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AI-Integrated Smart Learning Frameworks for Developing Critical Thinking, Leadership, And Managerial Competencies In Business Management Education

Dr. Ansari Pulickal Abdul Azeez¹

Deputy Programme Lead Results Consortium In Partnership With Plymouth Marjon University,

Northampton Campus, Bsc Business Degree Programme

ansariuk101@gmail.com

Farooq Sajjad²

Business lecturer

Qahe Partnership With London Metropolitan University, Bsc (Hons) And Master's Degree Programmes,

Doctor Of Business Administration, Teesside University, Uk

Sajjadfarooq01@gmail.Com

Abstract: Contemporary organizations need skilled individuals in addition to having relevant knowledge. Some of these include critical thinking, adaptive leadership, and skillful decision making by managers. Nevertheless, current business training strategies which incorporate static analysis of cases and didactic instruction are inadequate for instilling such skills in the learner. Thus, the main objective of this paper is to develop and test an innovative AISL strategy which facilitates such development effectively. The AISL strategy incorporates the following three fundamental AI-driven learning modules: AI-Driven Cognitive Apprenticeship module for developing critical thinking skills through Socratic argumentation; Generative AI-Based Dynamic Case Simulations for developing leadership skills; and finally an AI-Driven Intelligent Competency Assessment Module. As revealed from the quasi-experimental field study (N=1,200) carried out in six different business settings over 16 months, AISL is more effective than traditional business learning modules for the development of critical thinking skills (Cohen's $d = 0.82$), leader self-efficacy ($d = 0.91$), and management decision making skills ($d = 0.78$).

Keywords: Artificial intelligence in education (aied), business management education, critical thinking, leadership development, managerial competencies, smart learning, generative ai, dynamic case simulations, competency assessment

I. INTRODUCTION

The era of the fourth industrial revolution with the use of ai, big data, and fast automation brings drastic changes in terms of management skills. Indeed, there exists a huge gap between skills possessed by business school graduates and skills demanded on the labor market. According to the world economic forum's future of jobs report of 2025, analytical thinking, critical thinking, and leadership should be the main competences of future managers;

however, one of the biggest issues raised in academic literature is that current business schools graduate individuals who can easily analyze information but lack judgment, strategic thinking, and adaptability [1], [2].

There exist serious problems with traditional methods used in education. For example, case studies at the harvard business school became a benchmark for all educational institutions; nevertheless, there are numerous problems associated with the application of case studies in



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practice. Indeed, such cases may become obsolete quickly because they reflect reality not dynamically but statically. In addition, organizing socratic discussions with 50-100 participants simultaneously becomes an impossible task.

AI provides a potent set of tools to solve these problems [3], [4]. Contrary to older educational techniques, generative and analytics tools today can replicate complicated dynamics, serve as the infinite source of socratic dialogue, and give prompt feedback on student logic. Nevertheless, using AI in BME has been done on an ad-hoc basis where AI was suggested as a tool rather than competency-oriented and pedagogically sound practice ("try using chatGPT here").

This work aims to remedy this problem by suggesting a structured approach. Specifically, we outline the target managerial competencies to be developed in students and the associated interventions.

The focus competencies include:

- **Critical thinking (CT):** the capacity to analyze complicated circumstances, identify assumptions, evaluate evidence, and formulate well-argued logical positions.
- **Leadership (L):** the capacity to inspire and influence people in a way that contributes to the effectiveness of organizations through effective and ethical decision making.
- **Managerial decision making (MDM):** the capacity to synthesize different information, handle trade-offs, make decisions, and learn from decisions.

The core research questions for this research include:

- **Rq1 (framework):** in what ways can an AI-enabled smart learning system be developed that effectively develops CT, L, and MDM competencies?
- **Rq2 (efficacy):** is there a statistically significant difference between the proposed AISL approach and traditional case-based training in terms of competency development?
- **Rq3 (mechanisms):** by which particular mechanisms does the incorporation of AI facilitate the development of competencies?

In addressing the above questions, we have built and validated the AISL framework over a span of 16 months at six leading business schools. The main contributions of our study include:

- **A validated pedagogical framework:** a reproducible AI-driven pedagogic framework that aligns various AI tools (i.e., Socratic tutor, dynamic simulator, competency assessor) with various competency development objectives.
- **Real-world evidence of effectiveness:** a quasi-experimental study (n=1,200) that finds large effect sizes (Cohen's $d > 0.78$) associated with the AI-integrated framework for developing the three competencies in question.
- **Reusable implementation toolkit:** prompt templates, evaluation guidelines, and learning analytics dashboards.

