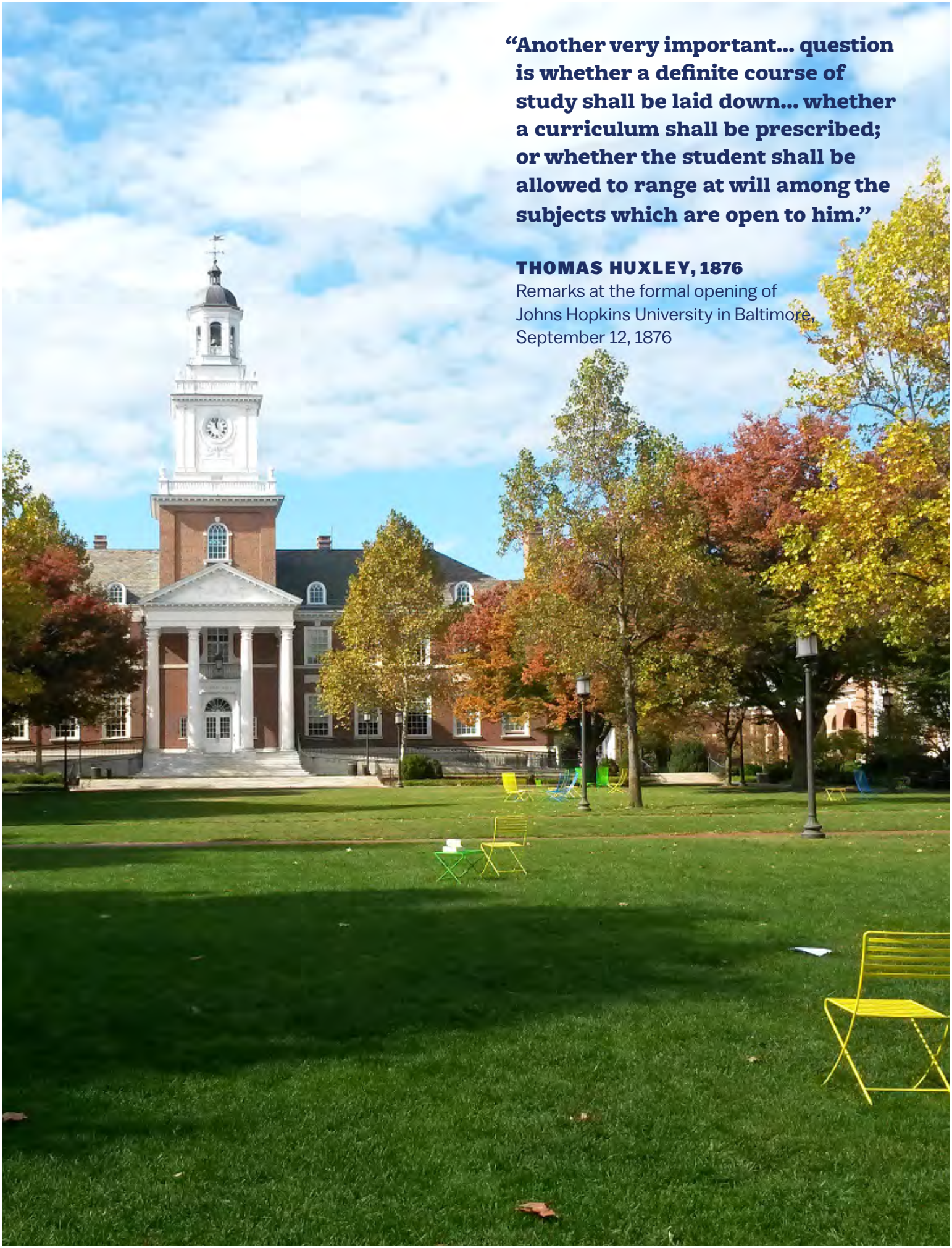
JOHNS HOPKINS
WHITING SCHOOL
of ENGINEERING

WSE CUE2
LAUNCH PLAN

The Whiting School of Engineering Launch Plan in response to Johns Hopkins University's Second Commission on Undergraduate Education

FINAL DOCUMENT



"Another very important... question is whether a definite course of study shall be laid down... whether a curriculum shall be prescribed; or whether the student shall be allowed to range at will among the subjects which are open to him."

