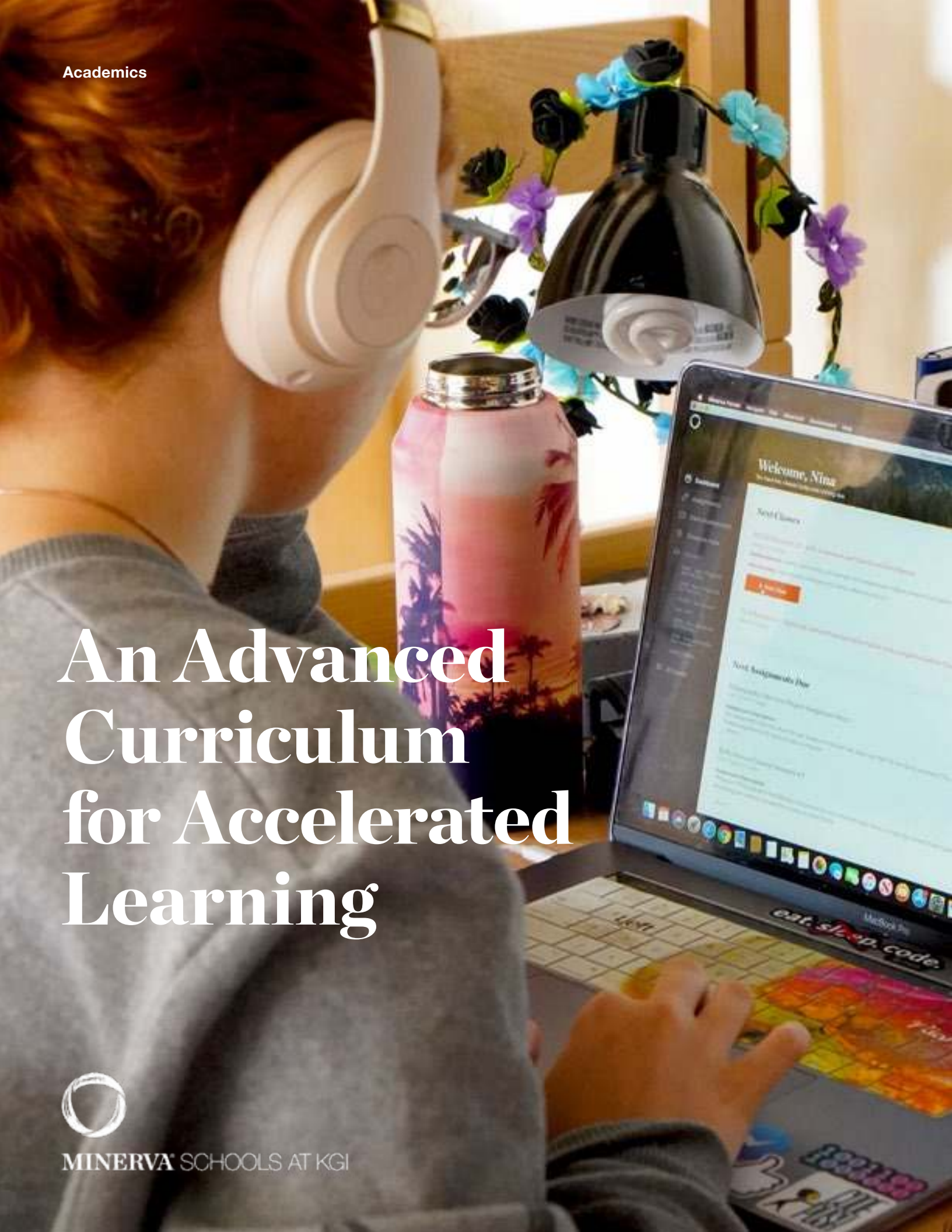


An Advanced Curriculum for Accelerated Learning

MINERVA SCHOOLS AT KGI

Effective education does not come from the passive absorption of facts, yet classes at most universities are large lectures devoted to sharing static content. At Minerva, students actively participate in learning the core capabilities needed to analyze, comprehend, and collaboratively solve complex challenges. Combining rigorous academics, small interactive seminars, and four years of intensive global immersion, Minerva is the first higher education institution built for the twenty-first century. Our innovative pedagogy and curriculum are not only changing what students learn, but how they learn.

