.Y., Adornado, A., Buelo, R.J.V., Galas, E., Reyes-Chua, E., Santiago, C., Ulanday, M.L.: Use and Impact of Artificial Intelligence in Philippine Higher Education: Reflections from Instructors and Administrators. Internet Reference Services Quarterly **28**(3), 315–338 (Jul 2024). https://doi.org/10.1080/10875301.2024.2352746, https://www.tandfonline.com/doi/full/10.1080/10875301.2024.2352746
7. Kolb, A.Y., Kolb, D.A.: Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education. Academy of Management Learning & Education **4**(2), 193–212 (Jun 2005). https://doi.org/10.5465/amle.2005.17268566, http://journals.aom.org/doi/10.5465/amle.2005.17268566
8. Pasin, F., Giroux, H.: The impact of a simulation game on operations management education. Computers & Education **57**(1), 1240–1254 (2011), https://www.sciencedirect.com/science/article/pii/S0360131511000029
9. Sottilare, R.A., Schwarz, J.: Adaptive Instructional Systems. Design and Evaluation: Third International Conference, AIS 2021, Held as Part of the 23rd HCI International Conference, HCII 2021, Virtual Event, July 24–29, 2021, Proceedings, Part I, vol. 12792. Springer Nature (2021), https://books.google.com/books?hl=en&lr=&id=cbI2EAAAQBAJ&oi=fnd&pg=PR5&dq=R.+A.+Sottilare+and+J.+Schwarz+(Eds.),+Adaptive+Instructional+Systems:+Design+and+Evaluation,+Proc.+AIS+2021,+LNCS+12792,+Springer+Nature,+2021.+https://doi.org/10.1007/978-3-030-77857-6+&ots=SeVHstPSOY&sig=zvxLSVBwX0kzzIP5IVZSEieOEcg
10. Stummer, C., Kiesling, E.: An agent-based market simulation for enriching innovation management education. Central European Journal of Operations Research **29**(1), 143–161 (Mar 2021). https://doi.org/10.1007/s10100-020-00716-3, http://link.springer.com/10.1007/s10100-020-00716-3
11. Zawacki-Richter, O., Marín, V.I., Bond, M., Gouverneur, F.: Systematic review of research on artificial intelligence applications in higher education – where are the educators? International Journal of Educational Technology in Higher Education **16**(1), 39 (Dec 2019). https://doi.org/10.1186/s41239-019-0171-0, https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-019-0171-0