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Office of the President

TO MEMBERS OF THE ACADEMIC AND STUDENT AFFAIRS COMMITTEE:

DISCUSSION ITEM

For Meeting of November 18, 2020

TWENTY-FIRST CENTURY SKILL DEVELOPMENT FOR UNIVERSITY OF CALIFORNIA STUDENTS

EXECUTIVE SUMMARY

Universities need to ensure students have the skills to succeed in the work force and society, with numerous national organizations identifying those needed for the 21st century. These 21st century skills are woven into multiple aspects of UC's undergraduate experience, ranging from curricular and programmatic opportunities to extracurricular activities and the residential experience. This item will illustrate some of these campus efforts, along with methods of assessment and systemwide knowledge sharing.

BACKGROUND

Higher education institutions need to prepare students to succeed in the workplace and society. With economic, social, and technological changes, universities continue to adapt to ensure postgraduate success. A number of organizations have identified what they see as the knowledge, skills, and competencies needed to succeed in 21st century.

National Association of Colleges and Employers (NACE) identified the following seven core competencies: critical thinking/problem solving, oral/written communication, leadership, teamwork/collaboration, information technology application, professionalism/work ethics, and career management.

Partnership for 21st Century Learning (P21), a coalition including members of the national business community, education leaders, and policy makers, identified the skills needed for work, life, and citizenship:

- Life and career skills (flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, leadership and responsibility)
- Information, media, and technical skills (information literacy; media literacy; and information, communication, and technology literacy)
- Learning and innovation skills (creativity and innovation, critical thinking and problem solving, communication and collaboration)

Association of American Colleges & University (AAC&U) developed a set of essential learning outcomes that define the knowledge and skills graduates need to attain:

- Knowledge of human cultures and the physical and natural world (studies in the sciences and mathematics, social sciences, humanities, history, languages, and the arts)
- Intellectual and practical skills (inquiry and analysis, critical and creative thinking, written and oral communication, quantitative literacy, information literacy, teamwork, and problem solving)
- Personal and social responsibility (civic knowledge and engagement in both local and global level, intercultural knowledge and competence, ethical reasoning and action, and the foundations and skills for lifelong learning)
- Integrative and applied learning (synthesis and advanced accomplishment across general and specialized studies)

National Research Council (NRC) published a paper entitled "Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century" that identified three domains of competence:

- The Cognitive Domain includes three clusters of competencies: cognitive processes and strategies, knowledge, and creativity. These clusters include competencies, such as critical thinking, information literacy, reasoning and argumentation, and innovation.
- The Intrapersonal Domain includes three clusters of competencies: intellectual openness, work ethic and conscientiousness, and positive core self-evaluation. These clusters include competencies, such as flexibility, initiative, appreciation for diversity, and metacognition (the ability to reflect on one's own learning and make adjustments accordingly).
- The Interpersonal Domain includes two clusters of competencies: teamwork and collaboration, along with leadership. These clusters include competencies, such as communication, collaboration, responsibility, and conflict resolution.

The Academic and Student Affairs Committee (ASAC) Chair requested a discussion on how UC campuses ensure students are prepared to enter the 21st century workforce and society. This item will illustrate how campuses address the knowledge and skill development needed by today's student, along with means to assess, adapt, and collaborate across the system. In future meetings, ASAC will continue this discussion by examining how campuses are leveraging technology in the classroom and ways campuses are redesigning the curriculum to address equity gaps.

UC EFFORTS TO PROMOTE 21st CENTURY SKILLS

The University of California promotes 21st century skills through its curriculum, academic programs, undergraduate research and capstone experiences, co-curricular activities, and residential experiences. Educational opportunities vary across the system, in part based on how campuses are organized. For example, UC San Diego and UC Santa Cruz have residential college systems, each with its own general education curriculum, academic support, residential experiences, and distinctive traditions. UC Berkeley, UC Davis, UCLA, UC Riverside, and UC

Santa Barbara have separate colleges, with the majority of programs clustered under a larger College of Letters and Sciences or College of Humanities, Arts and Social Sciences. UC Irvine undergraduate programs are within 14 schools and colleges, and UC Merced has 24 undergraduate majors. This variety provides student choice on academic programs, educational delivery models, and residential experiences. It also provides UC campuses an opportunity to learn from one another about effective practices and strategies in developing 21st century skills across the system. Below are some examples.