Today, information is abundant and easy to access; content has become a commodity. Instead of focusing on memorization of static information, academics at Minerva are built to teach the four core capacities needed for leadership, innovation, broad thinking, and global citizenship. These capacities—critical thinking, creative thinking, effective communication, and effective interaction—have been split up into an extensive set of teachable components, the learning objectives that underlie the curriculum.

The curriculum design focuses on developing practical knowledge by systematically applying methods from the science of learning, via an advanced technology platform called Forum. As students progress toward earning their degrees, the courses they take are increasingly personalized, allowing them to gain both a broad understanding of interdisciplinary subjects, as well as a depth of mastery in their chosen fields.

At Minerva, the most important measure of success is the success of our students, and we have defined success not simply as doing well while in school, but also in life after graduation—both professionally and personally.

Content in Service of Concepts and Skills

Minerva's curriculum is devised to solve a persistent issue found in traditional pedagogic approaches: students—as well as parents and employers—find that typical university curricula do not prepare them for life after college. The standard curriculum has three parts: general education requirements, courses within the major, and electives. General education is supposed to prepare students for life after college, but it often consists of a set of breadth requirements that are not part of a coherent structure or designed to meet specific goals. A student's major is often of little direct use after graduation—how many sociology majors actually become sociologists? And elective courses are typically based on the personal interests of the faculty, with little or no regard for their possible utility for students. Students often select electives based on what sounds interesting, easy or convenient—as opposed to any broader educational goal.

Minerva has based its curriculum on the goal of imparting *practical knowledge,* concepts and skills that students can use to achieve their goals. We have intentionally created a first-year general education program that provides students with a set of cognitive tools they can use in multiple and diverse situations. The following years offer a set of majors, and concentrations within them, that allow students to expand on this knowledge base and apply it in more specific and practical contexts. As students progress through the curriculum, they increasingly personalize the set of courses they take, while they focus their goals to gain specific areas of mastery.

The Minerva curriculum is motivated by *first principles* and *empirical findings.* The first principles are the goals we have for graduating students: understanding leadership, knowing how to innovate, being broad thinkers, and having a global consciousness.

The empirical findings were available in the published scientific literature, but not previously used systematically in the service of education. To begin, we reviewed the empirical literature on the characteristics of successful leaders and inventive people, and considered characteristics that allow students to think broadly with a global perspective. We then organized the entire set of characteristics into four core competencies: the ability to engage in critical thinking, creative thinking, effective communication, and effective interaction with others. Crucially, we divided each of these competencies into more specific components (e.g., for critical thinking, "evaluating claims," "analyzing inferences," and "weighing decisions"). This disaggregation allowed us to make the learning goals precise and concrete enough to devise specific learning objectives for each one.

80%

of the jobs students will fill in the future do not exist today.

Source: 2014 Study by Siemens USA

Next, we defined two types of learning objectives for each aspect of the four core competencies. One type consists of *Habits of Mind,* which are cognitive skills that one can carry out automatically—such as evaluating a claim, by immediately and reflexively searching for counterexamples and considering the logic underlying the claim. The other type of learning objective consists of *Foundational Concepts,* which are knowledge that one can apply broadly in order to adapt to diverse situations or circumstances, such as by performing cost/benefit analyses.

The first-year general education program—the Cornerstone courses—focuses on introducing the Habits of Mind and Foundational Concepts (HCs). Each of these learning objectives is introduced in the context of a specific Big Question, such as "Who owns information?" "Can we end war?" "How can we feed the world?" These Big Questions were selected to be very difficult, requiring multiple avenues of inquiry and multifaceted solutions. By considering possible responses to these questions, we focus on the HCs, making them concrete and helping students see how the HCs can be applied to specific, real-world problems.

Additionally, in order to ensure that the practicality of what we teach can translate to the real world, we devised the final Capstone project. Beginning in the first semester of junior year, students plan a novel solution to an important challenge they define. Then, over the following three semesters, students incorporate all that they have learned at Minerva by fully developing an original work, for presentation at the end of their senior year. This self-directed project is practical preparation for the transition to life after graduation.

Classes Devoted to Continuous Engagement

Unlike the passive lectures that most other university students experience, all Minerva classes rely on fully active learning. Moving beyond the now-familiar standard "flipped classroom," Minerva has moved both lectures and homework—including readings, which often address the Big Questions—outside of class, reserving class time for face-to-face interaction with professors and classmates. During class, students are constantly engaged in discussion, debate, simulations, polls, quizzes, and collaborative work sessions. They actively use the HCs in the context of the Big Questions, and by engaging with this material they come to master it.