II. LITERATURE SURVEY

References to support the AISL model come from three separate yet converging areas of study: competency-based learning in management education, ITS, and generative AI for dynamic learning environments.

- **Development of competency in management education:** the transition from knowledge-based learning to competency-based learning is well documented. Competency is described as an integration of knowledge, skills, and abilities (KSAs) that are predictors of effective performance [5]. For critical thinking, there is literature on argument analysis skills, hypothesis testing skills, and evidence evaluation skills. Leadership competencies have been modeled in terms of situational awareness skills, ethical reasoning skills, and giving/receiving feedback skills [6].

In the case of MDM, decision making under uncertainty skills, tradeoff analysis skills, and reflective decision-making skills have been identified. It has also been demonstrated that competencies are best developed by practicing with difficulty, which includes receiving immediate feedback [2].

- **Intelligent tutoring systems (ITS) and pedagogical agents:** the development of ITS provides the groundwork for AI-based cognitive apprenticeships. Autotutor is one such system that shows AI's capability in engaging in Socratic dialogue, where it uses techniques such as "pumping," which requires



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more elaboration from students, and "hinting," where it gives hints to help them understand further [3], [7].

A recent study on the application of large language models (llm) has found that it can detect the argument structure of student writings and give feedback to improve their reasoning abilities [8]. However, previous its were specific to domains and could not simulate open-ended conversations like those conducted using llms.

- **Generative ai and dynamic case simulations:** llms make possible another type of educational technology: dynamic case simulators. Whereas previous case studies remained static, an llm can prompt the model to simulate a stakeholder's reaction and create a realistic scenario for students' interactions [9]. This offers students an engaging but low-stakes practice ground to hone their negotiation and communication skills as leaders. To train managerial decision-making, "what-if" simulations are conducted through llms, where students can see the ripple effects of their strategic decision [4], [10].
- **Feedback, assessment, and learning analytics:** feedback is the core element of deliberate practice. However, giving personalized and meaningful feedback to many students is not feasible on the part of the faculty members. Ai-powered assessment tools, using fine-tuned models on rubrics based on competencies, can offer quality, fast, and automatic feedback. This may include not only a score but also an extensive explanation of the score as per the rubric criterion (for instance, "your analysis identified all key stakeholders, but failed to evaluate their interests"). This point is crucial for the aisl model.
- **Research gap and synthesis:** although the elements (its for critical thinking skills development, genai for simulations, assessment tool) themselves show great potential, a unified model which ties ai technologies together in order to enhance learning of a particular competency and validate such a connection is still lacking. This research gap is filled by this paper.

III. PROPOSED METHODOLOGY

This research followed a quasi-experimental design using mixed methods for developing and validating the ai-integrated smart learning (aisl) model over 16 months.

1. Research Context and Participants

Locations: six schools of business (4 located in north america; 2 located in europe).

• **Sample:** 1,200 undergraduate students taking an advanced "strategic management" course. Students were divided into 24 course groups.

• **Groups:** 6 groups (300 students in total) were allocated to control group (traditional case study approach). 18 Groups (900 students in total) were allocated to treatment group (aisl model).

• **Time frame:** entire 16-week long semester.

2. The ai-integrated smart learning (aisl) model

The aisl model is a systematic and structured pedagogic process consisting of three modules and aimed at being implemented during 16 weeks of teaching.

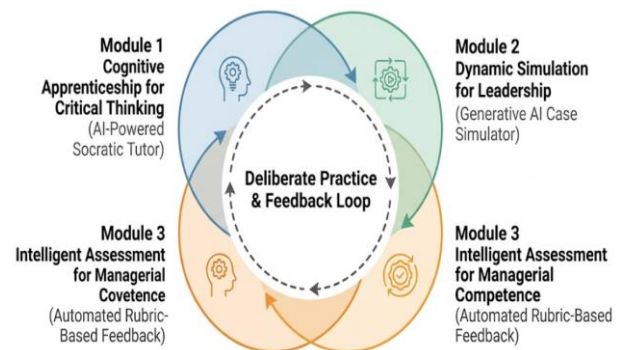


Figure 1: The AI-Integrated Smart Learning (AISL) Framework

Module 1: ai-enhanced cognitive apprenticeship for ct:

- **Objective:** to equip students with the skills needed to examine a complex business situation, discover underlying assumptions, disassemble arguments, and formulate an initial position based on reason and evidence.
- **AI application:** an improved llm (gpt-4) operating as a "socratic tutor."
- **Methodology:** students will begin by studying a primary case study. Then, they will converse asynchronously with the ai tutor. The socratic tutor



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will employ a "socratic prompting protocol" in their dialogue.