General education and other curricular experiences

Campus general education requirements are designed to give UC undergraduates a broad background in all key academic disciplines, including natural sciences, physical sciences, social sciences, humanities, and the arts. These requirements also advance 21st century skills, including the National Association of Colleges and Employers' (NACE's) critical thinking/problem solving skills; P21's learning and innovation skills; the Association of American Colleges & University's (AAC&U's) knowledge of human cultures and the physical and natural world, along with intellectual and practical skills; and the National Research Council's (NRC's) cognitive domain. Two UC campus examples include:

UC Santa Barbara's general education learning outcomes that advance 21st century skills within the framework of a research university include students being able to:

- Participate in the protocols of scholarly inquiry within and across specific academic disciplines by exploring: how questions are developed; what methods are used for investigation; what evidence is used to explore questions; appropriate conventions of knowledge organization (form, style, syntax, mechanics, citation); the relevance of inquiry for contemporary contexts.
- Locate, interpret, and use sources from academic and vernacular sources (documents, artifacts, performances, etc.) in ways that are appropriate for specific contexts, audiences, and purposes.
- Critically read and interpret qualitative, quantitative, primary, and/or secondary sources to inform inquiry.
- Demonstrate effective strategies to approaching and understanding key concepts and ideas within particular disciplines.
- Articulate understandings of key concepts and ideas through production of texts, performances, or other materials appropriate to the discipline (i.e., documents, artifacts, arguments, performances).

UC Merced's general education learning outcomes cover five main areas:

- "Life at the research university: asking questions" where graduates take an inquiry-oriented approach to the world that reflects engagement with the mission and values of our research university.
- "Reasoning: thinking critically" where graduates are equipped with multiple tools of analysis to support accepting or formulating an opinion or conclusion.

- "Communication: explaining and persuading" where graduates communicate in a variety of ways to diverse audiences.
- "Cultural and global awareness: engaging with differences" where graduates see themselves in relation to local and global cultures and systems of power, past and present.
- "Citizenship: contributing to the public good" where graduates are engaged with their communities for the benefit of society).

General education at UC Merced is designed to extend over four years, regardless of major. In their first year, students take a Spark Seminar, which explores the nature of inquiry through multiple disciplinary and interdisciplinary perspectives and experiences. In their second year, students propose a plan for meeting their educational goals, including coursework in general education, their major, minor, as well as co-curricular experiences. In their third year, students take an upper-division "Crossroads" course that brings the perspectives of two disciplines to bear on a particular topic. In the fourth year, students have a culminating integrative experience in their major. This culminating experience provides an opportunity to integrate students' studies in general education and in the major.

Other curricular examples further develop 21st century skills, including NACE's written communication; the Partnership for 21st Century Learning's (P21's) information, media and technical skills; AAC&U's personal and social responsibility learning outcomes; and competencies along NRC's intrapersonal domain. **UC Berkeley's American Cultures graduation requirement** was established so every student takes a course uniquely designed to teach them to critically engage in important issues within the United States by helping students develop a deeper understanding of race, culture, and ethnicity in the context of American society. These courses are offered across more than 40 departments and programs. Several examples include:

- An English course on American Hustle: Race, Ethnicity, and Dreams of Getting Ahead asks about the desires, imagination, and labor that go into the American dream. What is the relationship between immigration and dreams of upward mobility in America? What are the ways in which people negotiate relationships to the state and to a sense of Americanness through fantasies of economic prosperity and increased possibility—how do some communities come to be figured as "model minorities" and others burdens on the state? Students will develop a critical vocabulary for race, gender, and class in contemporary America and an understanding of their historical antecedents.
- A New Media Graduate Group course on Transforming Tech: Issues and Interventions in STEM and Silicon Valley studies major tech industry controversies and heavily criticized tech products, policies, and effects, including social media platforms' spread of disinformation and fake news, racial bias in algorithms, and internet trolling, and harassment. The course examines tech companies' long-running tendency to exclude women and non-Asian minorities. Students will be required to brainstorm and design their own interventions into the workings of the tech sector to make it more inclusive, equitable, and diverse.
- A College Writing Program course on Reading in and about U.S. Education Institutions has students read, discuss, and write about the expectations of the American educational

system, especially within a multicultural context. The goal is to deepen the understanding of the history and diversity of American educational institutions, while strengthening reading and seminar participation skills through critique and analysis of communication patterns.