This approach is designed to stimulate deep cognition, enhancing the understanding of course material by using the information acquired outside of class to promote critical thinking, creative thinking, effective communication, and effective interaction. In the first year, course content is used as a vehicle to introduce and apply the Habits of Mind and Foundational Concepts. In subsequent years, class time is focused on furthering the ability to apply the HCs to unfamiliar situations and in novel ways, while building individual expertise in students' chosen fields.

Although the traditional lecture format is easier for students—they simply record what the professor says and memorize it in preparation for a test—the vast majority of what is "learned" is soon forgotten. In a recent analysis that considered results from over 250 studies comparing lectures with active learning seminars, the researchers concluded:

"...active learning leads to increases in examination performance that would raise average grades by a half a letter, and that failure rates under traditional lecturing increase by 55% over the rates observed under active learning...

...Finally, the data suggest that STEM instructors may begin to question the continued use of traditional lecturing in everyday practice, especially in light of recent work indicating that active learning confers disproportionate benefits for STEM students from disadvantaged backgrounds and for female students in male-dominated fields ..."

Freeman et al., 2014,
Proceedings of the National Academy of Science

Fully Active Learning

There is another assumed drawback to active learning: less material can be covered than in a traditional lecture format. However, if retention is tested three months later, students who took part in active learning typically retain many times as much as students who received the material in a lecture. Moreover, active learning focuses on using information, which is ideal for Minerva's emphasis on developing practical knowledge.

Minerva's active learning approach is complemented by co-curricular programs, as well as participation in research projects, field work, internships, and other practical training that afford students the opportunity to test and deepen their understanding through practical application of knowledge.

Whether working with the mayor's office to envision new public uses for San Francisco's Market Street or partnering with an entrepreneurial incubator to evaluate submissions for funding, students are applying the HCs in contexts well beyond their academic studies. Additionally, because Minerva students utilize the city as their campus, as they move from San Francisco to Seoul, Hyderabad, Berlin, Buenos Aires, London, and Taipei, each location broadens their perspectives and extends their learning environment into a wide range of diverse urban contexts.

Advanced Technology

Enhanced Interaction and Performance Evaluation

All classes at Minerva are intimate, face-to-face seminars taught using Forum. Forum has two primary benefits. First, the platform allows us to teach more effectively. In particular, Forum is designed to allow us to teach using various types of active learning, and allows us to apply the science of learning systematically. The second reason is even more important: Forum allows students to learn more effectively. The science of learning has documented methods that can often double the amount of learning, but Minerva is the only institution that systematically uses these methods in all classes. For example, research shows that prompt feedback is invaluable; we take advantage of this by recording all classes, which allows faculty to score students' performance and give them feedback within a week of class. Assessment data are not only collected from every interaction with each student, but are also fed back to professors through a decision support tool that is built into Forum, allowing faculty to provide support and mentoring in ways that traditional, offline instruction cannot even approximate.

In the first classes, simple data help the professor decide which student to call on for a given activity, usually based on the amount of time that student has already spoken. With time, these data become increasingly sophisticated. By the second semester of the sophomore year, the data enrich every interaction in class and every group project assignment—and are even used to facilitate personalized office hours. Professors adjust the way class is conducted based on the intellectual development arc of each student. This ensures that students have the best possible learning outcomes by the end of their time at Minerva—an individualized approach that is simply not possible without Forum.

Forum delivers many additional benefits. Although of secondary importance pedagogically, these benefits have profound positive impacts on the overall student experience. Forum allows students to take classes—and faculty to teach classes—from anywhere in the world. This means that in the same seminar we can have students who are living in different world cities, who can then bring their distinct experiences into class for compare/contrast exercises. It also enables us to recruit first-rate faculty from anywhere in the world.

The lack of a physical classroom also means that we do not have to construct and maintain buildings, which would raise the cost of tuition while supplying substandard and poorly utilized learning environments. The advanced technology of Forum also facilitates effective iteration and improvement of the curriculum and lesson plans, rapid revision of tools and features, systematic testing to define best teaching practices, and many other benefits.

Courses Structured for Individual Growth

At Minerva, students set the direction for their individual learning path. While pursuing an undergraduate degree, students construct a progressively personalized curriculum based on their specific educational goals. The curricular framework is intentionally designed to balance breadth of understanding with depth of mastery.