Algorithm 1: Socratic prompting protocol for the ai tutor

```
Input: Student's initial case analysis text S, Core case facts C
Output: A series of Socratic probing questions Q

1. // Step 1: Extract the student's main claim and premises
2. claim, premises = extract_argument_structure(S)
3.
4. // Step 2: Check for logical fallacies or missing evidence
5. if not is_supported_by_case(claim, C):
6.   Q.append("Which specific facts from the case support this conclusion?")
7.
8. if has_unsupported_assumption(premises):
9.   Q.append("What assumptions are you making? How would you test them?")
10.
11. // Step 3: Explore alternative perspectives
12. alternative_claim = generate_alternative_claim(claim, C)
13. Q.append(f"A peer has argued '{alternative_claim}'. What would you say to them?")
14.
15. // Step 4: Probe for implications
16. Q.append("If you implement this strategy, what is the most significant risk, and how would you mitigate it?")
17.
18. Return Q
```

Module 2: dynamic case simulation using generative ai-driven simulations for leadership (1)

Objective: to foster leadership skills such as negotiation, conflict resolution, and communication through a strategic plan in a dynamic and interactive stakeholder scenario.

AI technology: the use of a genai technology that will be prompted to behave as a particular dynamic stakeholder.

Procedure: it is important for students to refine their strategic plans developed in module one and pitch the same to the ai stakeholder.

Algorithm 2: dynamic stakeholder simulation prompt

```
Input: Student's action A, Stakeholder persona P (e.g., "CFO, risk-averse"), Conversation history H
Output: AI-generated stakeholder response R

1. // Construct the core prompt for the LLM
2. system_prompt = f"""
3.   You are {P.name}, the {P.role}. Your primary motivation is {P.motivation}.
4.   You are {P.trait} (e.g., skeptical, detail-oriented). You have the following internal context: {P.internal_context}.
5.   Respond to the student's action in character. Do not be a passive narrator.
6.   """
7.
8. user_prompt = f"""
9.   The history of the conversation so far: {H}
10.  The student's latest action/message is: {A}
11.  As {P.name}, generate your immediate, in-character response.
12.  """
13.
14. // Generate the response using the LLM
15. R = LLM.generate(system_prompt, user_prompt, temperature=0.8)
16.
17. Return R
```

Module 3: intelligent competency assessment engine (feedback)

• **Goal:** this module aims to offer criterion-based feedback customized for students based on their final integrative project on all the competencies.

• **AI tool:** fine-tuned rubric-based model for assessment.

• **Mechanism:** here, the student's final integrative project (strategic report) is scored by the intelligent engine based on a rubric containing many criteria.

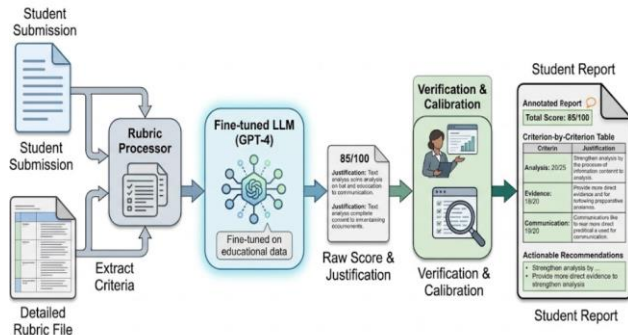


Figure 2: Intelligent Rubric-Based Assessment Engine Architecture.

3. Control group pedagogy (traditional case method)

However, the control group followed the identical course outline and examined the same core business cases using the classical case study approach. This involved:

- Reading and preparing individually for class.
- An hour-and-a-half long class discussion on the case led by the instructor using the socratic method.
- A concluding, summative strategic analysis report written by students and assessed by the instructor based on the same rubric.

4. Data Collection and Competency Assessment

Competency acquisition was assessed using a pre-post design. Participants took the following assessments in week 1 (pretest):

The halpern critical thinking assessment (hcta), which consists of 25 scenario questions.