At **UC Santa Cruz**, all entering freshmen take a **first-year "core course"** in each residential college as an introduction to university discourse. These core courses are designed to prepare students for the styles of critical reading, thinking, and engagement that they will encounter throughout the university experience, further advancing 21st century skills including NACE's information technology application, P21's information, media and technical skills and NRC's interpersonal domain competencies. The course subject matter is distinct to each college; each course is designed to build unique intellectual communities, bringing entering first-year students together around distinctive themes and questions. An incomplete but illustrative list include:

- Crown College's core course, Ethical Issues in Emerging Technologies, presents several rapidly growing technologies, shows where those technologies are taking us, and provides reasoning skills to help evaluate the consequences to individuals and societies. Students focus on developing strategies that can guide them in making public policy decisions and personal decisions concerning these technologies. The course typically covers ethical issues arising from biotechnology, information technology, and artificial intelligence.
- The Merrill College core course, Cultural Identities and Global Consciousness, examines peoples' struggles to preserve their cultural identities, as well as social change within and beyond the borders of the United States. Students study nationalism, imperialism, migration, globalization, cultural clashes, religious conflicts, and social inequalities. This academic experience is a student's first step to becoming the culturally conscious global citizen.
- The Porter College core course, Writing Across the Arts, addresses social, political, and aesthetic issues raised by selected works of literature and art in a variety of media. Core course instructors and instructional assistants work with freshmen in small groups to develop skills in writing, verbal presentation, and critical reading and analysis.
- Rachel Carson College's core course focuses on California, deepening students' understanding of the vital connections between contemporary social systems and environmental change through lectures, films, readings, writing classes and research, and enabling students to develop reading and writing skills in a seminar format.

Academic program learning outcomes and reviews

Undergraduate education at the University of California not only conveys content knowledge in a particular field of study, but other 21st century knowledge and skills including NACE's teamwork/collaboration; P21's learning and innovation skills, along with information, media and technical skills; AAC&U's integrative and applied learning; and competencies along NRC's cognitive and interpersonal domain. Across the UC system, major programs identify learning outcomes for undergraduates, including the following campus example.

UC Davis's program goals for undergraduate learners in Mathematical Analytics and Operations Research:

- Have a mental habit of logical thinking and familiarity with the tactics of problem solving. Students will be able to estimate the solution to a problem, apply appropriate techniques to arrive at a solution, test the correctness of the solution, and interpret their results.
- Demonstrate a good understanding of rigorous mathematical argument that justifies decisions or analysis. Students will be able to write well-organized and logical mathematical arguments. Graduates will have the ability to ask questions and seek answers when performing quantitative analysis. Graduates will recognize the need for intellectual curiosity and life-long learning.
- An ability to compute with, identify, formulate, abstract, and solve mathematical problems that using a tools from a variety of mathematical areas, including optimization, discrete mathematics, probability, and understanding how the relate to problems from other areas of science, engineering, and management.
- Solid understanding of the many ways applied mathematics can be used to extract data information and for making decisions.
- Familiarity with technology, software, and algorithmic processes necessary in modeling or applications. Confidence with computers and technology necessary to do decision analysis. Graduates will be able to use computers in research, information acquisition, and processing, and use available software as a tool in their work.
- An ability to understand and design mathematical and statistical models for, and analyze data from, a wide variety of sources. An ability to use visualization and statistics tools to expose ideas and solutions.
- An ability to communicate effectively and to function well on multi-disciplinary teams.