Beginning with the first-year Cornerstone courses, students are introduced to the HCs, core skills and concepts that are a common foundation for every Minerva student. Through these four interdisciplinary courses—*Multimodal Communications, Formal Analyses, Empirical Analyses,* and *Complex Systems*—students use the HCs to deepen their learning and begin addressing the most complex challenges of our time.

In the second year, students select a major from one of five colleges—Arts & Humanities, Business, Computational Sciences, Natural Sciences, or Social Sciences—setting the direction for a personalized course of study, where each semester builds upon the previous one. Students also have the option to double-major, choosing two different tracks to pursue.

In the third year, students not only begin their two-year Capstone project, but also focus further by selecting a concentration within their major(s), with the ability to double- or triple-concentrate as well. Each concentration enables more specialized work in the selected field. Students also have the option to add the Research Methods courses in preparation for the Master's program.

The final year is devoted to more self-directed study, both through self-directed tutorials, as well as completing the final Capstone project. The tutorials are very small courses (three students each) in which the students determine the topic of study. Then, in collaboration with their professor, they design the syllabus to be used for the remainder of the course. The Capstone project allows students to synthesize their previous learning by fully developing a novel solution to a challenge they define.

Finally, leading up to graduation is a month-long term called Manifest, during which students complete and present their Capstone work to an audience of faculty, fellow students and members of the broader community.

Majors at Minerva are conceived as an interrelated matrix of courses, wherein every class offered is essential to one of the five fields. Each major has a core requirement of three courses—four for the Business major—and a concentration requirement of an additional three courses.

The majors and concentrations are structured to eliminate superfluous courses, meaning that even elective courses count toward a requirement in one of the majors.

Following are descriptions of each major and the courses associated with the concentrations within each major. In the concentrations matrices, each row and each column represent a different concentration. Individual courses overlap concentrations, making it much simpler to double- or triple-concentrate.

Arts & Humanities Major

The arts and humanities take the history of human creative thought and expression and apply it to understanding and contextualizing events, ideas, policies, and human relationships. They foster an appreciation for other ideas, other times and other cultures, as well as new ways of looking at the world.

Arts and humanities scholarship produces better-informed leaders, innovators and global citizens with a social conscience, who are able to express their views persuasively and through different media and forms.

Core Courses

The three core requirements for the Arts & Humanities major are:

AH110 / Global History
AH111 / Morality and Justice
AH112 / The Arts and Social Change

AH

Concentrations in Arts & Humanities

	Humanities Analyses	Humanities Foundations	Humanities Applications
Historical Forces	AH142 / Historical Analysis: Challenges and Responses	AH152 / Comparing Societies and Histories: The Impact of Time and Place	AH162 / Uses and Misuses of History
Philosophy, Ethics, and the Law	AH144 / Ethical Systems, Moral Dilemmas	AH154 / Ethics and the Law	AH164 / Creating Ethical Political and Social Systems
Arts and Literatures	AH146 / Decoding Arts and Literatures	AH156 / Socioeconomic Influences on the Arts and Literature	AH166 / Using the Arts and Literature to Communicate and Persuade

Each row and each column of the matrix represent a different concentration.

Business Major

Private enterprise is the world's primary driver of wealth, employment, technological advancements, and cures for social ailments. Minerva's business major will focus on corporate and market dynamics, the strategy and mechanics behind transactions, and the operational complexity involved with taking a concept from ideation to global availability.

Core Courses

The four core requirements for the Business major are:

B110 / Market Dynamics and Product Analytics
B111 / Financial Planning, Budgeting and Modeling
B112 / Doing Business
B113 / Enterprise Design and Optimization

B

Concentrations in Business

	New Business Ventures	Scalable Growth	Enterprise Management
Brand Management	B144 / Needs Identification and Product Development	B154 / Strategic Brand Leadership	B164 / Product Evolution and Reinvention
Strategic Finance	B145 / Venture Initiation and Valuation	B155 / Capital Allocation for Value-Creating Growth	B165 / Global Enterprise Financial Strategy
Managing Operational Complexity	B146 / Business Operations	B156 / Business Systems	B166 / Business Optimization

Each row and each column of the matrix represent a different concentration.

Computational Sciences Major

Computational sciences provide the scientific foundations for making sense of natural, human-mediated and social phenomena through analytics, computational methods and modeling.