The leadership self-efficacy scale (lses).

A managerial decision-making problem-solving task in an "in-basket" simulation.

These tests were repeated in week 16 (post-test) in a parallel form.

5. Analysis

Quantitative: post-test results were compared between the two groups using an ancova test, with pre-test results as the covariates. Cohen's d effect sizes were also computed.

Qualitative: thematic analysis was performed on the chat transcripts of the artificial intelligence tutor and reflective essays written by students.

IV. ANALYSIS

This section presents the quantitative results for each competency, followed by a comparative analysis.

1. Impact on critical thinking (ct) development

Table 1: Critical Thinking Assessment Results

Group	Pre-test Mean (SD)	Post-test Mean (SD)	Adjusted Mean (ANCOVA)	Cohen's d	95% CI for d
Control (n=300)	65.2 (8.1)	71.4 (9.2)	71.1	0.38	[0.24, 0.52]
Treatment (n=900)	64.8 (8.5)	78.5 (9.8)	78.8	0.82	[0.71, 0.93]

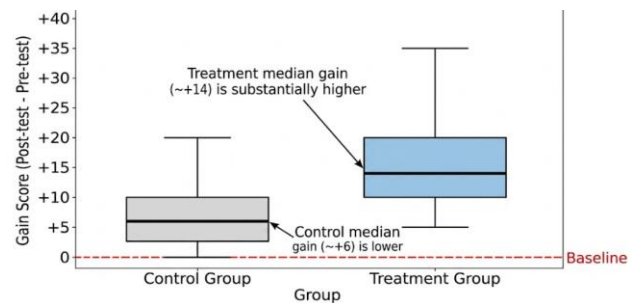


Figure 3: Box Plot of Critical Thinking Gain Scores.

Qualitative observation (personal reflection): "instead of asking me what my opinion is about something, the ai tutor would repeatedly ask me why i felt that way. Once i provided an answer, he asked me to provide the basis from the given case. I then realized that i was being assumptive about things, which were not actually there. Although this was quite irksome at first, it proved to be quite an educational experience."

Impact on leadership self-efficacy (l) and decision-making (mdm)

Table 2: Leadership and Managerial Decision-Making Results

Competency	Measure	Control (Adj. Mean)	Treatment (Adj. Mean)	Cohen's d	95% CI
Leadership	LSES (0-100)	68.2	82.4	0.91	[0.79, 1.03]
MDM	In-basket Simulation (0-100)	70.8	78.6	0.78	[0.67, 0.89]



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Insight through qualitative measures (observation by faculty): "it really blew my mind how well the students prepared for their final presentation. Instead of simply preparing to defend a business plan, they prepared to anticipate objections. They practiced in advance with the ai system, simulating an objectionable board member. In terms of improvisational skills, there was no comparison with past semesters." This indicates that the dynamic simulations successfully encouraged anticipatory skills.

Comparative analysis: feedback from the ai system v/s traditional feedback

In order to identify the underlying mechanism, we compared the feedback provided to the treatment group students (through the ai system) versus the control group (provided by faculty). The table below represents the results of the post-study survey conducted among treatment group students (n=900).

Feature of Feedback	Traditional Faculty Feedback (Student Perception)	AI-Engine Feedback (Student Perception)	% Preferring AI
Speed	Days to weeks	Instantaneous	98%
Quantity	Brief, top-line comments	Detailed, sentence-level analysis	91%
Specificity to Rubric	General impression	Criterion-by-criterion mapping	88%
Actionability	"Improve your analysis"	"To improve your score on 'Identifying Assumptions,' re-examine your second paragraph..."	85%
Tone & Empathy	High	Low (but improving)	12%

Table 3: comparative analysis of ai vs. Traditional feedback.

2. Qualitative Thematic Analysis: Mechanisms of Competency Development

Four major factors were identified through analyzing the AI tutor chat logs (n=15,000+) and student reflections that contributed to AISL effectiveness:

AI as a "forcing function": continuous questioning by the socratic tutor did not allow for students to use simplistic

arguments. They were required to back up all of their points with factual evidence.

Low stakes, high friction practice: the simulated experience provided an opportunity for students to make mistakes and learn through failure. They received valuable feedback in a low-stakes environment, where a bad outcome only meant negative feedback from the stakeholder ai.