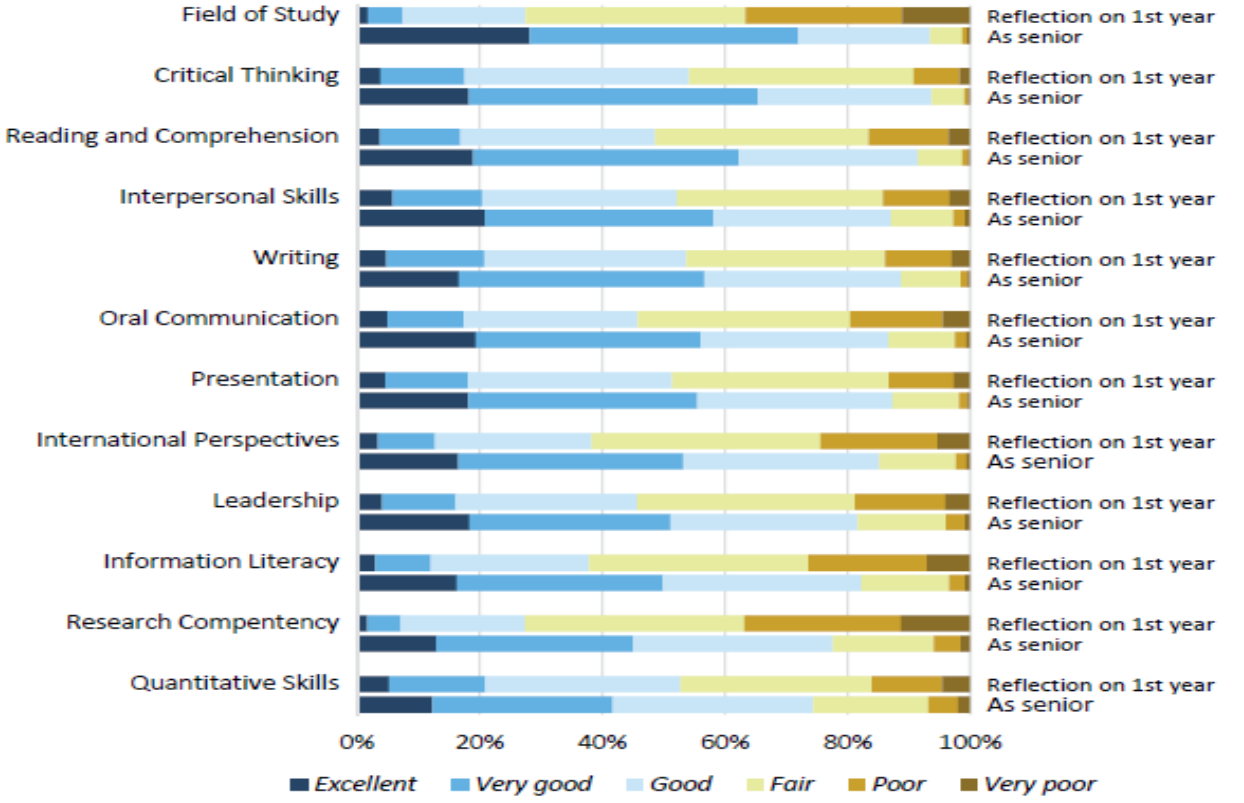
In addition to learning outcomes, the Western Association of Schools and Colleges' Senior College and University Commission (WSCUC) advances 21st century skill development through its "Core Competencies" which include written and oral communication, quantitative reasoning, information literacy, and critical thinking. All institutions receiving WSCUC accreditation must "describe how the curriculum addresses each of the five Core Competencies, explain their learning outcomes in relation to those competencies, and demonstrate, through evidence of student performance, the extent to which these outcomes are achieved."

UC Riverside is exploring 21st century skills at the institutional level through WSCUC's Core Competencies and AAC&U's rubrics for assessing their essential learning outcomes. In academic year 2018–19, as part of its planning for the institutional-level assessment of WSCUC's Core Competencies, the campus asked programs to indicate which of their upper-division courses are reflective of each of the Core Competencies. This list of courses was used to create a map of the courses that address each of the Core Competencies, and this map is being used to obtain samples of student work to assess the Core Competencies. Each year, the faculty teaching courses mapped to that year's competency being assessed will receive a request to provide student work. The student work will be collected and assessed using the AAC&U's rubrics for the essential learning outcomes by a team of faculty and staff. Each academic year, a

new competency will be assessed to support UC Riverside's efforts to develop students' 21st century skills. In academic year 2019-20, the campus assessed Information Literacy.