THOMAS HUXLEY, 1876
Remarks at the formal opening of
Johns Hopkins University in Baltimore,
September 12, 1876

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Distilled Down to Four

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Glossary of Abbreviations

AA/SC	Academic Advising Success Coach
ABET	Accreditation Board for Engineering and Technology
AMS	Applied Math and Statistics
AY	Academic Year
BME	Biomedical Engineering
CAL	Customized Academic Learning (see page 11)
CaSE	Civil and Systems Engineering
ChemBE	Chemical and Biomolecular Engineering
CLE	Center for Leadership Education
CS	Computer Science
CUE2	Second Commission on Undergraduate Education
DUS	Director of Undergraduate Studies
ECE	Electrical and Computer Engineering
EHE	Environmental Health and Engineering
FA	Foundational Ability (see page 10)
FLI	First-generation and/or Limited Income
HS	Hopkins Semester (see page 27)
JHU	Johns Hopkins University
KSAS	Krieger School of Arts and Sciences
MechE	Mechanical Engineering
MSE	Materials Science and Engineering
NCBW	Non-Course-Based Work
NEST	New Engineering Support Team
OEA	Office of Engineering Advising
SCAA	Success Coaching in Academic Advising Program
UAA	Undergraduate Academic Affairs
WSE	Whiting School of Engineering

Foreword: About this Document

THE INNOVATIONS to undergraduate education recommended in this document are bold. They reconsider the interrelation of education, mentorship, empowerment, and the coming-of-age process. They commit us to redefining engineering education as an entry point to entrepreneurial innovation rather than a process of industrial standardization more apropos of the 19th and 20th centuries. We are confident that the result will better prepare our students for a world of ubiquitous information and relentless transformation where creativity is an essential ingredient for success. Our driving vision is engineering education that is dynamic, accessible, inclusive, and humane. As engineering education develops capacities to repair genetic codes, imbue machines with ethical intelligence, generate energy sustainably, and heal ecosystems, the promise and challenge of our educational systems have never been more existential.

CUE2, the Second Commission on Undergraduate Education convened by Johns Hopkins University in 2017 to reimagine undergraduate education, delivered its final report in 2020. The Whiting School of Engineering (WSE) established its own committees to consider, evaluate, and develop a response and implementation plan to address the CUE2 recommendations. The copy of the WSE CUE2 Launch Plan you are now reading should be clearly marked as being the first draft, second draft, or final document. This document was developed with extensive input and consultation from a broad cross-section of WSE faculty. We will review the first draft with our department heads, the provost's office, and the vice dean for undergraduate education in the Krieger School of Arts and Sciences. The feedback we receive will be incorporated to produce a second draft that will be reviewed by the WSE Faculty Senate and the JHU Student Government Association. Input from that review will be developed into a final document that will be shared with the Homewood Academic Council for endorsement.

This last stage of the work on Foundational Abilities (FAs) and the Hopkins Semester intensely engaged the directors of undergraduate studies. The FA implementation working group comprised six WSE directors of undergraduate studies: Donniell Fishkind (AMS), Eileen Haase (BME), Hari Rajaram (EHE), Julie Reiser (CLE), Rachel Sangree (CaSE), Joanne Selinski (CS), along with Michael Falk (vice dean for undergraduate education, MSE) and Constanza Miranda (assistant dean for faculty undergraduate mentoring, BME). The group met six times between December 2022 and May 2023 to discuss the implementation of the CUE2 Foundational Ability (FA) recommendations starting from the WSE CUE2 Blueprint, itself the output of faculty deliberations during the spring of 2022. The FA implementation group also reviewed the wording of FA learning objectives as recommended by a faculty committee consisting of Ciaran Harman (EHE), Yannis Kevrekidis (ChemBE), Ali Madooei (CS), Feilim MacGabhann (BME), Andy Ross (CLE), and Hari Rajaram (EHE) that met in the fall of 2022. These learning objectives are listed below alongside the FA wording as recommended by CUE2.

The Hopkins Semester (HS) implementation working group comprised five directors of undergraduate studies (DUS): Lilian Josephson (ChemBE), Elizabeth Logsdon (BME), Steven Marra (MechE), Susanna Thon (ECE), and Orla Wilson (MSE) along with Janet Weise (associate dean for undergraduate academic affairs). Lucas Buccafusca (ECE) joined the group in support of Susanna Thon for the last two meetings. The group met five times between January and May 2023 to discuss non-course-based work (NCBW) to develop an implementation plan for the Hopkins Semester recommendation from CUE2. Starting from the recommendations in the WSE CUE2 Blueprint, the

working group considered all existing policies which were discussed at length to determine if changes were needed. Once any changes were agreed upon, the updated policy was brought to a meeting of all the DUS faculty and approved for recommendation.

The Blueprint further recommended the development of a First-Year Seminar (FYS) in multidisciplinary engineering design, created under the guidance of a FYS Design Course Steering Committee to meet CUE2 guidelines. To implement the CUE2 Blueprint's recommendations effectively, a faculty group with design teaching expertise from diverse departments convened to envision a multidisciplinary design First-Year Seminar (FYS) course aligned with the CUE2 report's objectives. This committee's responsibilities included developing a pilot for the fall of 2023, determining credit loads for the course, defining the course parameters. The FYS Design Course working group comprised the following faculty members: Jenna Frye (CLE), Alissa Burkholder Murphy (CLE), and Nusaybah Abu-Mulaweh (CLE) from the Multidisciplinary Design Program, Steve Marra (MechE), Orla Wilson (MSE), Elizabeth Logsdon (BME), Constanza Miranda (BME), Rachel Sangree (CaSE), Lucas Buccafusca (ECE), and Lilian Josephson (ChemBE).

