

Research Article

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An Innovative Paradigm of Cross-Border Financial Education Based on Reverse Engineer Perspective - A Case Study of Big Data Credit Scoring

Fan Ding

Guangzhou City University of Technology 15920168238, China

ABSTRACT

Addressing the cognitive challenge of the algorithm black box faced by business students in the context of the New Liberal Arts, this study proposes a novel experiential learning paradigm based on reverse engineering. Leveraging the Zhima Credit scoring modeling project, the study employs parametric scaffolding instruction to guide 27 business students with no programming background through the reverse deconstruction and value reconstruction of credit models. The results indicate that this model significantly enhanced students' sensitivity to unstructured data and comprehension of risk control logic, while effectively awakening their ethical consciousness regarding the mitigation of algorithmic discrimination. This study confirms that Reverse Engineer Learning effectively breaks disciplinary barriers, providing a pedagogical paradigm for cultivating composite financial talents who possess both technical rationality and humanistic care.

*Corresponding author

Fan Ding, Guangzhou City University of Technology 15920168238, China.

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Literature Review

The financial industry has entered an algorithm-driven era [1]. In the context of FinTech, proficiency solely in traditional data analysis tools such as Excel and Tableau is no longer sufficient. The continuous iteration of tools is widening the competency gap, creating a demand for professionals possessing data thinking [2]. Although current pedagogical reforms have introduced Python or visualization tools, existing curriculum designs predominantly focus on enhancing students' operational skills, such as programming syntax or data plotting while neglecting the education of underlying business logic essential to business courses. This results in a phenomenon where students can execute code but fail to comprehend the rationale behind model construction and the theoretical basis for its establishment [3]. Consequently, it is necessary to introduce experiential teaching capable of penetrating the internal mechanisms of algorithms. This approach aims to enable students to not only understand data but also grasp the complex logic of risk control, thereby realizing the value of New Liberal Arts education.

Drawing upon Kolb's (1984) Experiential Learning Cycle, traditional finance education is frequently confined to the stage of Abstract Conceptualization, primarily theoretical lecturing resulting in a significant disconnection between knowledge and practice [4]. Both experiential learning and reverse engineering are significantly undervalued in higher education, particularly within the domain of business education. The instructional design of Reverse Engineer

enables students to initiate their learning journey from Concrete Experience, proceed through Reflective Observation, and ultimately achieve deep knowledge construction [5].

While such methods can enhance students' situational engagement, they inherently presuppose fixed algorithmic parameters and market rules. Consequently, students function more as passive adapters within a predetermined framework rather than explorers of rules. This black-box operation constrains students' deep cognition of the underlying financial logic [6]. In contrast, the Reverse Engineering mindset widely applied in engineering education to deduce design principles by deconstructing finished products, is rarely explored in business pedagogy. For students growing up in environments defined by algorithmic recommendations and digital credit, utilizing Reverse Engineer to deconstruct familiar business products and deduce the underlying risk control logic not only aligns with constructivist learning theory but also represents a more effective pathway for deep learning compared to mere forward-looking operations.

With the increasing prevalence of algorithmic discrimination and data bias, the construction of the New Liberal Arts urgently needs to address the unification of instrumental rationality and value rationality [7]. However, current financial ethics education exhibits a significant Silo Effect: ethics instruction typically exists in the form of independent theoretical courses, remaining physically isolated from professional skills training. In practical FinTech courses, instructional objectives often focus singularly on the accuracy and efficiency of model prediction, rarely involving technical safeguards for algorithmic fairness. This status quo of

a technology-ethics dichotomy hinders students from establishing the professional competence required for responsible modeling. Therefore, there is an urgent need to develop instructional cases that deeply integrate technical modeling with ethical reflection. Through practical segments such as model gaming, students can be guided to spontaneously awaken their ethical consciousness amidst the specific pain points of technical operations.

Background of the Study

The Core Issue Addressed in this Paper

As financial decision-making shifts from financial analysis to algorithmic pricing, traditional finance education faces a severe cognitive gap: business students view algorithms as black boxes and lack the programming skills to engage with technical content. The core issue lies in enabling non-technical students to master data logic without requiring low-level coding proficiency. This study addresses this by employing Reverse Engineer Learning and Parametric Scaffolding to explore a pedagogical path that prioritizes business logic over code syntax.