Campus academic program reviews, which are conducted to maintain and strengthen the quality of undergraduate and graduate degree programs, will often require assessment of student outcomes, including a review of learning outcomes and skill development. The UC Undergraduate Experience Survey (UCUES) provides information on how UC undergraduates view their educational experience, in this case capturing students' perception of how much they have developed along the lines of WSCUC's Core Competencies and other 21st century skills. Figure 1 provides systemwide responses published in the UC Accountability Report comparing skill levels as freshman and senior year. UC students self-reported significant improvements in all areas, including field of study, critical thinking, reading and comprehension, research competency, and understanding international perspectives.

Figure 1: Self-reported skill levels from first year to senior years for seniors that entered as freshmen (Spring 2018)



Source: UC Accountability Report (Indicator 8.1.1)

Table 1 provides similar data by subpopulations and additional detail by campus is available in the UC Information Center. Also, campus institutional research offices will often provide UCUES data by student major to support academic program review.

Table 1: Self-reported skill gains ("Excellent," "Very Good" and "Good") from freshmen to senior year, Spring 2018

	Freshman Year to Senior Year Learning Gains in 21st-century skills					
Student Group	Understanding field of study	International perspectives	Information literacy	Research competency	Reading and comprehension	Critical thinking
All undergraduates	38% → 89%	48% → 83%	44% → 79%	36% → 70%	56% → 89%	59% → 91%
Pell Grant	37% → 88%	46% → 82%	42% → 80%	34% → 71%	54% → 89%	55% → 91%
First generation	36% → 88%	44% → 82%	41% → 80%	33% → 69%	52% → 88%	52% → 91%
Black	44% → 90%	56% → 87%	49% → 83%	39% → 72%	63% → 91%	63% → 93%
Latinx	37% → 90%	46% → 85%	39% → 81%	32% → 70%	53% → 90%	54% → 93%
White	46% → 93%	56% → 87%	51% → 82%	41% → 75%	67% → 94%	75% → 96%
Asian	33% → 87%	45% → 80%	44% → 76%	34% → 67%	53% → 86%	55% → 88%

Source: UC Information Center UCUES data tables

Creation of original content and knowledge

One unique outcome from a UC education is the opportunity to conduct research and complete capstone projects. These experiences can advance 21st century skill development, including NACE's leadership and professionalism/work ethics; P21's life and career, along with information, media and technical skills, and learning and innovation skills; AAC&U's intellectual and practical skills and integrative and applied learning; and NRC's cognitive domain. This work occurs across the UC system, with examples for one campus provided below.

UCLA's first-year experience begins by highlighting **undergraduate research opportunities** and an undergraduate's academic career can end with a **capstone experience.** UCLA has two Undergraduate Research Centers, one for the Sciences and one for the Humanities, Arts, and Social Sciences. These centers provide information and support for undergraduate students seeking research opportunities. The offices hold regular workshops throughout the quarter on getting involved in research and have counselors who can advise students in one-on-one sessions. The research centers hold events during the annual Undergraduate Research Week where UCLA students involved in research can showcase their studies. UCLA students also have an option to receive course credit for their research by enrolling in the Student Research Program course 99, with some research scholarships and grants opportunities.

UCLA's Capstone Initiative recommends that all UCLA undergraduates complete a capstone experience, defined to include not only research, but also creative performances, product designs, community service, and campus leadership projects. UCLA capstones build on a curriculum with core requirements and a progression of electives that lead to a culminating experience. Capstone options also build on the success of existing experiences and allow for broad applicability across UCLA's diverse programs. Certified UCLA capstone experiences must meet five criteria:

1. The project must require the student to engage in a creative, inquiry-based learning experience that deepens the student's knowledge and integration of the discipline.

2. The project may be completed individually or by a group of peers, provided each student is given agency; each student's contribution must be significant, identifiable, and graded.
3. The project must culminate in a tangible product that can be archived (including film, video, etc.) for at least three years by the responsible unit (department or program).
4. The project must be part of an upper-division course of at least four units, usually within the curriculum established for the student's major or minor. Whenever possible, capstone courses and projects should be taught and mentored by ladder faculty.
5. Opportunities must be available or developed for students to share their capstone products (paper, performance, or project) publicly. Examples might be a presentation to a peer audience such as a class, a departmental mini-conference, or a research group meeting; a poster at a department or campus venue or professional meeting; campus music, dance, theater or art event; or a competition that is judged by the professional community in the discipline.