In an age of ubiquitous—often overwhelming—data, the ability to harness that data to reflect, reach out and make better decisions is increasingly crucial. The Computational Sciences major prepares students to be analytics-driven and logical decision makers, innovators, and leaders.

Core Courses

The three core requirements for the Computational Sciences major are:

CS110 / Computation: Solving Problems with Algorithms
CS111 / Structure: Mathematical and Computational Models
CS112 / Knowledge: Information-Based Decisions

CS

Concentrations in Computational Sciences

	Computational Theory and Analysis	Contemporary Knowledge Discovery	Applied Problem Solving
Computer Science and Artificial Intelligence	CS142 / Computability and Complexity	CS152 / Harnessing Artificial Intelligence Algorithms	CS162 / Software Development: Building Powerful Applications
Mathematics and Operations Research	CS144 / Principles of Advanced Mathematics	CS154 / Contemporary Applied Mathematics	CS164 / Optimization Methods
Data Science and Statistics	CS146 / Modern Computational Statistics	CS156 / Machine Learning for Science and Profit	CS166 / Modeling, Simulation, and Decision Making

Each row and each column of the matrix represent a different concentration.

Natural Sciences Major

Natural sciences provide the foundations for understanding the natural world and for using that knowledge to solve practical problems. Scientists and engineers use theories and findings of the physical and chemical sciences as well as the biological and biomedical sciences to develop new technologies, improving the lives of millions of people around the world.

Effective decision making in many technology-oriented organizations requires a deep understanding of the natural sciences; the Natural Sciences major gives students the practical knowledge to become leaders and innovators in science and technology-based organizations.

Core Courses

The three core requirements for the Natural Sciences major are:

NS110 / Fundamental Laws of Nature
NS111 / Implications of Earth's Cycles
NS112 / Evolution Across Multiple Scales

NS

Concentrations in Natural Sciences

	Theoretical Foundations of Natural Science	Research Analyses in Natural Science	Designing Solutions
Molecules and Atoms	NS142 / Quantum Nature of Matter: Theory and Applications	NS152 / Analyzing Matter and Molecules	NS162 / Statistical Mechanics: Theory and Application
Cells and Organisms	NS144 / Genetic Blueprint to Organism	NS154 / Life's Chemistry	NS164 / Solutions From and For Life
Earth's Systems	NS146 /Geobiochemiphysics: Integrating Earth's Systems	NS156 / Monitoring and Modeling Earth's Systems	NS166 / Keeping Earth Habitable

Each row and each column of the matrix represent a different concentration.

Social Sciences Major

The social sciences apply the methods of science to understand the way people think and act—individually, in groups, and in societies—and the way that biology and the environment interact to make each of us unique.

Research findings from the social sciences inform public policies on a wide range of issues, such as reducing crime, designing effective political campaigns, helping people overcome addictions, crafting economic/labor policies, and convincing people to conserve resources.

Core Courses

The three core requirements for the Social Sciences major are:

SS110 / Perception, Cognition and Reality
SS111 / Boom, Bust, and Bubbles: The Free Enterprise System
SS112 / Government and Social Change

SS

Concentrations in Social Sciences

	Theory and Analysis in the Social Sciences	Empirical Approaches to the Social Sciences	Designing Societies
Cognition, Brain, and Behavior	SS142 / Theories of Cognition and Emotion	SS152 / Cognitive Neuroscience	SS162 / Personal and Social Motivation
Economics and Society	SS144 / Economic Theory and Tools	SS154 / Econometrics and Economic Systems	SS164 / Global Development and Applied Economics
Politics, Government, and Society	SS146 / Constructing Theories of Good Government	SS156 / World Political Systems in Practice	SS166 / Designing Constitutions

Each row and each column of the matrix represent a different concentration.