Purpose and Significance of the Study

Purpose of the Study The study aims to evaluate the effectiveness of Reverse Engineering Learning in demystifying the algorithm black box for business students. Specifically, it assesses whether this model can enhance students' competencies in three dimensions within a code-free environment, data sensitivity in identifying financial value from unstructured data, technical comprehension of model weighting and iteration, and ethical awareness in mitigating algorithmic discrimination. This study offers a replicable paradigm of Parametric Scaffolding Instruction for finance education under the New Liberal Arts. Theoretically, it validates the efficacy of reorganizing cross-disciplinary content to overcome students' tech anxiety. Practically, it demonstrates that reverse-engineering mature business cases effectively cultivates composite talents with both technical rationality and humanistic care, providing an empirical reference for the digital transformation of business curricula.

Method

Participants

The participants in this study consisted of 27 undergraduate students from the Class of 2023 majoring in Financial Management (specializing in Investment and Wealth Management). All participants were enrolled in the Internet Finance course. Regarding academic background, the participants exhibited characteristics typical of pure liberal arts students. Prior to this study, they had completed foundational courses such as Fundamentals of Finance and Commercial Bank Management, possessing a solid theoretical understanding of traditional credit assessment models (e.g. the 5C principles). However, as non-STEM majors, this cohort generally lacked proficiency in programming and data mining techniques, with no prior systematic training in Python or algorithmic modeling. This profile strong in business theory but weak in technical tools is highly representative of current finance students in the context of the New Liberal Arts. Therefore, selecting this group as the research subject is significant for exploring how scaffolded instruction can help non-technical students bridge the digital divide and decode the algorithm black box.

Instructional Action Design

Given that the participants were business students with no programming background and the instructional time was limited to two class hours (90 minutes), this study adopted a Parametric Scaffolding Instruction model. Based on the theoretical framework

of Reverse Engineer, the instructor pre-developed a Python-based Credit Scoring Sandbox. This program encapsulated complex underlying algorithms into a visual interactive interface, allowing students to deconstruct and reconstruct credit models through black-box testing and gray-box parameter tuning without writing code from scratch. The specific instructional process was divided into three progressive phases:

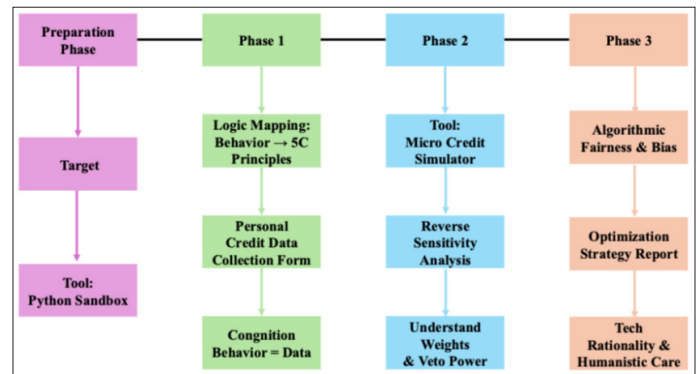


Figure 1: Three-Phase Flowchart

Phase 1 Cognitive Mapping and Quantification

Phase 1 focused on Logic Mapping and Data Quantification, aiming to implement the pedagogical concept of Reorganizing Course Content. The instructor guided students to transcend traditional financial definitions of data by mapping unstructured campus life behaviors onto the classic 5C Principles of financial risk control. Specifically, a Personal Credit Data Collection Form was distributed to students. This process transformed qualitative lifestyle habits into quantitative model variables, achieving preliminary data structuring. For instance, students mapped library borrowing frequency to the Character dimension as an indicator of self-discipline. The percentage of late-night food orders was identified as a negative factor reflecting lifestyle regularity, while the monthly living expense surplus rate was converted into a quantitative metric for Capacity. The core objective of this phase was to help students establish the foundational cognition that behavior is data, and data is credit prior to the sandbox simulation. This laid the logical foundation for subsequent model construction.

