Andrii BABII
PhD, Associate Professor of Economics
Department of Economics
University of North Carolina at Chapel Hill
andrii@ad.unc.edu
Oksana BABII
Teacher of French and German
Ternopil Academic Lyceum
"Ukrainian Gymnasium"
named after Ivan Franco

HIGH-SCHOOL SPECIALIZATION IN UKRAINE: LESSONS FROM THE USA AND THE IMPORTANCE OF SUPPORTING YOUNG TALENTS

"Chance favors the prepared mind"
Louis Pasteur

Ukraine is entering a decisive phase in modernizing upper-secondary education, where high-school specialization is intended to align learning trajectories with students' abilities, interests, and post-school pathways. Ukraine's reform should be understood as a national human-capital accumulation strategy. This abstract focuses on the positive effects of early specialization, particularly in STEM-oriented pathways. The central policy proposition is that a well-designed specialization can help build advanced competencies (e.g. foreign languages, technical and research skills, programming languages) on top of a strong general core, thereby improving educational outcomes and later labor-market readiness.

Scientific Evidence on Early Specialization from the U.S. In the United States, most day-to-day control of schools is not federal: states and local school districts run K–12 education. The Department of Education's role is restricted mainly to fund disadvantaged students, enforce civil rights, and collect national statistics. As a result of its highly decentralized system, the U.S. provides a useful empirical laboratory with different types of high-schools coexisting (private, public charter, magnet, arts, science, etc).

When economists compare educational outcomes in specialized vs. non-specialized schools, a major challenge is *self-selection*: motivated students and supportive families are more likely to choose demanding programs, and those students may have succeeded anyway. Good research designs try to approximate a fair comparison, e.g. comparing "similar students" who differ mainly in whether they received access to a specialized program. Two popular research designs are:

- **Lottery-based admission:** When a program has more applicants than seats, a lottery can determine admission by chance among similar applicants. Comparing later outcomes of lottery winners vs. lottery losers provides a credible estimate of what the program caused.

● **Cutoff-based admission and scholarship (Discontinuity Designs):** When admission or scholarship depends on a GPA threshold, students just above and just below the cutoff are typically very similar. Differences in their later outcomes can therefore be attributed to access to the specialized school/program or scholarship for students near that threshold.

Leveraging on these designs, economists have found the following evidence:

1) Structured specialization can improve persistence and completion. In the U.S. "career academy" models (school-within-school specialization that integrates academics with applied coursework and a coherent pathway), lottery-based evidence finds 8% increase in high-school completion and boosts college enrollments for males but not females [2]

2) Technical/STEM-oriented specialization improves labor-market outcomes. A particularly policy-relevant study of Connecticut's technical high school system—using cutoff-based admission—finds 10% gains in high-school graduation and 32% subsequent earnings for males (with no effect for females), indicating that intensive, high-quality technical specialization can translate into measurable labor-market value [1]

3) Inclusive STEM models can raise advanced STEM completion/readiness. A meta-analytic synthesis of evidence on inclusive STEM high schools reports positive effects for inclusive STEM high schools were found for completion of key STEM courses and for likelihood that students would engage in self-selected STEM activities with little impact on test scores. The positive effects were found for low-income, under-represented minority, and female students [3]

4) Selectivity alone is not the main driver of success. Evidence from selective U.S. exam schools using discontinuity designs often finds limited incremental effects on broad academic outcomes for students around the admission threshold [5] The constructive lesson is that specialized education should prioritize what students learn and do—advanced courses, labs, mentorship, and projects—rather than relying on selectivity or reputation as a proxy for value-added.

A personal case of Andrii Babii. The trajectory of one of the authors of this abstract (Andrii Babii) illustrates a mechanism that complements the aforementioned research studies. He was a student at "Ukrainian Gymnasium" named after Ivan Franko, 20 years ago, and had an early opportunity to choose one of the three pathways—STEM, humanities, or economics. He selected STEM because he enjoyed mathematics and physics. In hindsight, this early specialization was transformative: it provided deeper preparation in STEM matched with talented teachers and mentors, and an opportunity to write my first research. That early experience made research feel accessible and exciting.

