

Guiding Master Students in Computer Science to Value and Strive to Learn Mathematics through the Text Information Processing and Machine Translation Teaching

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Abstract: Mathematics plays a crucial auxiliary role in the research work of master's students. Currently, a significant portion of master's students have received insufficient mathematical training during their undergraduate studies. The course "Text Information Processing and Machine Translation" is a required course for postgraduate students majoring in computer science at Northeastern University. In the past few years of teaching this course, we have integrated content to guide master's students to attach importance to mathematics and strive to learn it. This paper outlines the content related to guiding master's students in computer science to strive in learning mathematics within the course "Text Information Processing and Machine Translation." We aim to provide an opportunity for master's students, who may not have had sufficient exposure to mathematics during their undergraduate studies, to reassess and place greater importance on mathematics learning. Several years of practice have shown that our approach has been effective.

Keywords: Mathematics; Master Students; Computer Science.

1. Introduction

The course "Text Information Processing and Machine Translation" is a required course for postgraduate students majoring in computer science at Northeastern University. In the past few years of teaching this course, we have integrated content to guide master's students to attach importance to mathematics and strive to learn it. This paper outlines the content related to guiding master's students in computer science to strive in learning mathematics within the course "Text Information Processing and Machine Translation." We aim to provide an opportunity for master's students, who may not have had sufficient exposure to mathematics during their undergraduate studies, to reassess and place greater importance on mathematics learning.

There was a time when exams were the sole motivation driving us to learn mathematics. The pressure of looming tests forced us into relentless study, drilling on problem after problem until the subject felt exhausting and even discouraging. For many, math seemed like a bitter, unavoidable hurdle on the journey to graduation, not something we would willingly engage with or appreciate. As young students, we often fail to see the relevance of math in our lives. It was simply one more obstacle we needed to overcome.

For most of us, mathematics has become an endless source of stress and frustration. We dreaded it, struggled with it, and hoped to leave it behind as soon as we could, thinking that once we stepped out of the classroom, we'd be able to leave math forever.

Yet, ironically, many of us find ourselves, just five or ten years later, needing math for work. Careers in data science, computer science, engineering, and even fields like economics or finance often require us to revisit the very topics we once struggled with: calculus, linear algebra, statistics,

and probability. This return to math is often accompanied by regret. If only I'd grasped the importance of math back then! In these moments, we sometimes find ourselves blaming both our past selves for neglecting math and a system that didn't connect math to its practical applications.

But the issue isn't mathematics itself; it's our approach and understanding of its role in our lives. Learning math solely for exams or grades reduces it to a rote exercise that lacks meaning or excitement. On the other hand, studying math purely for its theoretical beauty can feel too abstract for most people. To truly appreciate mathematics, we need a deeper, more personal reason to engage with it.

2. Powerful Skill Set: Mathematics + Programming + AI

For most people, mathematics is a tool, a way to approach and solve real-world problems. When we intentionally learn math with a purpose in mind, we find that it becomes a bridge to practical problem-solving rather than a burdensome subject to be endured.

In today's world, we have a new and pressing reason to embrace mathematics: artificial intelligence. AI has become deeply woven into almost every part of modern life—from healthcare diagnostics to personalized entertainment and from financial forecasting to climate modeling. Mathematics is the foundation on which AI operates, and to fully harness its potential, a solid understanding of mathematical principles is essential.

Not everyone is born into a world of opportunity, but for anyone eager to shape their future, mastering the combination of "mathematics + programming + artificial intelligence" is like holding a royal flush. This skill set is invaluable in today's data-driven world. As companies and industries increasingly rely on data analytics, automation, and intelligent systems, those with mathematical and computational skills stand at the

forefront of progress and innovation. This trio of math, coding, and AI can elevate careers, enabling people to work in diverse fields and take on roles that are crucial for societal advancement.

This time, studying math is no longer about exams, grades, or merely passing courses. It's about investing in oneself, achieving personal and professional growth, and opening doors to the future. Learning math with this new mindset transforms it from a subject of fear or frustration into a key that can unlock meaningful opportunities. We can expand opportunities with mathematics.

3. Mathematics: A Lifelong Advantage

For students today, mastering mathematics isn't just a requirement but an investment in a lifelong advantage. The mathematical skills we develop now will provide the problem-solving tools we need to thrive in an unpredictable future, where automation and AI continue to reshape industries and redefine jobs. Those with the foresight to build this foundation will find themselves well-prepared for a world where analytical thinking, data literacy, and technological fluency are indispensable.

Learning mathematics in the context of AI becomes a journey toward building lasting skills, gaining confidence in one's capabilities, and creating pathways toward the future. Rather than a transient subject we endure, math becomes a foundational asset, enabling us to tackle real-world challenges, make informed decisions, and contribute to a future shaped by innovation and knowledge. This new perspective allows us to see mathematics as an ally and an enabler, providing the foundation for success in a rapidly changing world.