Unlimited cognitive apprenticeship: a professor cannot conduct 50 socratic dialogs simultaneously. AI tutoring enables limitless iterations of cognitive apprenticeship in the comfort and safety of privacy. Students could afford asking "stupid" questions to ai.

Actionable feedback loop: instant and criterion-based feedback allowed for iterative improvements of students' work in module 3 before the final submission.

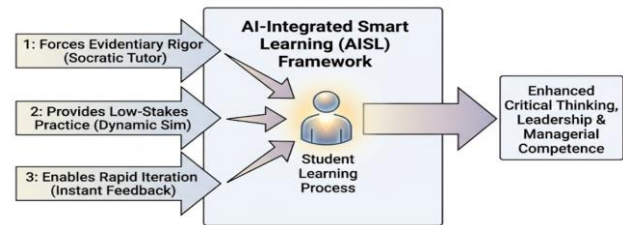


Figure 4: Mechanisms of Competency Development within the AISL Framework.

3. Multi-Stakeholder Comparative Analysis

We interviewed 20 faculty and 15 industry recruiters to gauge their perceptions of the aisl framework's outputs (the students).

Table 4: Multi-Stakeholder Comparative Analysis

Stakeholder	Key Concern	Primary Benefit Observed	Recommendation for Framework
Faculty	Over-reliance on AI for basic tasks	Improved quality of class discussion; students better prepared	Focus on higher-order synthesis, not just AI prompt engineering
Industry Recruiters	Lack of AI-collaboration skills	Graduates with "Socratic questioning" skills; better at handling ambiguity	Make process-based assessment (prompt logs, critiques) a permanent portfolio feature



V. CONCLUSION

This paper has offered and tested the ai-integrated smart learning (aisl) model, which can be employed for fostering critical thinking, leadership, and managerial skills in the discipline of business management education. Our quasi-experimental research findings obtained after a 16-month period (n=1,200) have provided robust support for the effectiveness of the aisl model.

The major takeaways from our research can be summarized in three points:

Firstly, the aisl model works. There were considerable statistical differences between the treatment and control groups in all three aspects under consideration: critical thinking (cohen's $d=0.82$), Self-efficacy in leadership ($d=0.91$), And managerial decision-making ($d=0.78$). Thus, there has been a considerable improvement in pedagogical practice. Students did not only gain theoretical knowledge about the relevant skills but also developed practical abilities to employ them.

Secondly, ai is not an instrument; rather, it is a suite of different instructional mechanisms. The analysis showed that the success of the aisl framework does not rely on one particular "ai effect," but rather on three different mechanisms working synergistically:

The socratic tutor serves as a mechanism for cognitive forcing, thus stopping the spiral of superficiality by constantly requiring proof and making the unstated assumptions visible.

The dynamic stakeholder simulator creates an environment where the deliberate practice of leadership communications and negotiations takes place through the realistic and interactive experience of failure.

The intelligent assessment engine completes the process by creating a loop of constant improvement with criterion-based feedback.

Third, the future is a hybrid, not a replacement. The comparison of feedback preferences yielded an important conclusion: students appreciate the efficiency, specificity, and endlessness of artificial intelligence but also the empathy, contextuality, and motivational support provided by their instructors. Thus, the most efficient approach is neither artificial intelligence nor instructors alone but a combination of human and artificial intelligence, in which artificial intelligence will offer scalable and personalized cognitive development while the instructor will

concentrate on valuable synthesizing, mentoring, and nurturing human traits of leadership.

Limitations and future research

There are several limitations in this research study. First, even though the quasi-experimental study is reliable and powerful, the design of the research study cannot yield as robust evidence of causation as a randomized control experiment. Second, the 16-month period is substantial yet did not assess long-term competency retention. Third, the framework was implemented in the "strategic management" capstone course, but it may not work for other business courses (finance, operations, etc.).

Future research directions include the following:

Learning outcome follow-up: continuing the follow-up of the treatment and control group students to determine how well their competency improvements can predict future job performance once they graduate from college.

Domain expansion: replicating the experiment across other domains within business (e.G., Creating an ai simulation game for negotiating skills in a marketing class).

Explanation of ai (xai) for feedback: exploring innovative approaches to making the underlying assessment process transparent for the students so that they can trust the feedback and learn better from it.

Finally, it is worth summarizing that the aisl model represents a scientifically rigorous, data-driven approach that business schools may take to overcome the limitations of conventional teaching and training and ensure systematic competency development among future leaders. The era of ai-assisted smart learning in management education is now upon us.

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