Phase 2 Sandbox Simulation and Reverse Engineer

Phase 2 was structured around the theoretical framework of Initiating Experiential Tasks and Granting Student Agency. To support students with no programming background, the instructor provided a Micro Credit Simulator V1.0, encapsulated within Jupyter Notebook, acting as a technical scaffold. This allowed students to bypass low-level coding and engage directly in model interaction. First, students input their personal data collected in the previous phase into the system's parameter section. Upon running the program, the system instantly generated visualized Credit Radar Charts and final credit scores. Subsequently, the instructional focus shifted to the core task of Reverse Sensitivity Analysis. Students were required to conduct controlled variable experiments by drastically modifying a single variable (e.g., changing the past overdue count from 0 to 1) while keeping other parameters constant to observe the magnitude of the score change. This immediate feedback mechanism enabled students to intuitively perceive the differential weighting of variables such as the veto power of certain negative factors and marginal effects, without needing complex mathematical derivations. Consequently, this hands-on practice deepened students' understanding of credit model iteration and risk control logic.

Phase 3 Value Reconstruction and Ethical Reflection

A critical component of experiential learning involves enhancing the efficiency of peer interaction. The objective is to shift the learning focus from mere technical operations to profound value judgments. At this stage, the instructor selected typical samples with similar total scores but distinct behavioral profiles for comparative display. This triggered students' reflection on the diversity of scoring criteria. Subsequently, a debate session was designed to guide students in exploring potential social equity issues arising from algorithms. For instance, students discussed whether utilizing lifestyle habits, such as late-night food ordering, as negative indicators constitutes implicit discrimination. Following these discussions, the final assessment format shifted away from submitting traditional rating model code. Instead, students were required to submit a Credit Model Optimization Strategy Report. This report documented not only the students' strategies for adjusting model weights but, more importantly, their reflections on algorithmic fairness. Thus, the instructional practice achieved an organic unification of technical rationality and the humanistic care advocated by the New Liberal Arts.

Results

Analysis and Discussion

Leap in Cross-Disciplinary Competencies

The instructional practice of this study indicates that Reverse Engineer Learning effectively assisted students with a pure business background in bridging the gap in technical understanding. This was achieved through visualized parameter adjustment and deep ethical gaming. By comparing self-assessment questionnaires from the beginning of the course with assessment performance at the end, significant progress was observed in three dimensions: data sensitivity, understanding of risk control logic, and ethical critical thinking. Prior to the experiment, students' understanding of credit scoring remained primarily at the level of financial statement analysis, with an average self-rating of 2.8/5.0. However, after undergoing logic mapping and sandbox simulation, students were able to rapidly identify the financial value of unstructured data, such as the frequency of late-night food orders and the average credit of social circles. Crucially, through the instant feedback of the Python sandbox, students profoundly grasped the complex non-linear penalty mechanism. They understood why a single severe credit default results in a precipitous drop in scores, without relying on complex mathematical derivations.

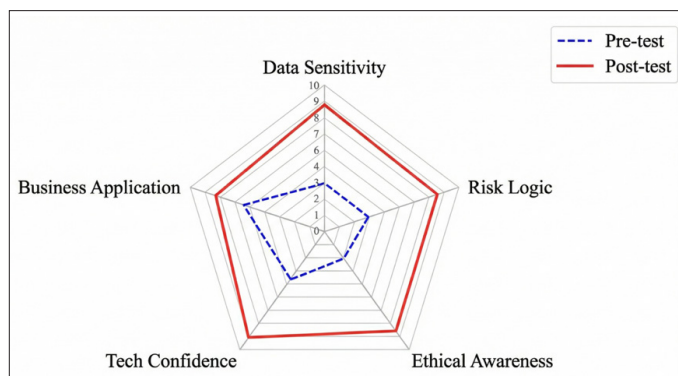


Figure 2: Reverse Engineer Enables Liberal Arts Students to Achieve All-Round Skill Expansion

The Discovery of Credit Gaming and Goodhart's Law

In the process of using the evaluation model, students inadvertently validated the famous economic principle, Goodhart's Law, through their experience of score gaming. This law states that when a measure

becomes a target, it ceases to be a good measure. In our teaching practice, we observed that during the Phase 2 sandbox simulation, some students proposed gaming strategies to pursue higher scores. For instance, realizing that library borrowing frequency carried a high weight, students hypothesized, If I borrow and return a book every day, will my credit score increase? Although this behavior constitutes cheating, it allowed business students to profoundly understand the importance of dynamic risk control. They learned that once the rules of a static model are disclosed, they can be reverse-engineered and exploited by users. Consequently, this triggered students to brainstorm countermeasures, such as introducing more complex cross-variables (e.g., borrowing duration or book category) to prevent fraud. This practical experience proved far more vivid and impactful than theoretical textbook explanations of model iteration.