UCLA capstone opportunities cross all disciplines, such as a senior recital for Music majors, an advanced project with senior show presentation for Design and Media Arts majors, field research with a paper for Ecology and Evolutionary Biology majors, a team project with project design for Engineering majors, and a service learning/internship experience for Labor Studies.

Learning experiences outside the classroom

UC educational experience is not limited to the classroom, with students gaining critical skills through extracurricular activities or the residential experience. These opportunities support 21st century skill development, including NACE's leadership, teamwork/collaboration, career management and professionalism/work ethics skills; P21's life and career skills; AAC&U's intellectual and practical skills and personal and social responsibility skills; and NRC's intrapersonal and interpersonal domains.

The Spring 2018 UCUES survey asked students to describe their most memorable academic experience. A number of students cited experiences outside the classroom, for example:

- "I believe one of the most meaningful experiences I have had is the opportunity to interact with students from a wide variety of socioeconomic backgrounds and truly understand my own standing was a very significant experience that greatly adjusted my overall perspective on the world."
- "The opportunity to interact with people who come from a variety of political, religious, and ethnic backgrounds has been the most meaningful experience to me. One example is my roommate whose religious ideas differ from my own. Discussing these different ideas have helped expand our understanding and acceptance for other views."
- "Overall, I think this climate has taught me a lot about myself and has helped me develop who I am as a person and grow. I also think that it has helped me learn about people of diverse backgrounds and experiences. It has taught me to be culturally sensitive and aware. This is meaningful to me and I think this campus offers this opportunity."
- "My participation in the UCDC academic internship program was by far the most influential and meaningful learning experiences of my undergraduate education. I had the

opportunity to develop long-lasting professional relationships, meet and speak with unique and talented individuals and have experiences I would never have had otherwise."

- "The most meaningful experience that I've had would be from when I joined an organization and I was the president, it gave me a great opportunity to learn about being a leader."
- "I was fortunately enough to be part of the No Place Like Home project. I had the opportunity to do field research, along with other students, with our professor. We were able to go into the Santa Cruz community and gather information on renters. There is a housing crisis in Santa Cruz and we wanted to understand what they are going through while rent prices are incredibly high."
- "One of the most meaningful learning experiences that I had was during my research internship last summer. The overall experience was just amazing, I got to learn various research methods, work and engage with PhD candidates one on one and was offered with the opportunity to conduct my own research."

UC campuses recognize students gain critical skills outside the classroom, with a number advancing support for co-curricular activities. **UC San Diego** has leveraged NACE career readiness competencies, AAC&U essential learning outcomes, and WSCUC Core Competencies in establishing its **12 competencies**:

These competencies inform the work of the Teaching & Learning Commons, including its Engaged Learning Tools, which incorporate the competencies, to promote student success and development. Facing outward, they enable students to discover, capture and share with employers and graduate programs a wide range of co-curricular achievements and career readiness competencies developed while at UC San Diego, including creation of a Co-Curricular

Record highlighting student involvement and achievements in opportunities beyond the classroom. Facing inward, they enable more sophisticated academic advising and career planning by mapping student activities onto a set of transferable, real-world skills.

UC San Diego's Career Center highlights these 12 competencies as a way to articulate one's transferrable skills through academic, co-curricular, and experiential learning. Students can schedule appointments with Career Center coaches to identify the competencies already developed, along with ones to strengthen to better position oneself for prospective employers or graduate schools.