Even though he has not continued in STEM, this early experience was defining for his career. It turned out that modern economics is a highly quantitative scientific discipline, relying on mathematics (probability, statistics, optimization), programming skills, and the rigorous analysis of large datasets. His own research in econometrics is focused on developing machine-learning methods for causal inference, forecasting, and personalization with AI. The main policy takeaway is not

that all students should pursue STEM, but that for students with strong aptitude and interest, early specialization combined with research projects and mentorship can convert ability into durable skills and long-run innovation capacity.

Why merit-based scholarships and awards are essential complements? Specialization expands opportunity, but it also raises resource demands: advanced courses, labs, computing resources, competitions, and mentorship may require financial and organizational support. Without targeted aid, specialized tracks can unintentionally become less accessible to talented students from constrained backgrounds. This is where merit-based scholarships and awards could become an important complement. Here again, the key question is causal: do scholarships and awards produce real gains, or do they merely reward students who would succeed anyway? The quasi-experimental evidence from the U.S. shows that scholarships can change educational choices and investments—although the design must avoid unintended incentives by shifting students into suboptimal trajectories [4; 5].

On a personal level, one of the authors of this abstract (Andrii Babii) benefited from merit-based support early in his career, receiving the scholarship named after Jean-Jacques Laffont and a 3-year research scholarship from the French Ministry of Education at Toulouse School of Economics. He now gives back to the next generation by supporting students at the University of North Carolina at Chapel Hill and "Ukrainian Gymnasium" named after Ivan Franko. A scalable version of this model—public, philanthropic, or mixed—can help ensure that profiling reforms become engines of social mobility and national human-capital development.

Looking into the future, given the pace of development in AI, it is hard to predict what type of skills will be rewarded on the labor market. We are living through a shock that is often compared to the industrial revolution when agriculture and blue collar jobs became automated. This time more prestigious white collar jobs are becoming automated. Just over the last year, the AI agents became capable of writing software, analyzing data, writing mathematical proofs, and accelerating research in various scientific fields. The growing share of the boring routine parts of academic and professional work is becoming automated. This changes what it means to be skilled, because effort is shifting away from execution toward formulating creative ideas, capacity to coordinate complex workflows, and critical thinking and validating ideas. For example, former Google CEO, Eric Schmidt, in his recent speech at Harvard University, described watching an AI generating an entire software program and reacting that it felt like seeing the "start and end" of a craft he had practiced for 55 years [6].

This already has profound implications for education and learning—AI simultaneously expands personalized learning and tutoring opportunities while challenging how learning outcomes are evaluated. Since polished take-home work is no longer a reliable signal of intellectual capacity, creativity, or mastery, there is already a growing turn towards AI-proof assessment formats. Older style examinations, including oral exams, Socratic dialogues, and in-class blue-book style exams can observe critical reasoning of a student in real time should deserve more attention these days [7]

References

1. Brunner, E. J., Dougherty, S. M., & Ross, S. L. (2023). The Effects of Career and Technical Education: Evidence from the Connecticut Technical High School System. The Review of Economics and Statistics, 105(4), 867–882. https://doi.org/10.1162/rest_a_01098

2. Hemelt, S. W., Lenard, M. A., & Paeplow, C. G. (2019). Building bridges to life after high school: Contemporary career academies and student outcomes. Economics of Education Review, 68, 161–178. https://doi.org/10.1016/j.econedurev.2018.08.005

3. Means, B., Wang, H., Wei, X., Young, V., & Iwatani, E. (2021). Impacts of attending an inclusive STEM high school: Meta-analytic estimates from five studies. International Journal of STEM Education, 8, Article 4. https://doi.org/10.1186/s40594-020-00260-1

4. Cohodes, S. R., & Goodman, J. S. (2014). Merit Aid, College Quality, and College Completion: Massachusetts' Adams Scholarship as an In-Kind Subsidy. American Economic Journal: Applied Economics, 6(4), 251–285. https://doi.org/10.1257/app.6.4.251

5. Abdulkadiroğlu, A., Angrist, J. D., & Pathak, P. A. (2014). The Elite Illusion: Achievement Effects at Boston and New York Exam Schools. Econometrica, 82(1), 137–196. https://doi.org/10.3982/ECTA10266

6. Harvard Institute of Politics (Harvard Kennedy School). (2025, December 1). Kissinger and the Future of AI ft. Eric Schmidt (JFK Jr. Forum event listing).

7. McMurtrie, B. (2025, September 9). The Student Brain on AI (Digital Minds). The Chronicle of Higher Education.