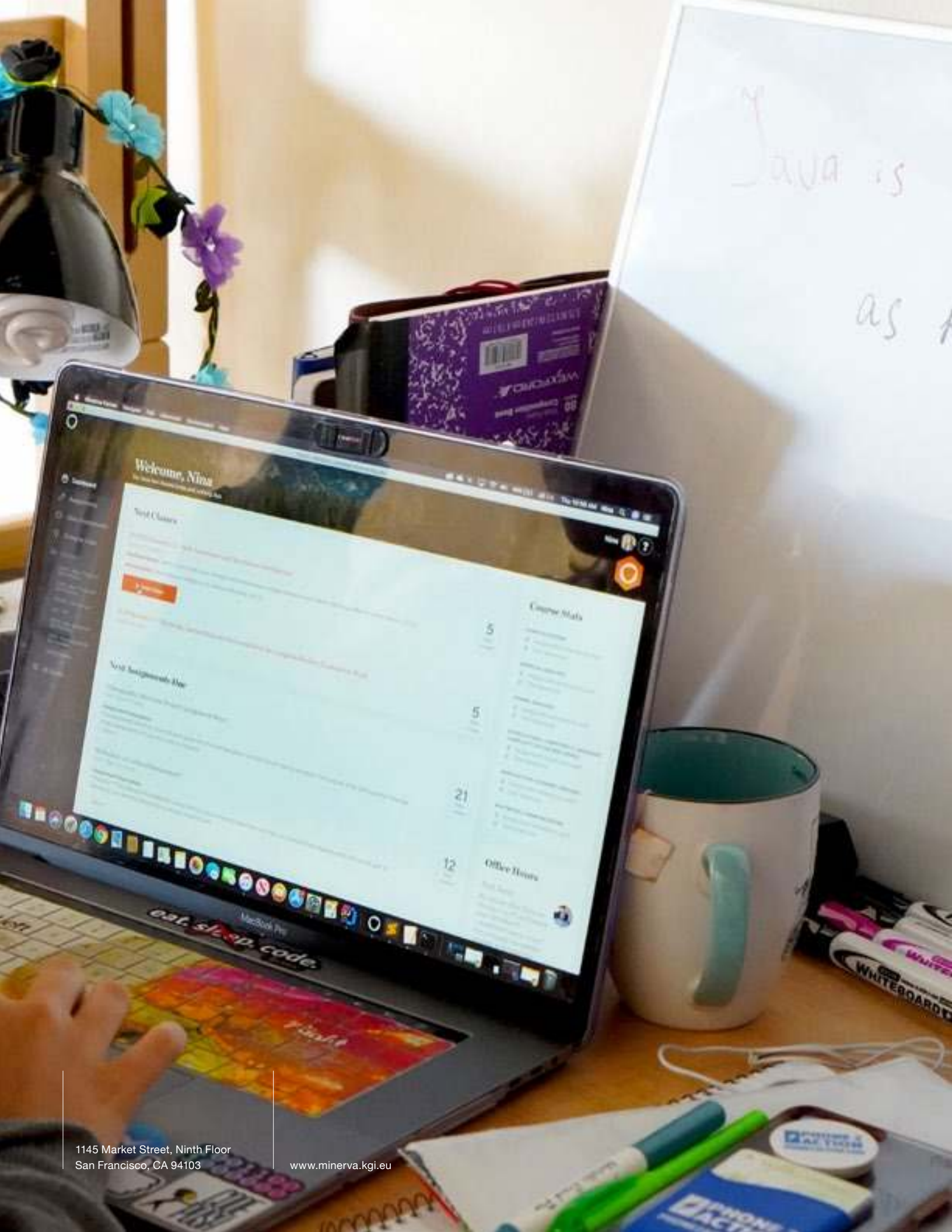
Preparing Students to Lead and Innovate

In closing, it's worth considering Minerva in a broader context. Higher education in general fails students in three ways. First, as noted at the outset, most universities do not prepare students adequately for success after college. At Minerva, our entire pedagogic approach is focused on building the adaptable capacities needed for successful careers in jobs and fields that may not even exist yet.

Second, other top-tier institutions typically charge about four times what we do for tuition, saddling many students with enormous debt. Because Minerva utilizes the infrastructure and facilities of cities around the world as a global "campus," we have far fewer expenses and can focus our investment on students—providing a more intimate, substantially higher quality educational experience, at a fraction of the cost.

Third, many university students drop out, either because they do not receive the support needed, or because they become disengaged. By restricting our classes to small seminars with required student participation, by nurturing individual achievement, and by enabling students to travel and live together around the world, we provide an unparalleled level of engagement, motivation, and global experience.

Everything at Minerva, from our close-knit residential communities to the innovative academic approach, is intentionally designed to prepare students to develop novel solutions to complex challenges, make consequential decisions, and realize their full potential.



1145 Market Street, Ninth Floor
San Francisco, CA 94103

www.minerva.kgi.eu