UC EFFORTS TO ASSESS AND IMPROVE 21st CENTURY SKILL DEVELOPMENT

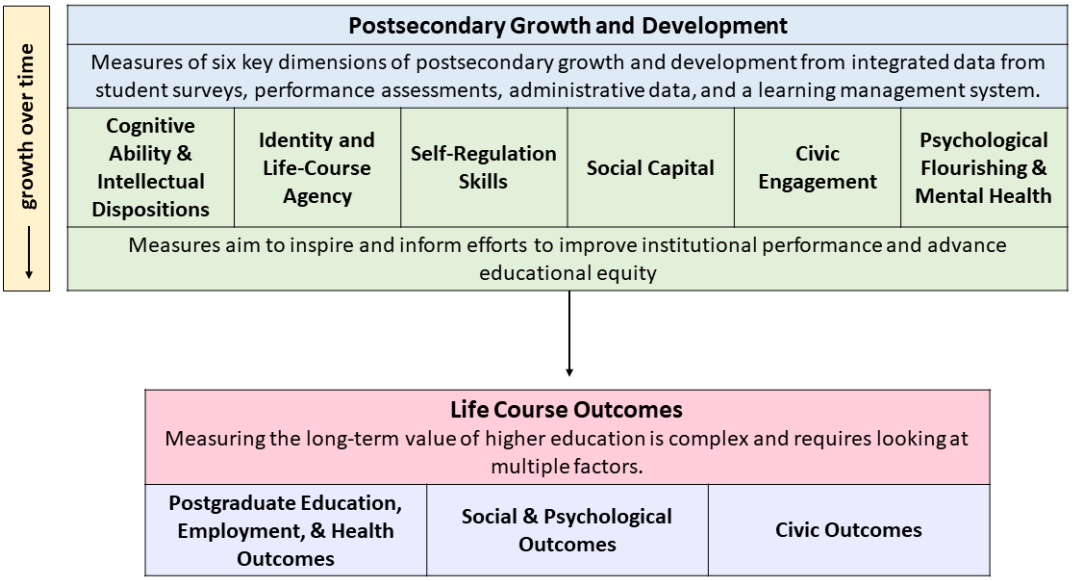
As campus strategies and practices to promote 21st century skills vary, there are systemwide efforts to learn from one another. Vice Provosts and Deans of Undergraduate Education (VPDUE), Vice Chancellors for Student Affairs, Campus Accreditation Officers, Teaching and Learning Center Directors, and Writing Project Directors meet regularly to share best practices and assessment of programs and strategies to advance continuous improvement.

For example, UC Santa Barbara has conducted four major assessments of its general education program since 2009. The fifth assessment, a longitudinal effort, is currently under way. Launched in Fall 2016, the General Education Longitudinal Study investigates both student experience and faculty assessment surrounding four intersecting questions:

- To what extent do students find that specific general education courses achieve the overall goals of the program, and does this change as students make their ways through the general education program?
- To what extent do students find that specific general education courses help them achieve the outcomes of the general education area in which the course is located, and does this change as they make their ways through the program?
- To what extent do faculty find that students are achieving the outcomes of the general education area in which the course is located?
- To what extent do faculty and student assessments of student performance with general education outcomes overlap or diverge?

Campus VPDUEs share results of studies such as this to inform campus efforts to revise general education and learning outcomes. Campus Teaching and Learning Centers are also engaged in research to understand effective strategies to advancing 21st century skills. For example, **UC Irvine's Next Generation Undergraduate Success Measurement Project**, supported by the Andrew W. Mellon Foundation and presented to the Regents at their September 2020 meeting, advances the understanding of the value of undergraduate educational experiences while promoting evidence-based models of undergraduate student success. The project measured six dimensions of student growth and development that were based, some wholly and some in part, in 21st century skills.

Next Generation Undergraduate Success Measurement Project Framework



While this project's primary focus is on the value of educational investments, it has obvious implications for general education programs, learning outcomes, and undergraduate education. At UC Irvine, it has been a source of inspiration for conversation on the aims of their general education program and the methods used have informed discussion on greater educational effectiveness—and educational equity—within the general education program. Research findings are also shared with VPDUE members to help inform programs and strategies across the system.

Conclusion

This item highlights numerous ways UC campuses ensure students are prepared to enter the workforce and 21st century society. It illustrates existing efforts to assess this work and foster systemwide discussions on how the University can remain on the forefront of teaching and learning 21st century skills, in light of the continued social, economic, and scientific challenges faced by the state and nation.

Key to Acronyms

AAC&U	Association of American Colleges & Universities
ASAC	Academic and Student Affairs Committee
NACE	National Association of Colleges and Employers
NRC	National Research Council
P21	Partnership for 21st Century Learning
UCUES	University of California Undergraduate Experience Survey
VPDUE	Vice Provosts and Deans of Undergraduate Education
WSCUC	Western Association of Schools and Colleges' Senior College and University Commission