Let's delve deeper into how mathematics is integral across various aspects of life:

Science and Engineering: Mathematics forms the very backbone of scientific exploration and engineering innovation. In physics, for example, math enables us to describe forces, motion, and energy transfer. Engineering disciplines, like civil or electrical engineering, rely on calculus, differential equations, and geometry to design structures, circuits, and systems that are safe, efficient, and sustainable. Whether modeling climate change or developing life-saving medical devices, math empowers us to understand and shape the world.

Finance and Economics: In finance, mathematics isn't just about numbers; it's the language of risk, growth, and opportunity. Actuaries use probability and statistics to forecast future events, allowing insurance companies to manage risk. In economics, game theory and optimization help policymakers craft strategies that promote economic stability and growth. Complex algorithms and statistical models power stock trading, portfolio management, and even credit scoring, influencing major economic decisions every day.

Computer Science and Technology: Math is at the core of computer science, laying the groundwork for algorithms that power everything from search engines to artificial intelligence. Discrete math helps us understand complex systems, such as cryptographic security protocols that protect online transactions. Concepts from linear algebra are essential in machine learning, enabling computers to process and recognize patterns in vast datasets. Graph theory informs networking, while Boolean algebra is the basis for logic gates in computers. Simply put, math is the driving force behind technological advancement.

Everyday Life: Mathematics provides us with tools for problem-solving in our daily lives. Whether planning a budget, remodeling a home, or calculating distances for a road trip, math helps us make sense of numbers, space, and relationships. Even seemingly simple tasks, like adjusting a recipe for more servings or figuring out the best deal on groceries, rely on mathematical reasoning. Learning to manage personal finances, understanding statistical information in the news, and even estimating time are practical skills grounded in math.

4. Conclusion

The world of AI and machine learning offers more than just lucrative job opportunities. It provides a chance to contribute to groundbreaking work—addressing climate change, developing healthcare innovations, enhancing renewable energy sources, and more.

With AI, people trained in math can build solutions for some of humanity's greatest challenges. This knowledge makes mathematics not just a subject but a gateway to creating a positive impact on the world. By investing in a solid math foundation, students empower themselves to contribute to advancements that reach beyond personal gain, potentially impacting global well-being.

Mathematics plays a crucial auxiliary role in the research work of master's students. Currently, a significant portion of master's students have received insufficient mathematical training during their undergraduate studies. The course "Text Information Processing and Machine Translation" is a required course for postgraduate students majoring in computer science at Northeastern University. In the past few years of teaching this course, we have integrated content to guide master's students to attach importance to mathematics and strive to learn it. The content related to guiding master's students in computer science to strive in learning mathematics within the course "Text Information Processing and Machine Translation" had been outlined in this paper. We aim to provide an opportunity for master's students, who may not have had sufficient exposure to mathematics during their undergraduate studies, to reassess and place greater importance on mathematics learning. Several years of practice have shown that our approach has been effective.

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References

- [1] W.S. Jiang: *Mathematical elements* (Tsinghua University Press, Beijing 2023).
- [2] Mickaël Launay: *Great Mathematical Novels: From Prehistory to the Present (Le grand roman des maths: de la préhistoire à nos jours)* (Flammarion Press, Paris 2016).
- [3] C.X. Liu: *Heard the Truth in the Morning* (Jiangsu Phoenix Literature and Art Publishing, Nanjing 2019).
- [4] H.L. Wu, K. Wang, *Teaching Design of Knowledge and Intelligence: Lead Students into the Course*, *International Journal of Education and Humanities*, Vol.11 (2023), p.151-153.

- [5] R.P. Perry, J.C. Smart: *The Scholarship of Teaching and Learning in Higher Education: An Evidence-Based Perspective* (Springer, Dordrecht 2007).
- [6] G.D. Phye: *Handbook of Classroom Assessment: Learning, Achievement and Adjustment* (Academic Press, Cambridge 1996).
- [7] H.L. Wu HL, K. Wang: Natural language processing subject organizing by TTD model based on stepwise refinement framework, the 2nd International Conference on Information Science and Education (Nanchang, China, November 26-28, 2021), p.353-356.
- [8] J.D. Novak, D.B. Gowin: *Learning How to Learn* (Cambridge University Press, Cambridge 1984).
- [9] H.L. Wu, F. Zhang, J.W. Cheng, K. Wang: Determine teaching content using a bottom-up approach, *Advances in Social Science, Education and Humanities Research*, Vol. 369 (2019), p.597-600.
- [10] T. Buzan, B. Buzan: *The Mind Map Book: How to Use Radiant Thinking to Maximize Your Brain's Untapped Potential* (Plume Press, New York 1996).
- [11] D.L. Stufflebeam, C.L.S. Coryn: *Evaluation Theory, Models, and Applications*, 2nd Edition (Jossey-Bass, Indianapolis 2014).
- [12] H.L. Wu, K. Wang: Design of the introduction part of information processing and machine translation course for students majoring in computer science and technology, the International Conference on Information Science and Education (Sanya, China, December 4-6, 2020), p.543-546.
- [13] J.D. Novak: *A Theory of Education* (Cornell University Press, Ithaca 1977).
- [14] H.L. Wu, Introduction Part of the Knowledge and Intelligence Course, *Journal of Education and Educational Research*, Vol.6 (2023), p.22-23.