Awakening of Algorithmic Ethical Consciousness

Another significant finding of this study is the reconstruction of students' values. Prior to the ethical reflection in Phase 3, the models constructed by student groups tended to prioritize maximizing predictive accuracy. They heavily utilized variables such as gender and native place. While statistically significant, these variables are ethically controversial. However, following the debate session on value reconstruction, 90% of the groups voluntarily excluded these sensitive variables in their final Strategy Reports. Instead, they sought fairer alternative factors, such as using consumption category as a substitute for gender. This transformation demonstrates that experiential learning not only imparted technical skills but also successfully instilled the New Liberal Arts philosophy of Technology for Social Good.

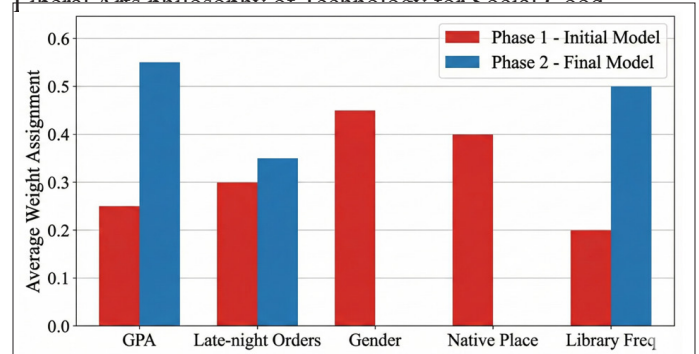


Figure 3: Students' Cognitive Shift from Data Centricism to the Integration of Data and Ethics

Conflict between Explainable AI (XAI) and Business Intuition Business and liberal arts students place a greater emphasis on causality (the why) compared to their engineering peers. For instance, a model might identify a high statistical correlation between a variable like low mobile battery and high default rates. However, students often refuse to incorporate such variables if they cannot explain the underlying business logic. This tendency aligns perfectly with the cutting-edge concept of Explainable Artificial Intelligence (XAI) in the FinTech domain. The insistence of business students that every variable must possess an explanation consistent with the 5C Principles proves to be a distinct advantage. It serves as a safeguard against overfitting and logical loss of control within black box algorithms. This validates the distinct value of New Liberal Arts education. In the era of fully automated algorithms, preserving the adherence of business professionals to business logic causality is critical. It acts as a key mechanism to prevent algorithmic errors and represents the core competitiveness of cross-disciplinary talents.

Research Limitations

Despite the positive outcomes, as an exploratory action research study, several limitations remain:

- This study was based on only 27 students from the same professional background (Financial Management). The lack of a control group or participation from science and engineering students makes it impossible to evaluate the model's potential in interdisciplinary collaboration scenarios. This also limits the generalizability of the findings to larger-scale teaching contexts.
- The Micro Credit Sandbox used in the course was built on desensitized and simplified rules. Real-world Zhima Credit algorithms involve PB-level data and more complex machine learning models (such as neural networks). Students' successful experiences in this simplified environment may lead them to underestimate the difficulty of data cleaning and model tuning in the real industry.
- This experiment lasted only two weeks (2 class hours). The changes in students' cognition were mainly reflected in short-term assignments. Whether this reverse thinking and ethical awareness can be internalized into long-term professional literacy still requires longer-term follow-up observation.

Recommendations for Future Research

Future research should transcend class boundaries and attempt to form mixed groups of finance and computer science students. Business students would assume responsibility for feature design and ethical review, while engineering students handle algorithm implementation and optimization. This collaborative approach would further enhance pedagogical depth through realistic gaming simulations.

It is recommended that universities collaborate with leading FinTech enterprises such as Ant Group or JD Tech to introduce industrial-grade datasets processed via privacy-preserving computation. This would not only enhance the realism of teaching but also allow students to directly encounter frontier challenges in risk control technology.

It is advisable to conduct follow-up surveys on participating students across academic years or even post-graduation. This will help evaluate the long-term impact of Reverse Engineer Learning on their internships, employment, and capability to address complex business problems, thereby providing robust empirical support for the promotion of the New Liberal Arts pedagogical paradigm.

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Author's Disclosure

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