In the fall of 2018, two years before CUE2 issued its final recommendations, the undergraduate academic affairs leadership in the Whiting School of Engineering (WSE), Krieger School of Arts and Sciences (KSAS), and Peabody Conservatory engaged in the Excellence in Academic Advising (EAA) strategic planning process, in consultation with the National Academic Advising Association NACADA[1] and the Gardner Institute.[2] To respond to the CUE2 recommendation that "each Hopkins undergraduate be provided an integrated team of a faculty mentor, an academic advisor, and a life design coach," WSE leveraged the rigorous EAA process to develop its strategic plan for undergraduate academic advising.

Faculty, undergraduate students, professional academic advising staff, directors of undergraduate studies, and departmental academic program staff comprised the committees and working groups which convened over more than a year. These working groups yielded a mission for undergraduate academic advising at JHU and established learning outcomes specific to undergraduate academic advising. These were used as the basis for formal revisions to the undergraduate academic advising model in WSE, including defining roles, expectations, and estimating the cost of implementation. Technology recommendations were also made to improve service delivery as well as proposed mechanisms for professional development for advisors and mentors. More details can be found on the JHU Excellence in Academic Advising website.[3]

The recommendations formulated here are the sustained work of at least 47 WSE faculty members over a period of 18 months starting with the work toward the WSE CUE2 Blueprint and then culminating in these specific recommendations. This work owes a great debt to Associate Dean for Undergraduate Academic Affairs, Janet Weise, for organizing the working groups and contributing to the discussions with her comprehensive knowledge of university policy; as well as to Assistant Dean for Undergraduate Academic Advising, Kimberley Bassett Zing, and Assistant Dean for Faculty Undergraduate Mentoring, Constanza Miranda, for their continuing work on redefining our advising and mentoring systems.

Michael Falk, Vice Dean for Undergraduate Education, Whiting School of Engineering, Johns Hopkins University

[1] https://nacada.ksu.edu/

[2] https://www.jngi.org/

[3] https://advising.jhu.edu/excellence-in-academic-advising

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Motivating Principles

- **essential background**
- **guide to the language used to describe the recommendations**

The recommendations that constitute this plan are motivated by a set of principles that emerged from the CUE2 report and have been further refined in discussions amongst the WSE faculty. This section provides essential background information for understanding these motivating principles and a guide to the language that will be used to describe the recommendations.

ITERATIVE, LONGITUDINAL OPPORTUNITIES FOR GROWTH

One of the key recommendations of CUE2 was to ground a Johns Hopkins undergraduate education in six Foundational Abilities (FAs), and, by doing so, ensure intellectual breadth as well as depth. This system will replace the current distribution system that requires students to select courses tagged as falling within broad disciplinary areas. As noted in the WSE CUE2 Blueprint, an inherent challenge of implementing the FAs is the issue of how to provide a framework that can support diverse learning contexts and modalities inside and outside the major of study, within or beyond the boundaries of a classroom. CUE2 guided the schools to avoid shortcomings that undermine the current distribution requirements. Specifically, CUE2 stated that "the current system does not ensure that students are learning enough about other disciplines to make meaningful connections between and across these disciplines." The commission also articulated a desire that students focus and reflect on their learning rather than becoming engaged in "a hodgepodge, box-checking exercise."

THE FACULTY WHO WRESTLED WITH THIS CHARGE AGREED UPON THE FOLLOWING PRINCIPLES TO GUIDE OUR FA IMPLEMENTATION:

- FAs should be taught early and often because **transformational learning requires iterative, longitudinal opportunities for growth**.
- **Acquisition of FAs must be overseen by expert teachers and mentors**, regardless of whether the FA is in writing, technical skills, the arts, literature, political science, or ethics.
- A great opportunity of the transition to FAs is the ability to **provide students with additional flexibility about how they might demonstrate their achievement of these abilities**. While some recommendations were made for specific course requirements, attainment beyond these courses was envisioned to be possible through mechanisms other than course completion.
- **Accessibility and equity were important watchwords** for designing a system that supports all students, including those who for various reasons struggle to navigate the current institutional structure, and that we are maximizing the potential of each student, not training cookie-cutter students.

The recommendations below engage several innovative strategies to ensure that the FAs in WSE move beyond the prior distribution requirement system. These strategies include the full embrace of customized academic learning and the expectation that every student will develop an ePortfolio highlighting their development as a student, an engineer, and a human being. Documenting and reflecting on the work they undertake while a student in WSE is anticipated to better support student academic achievement, advisement, and mentoring relationship development.

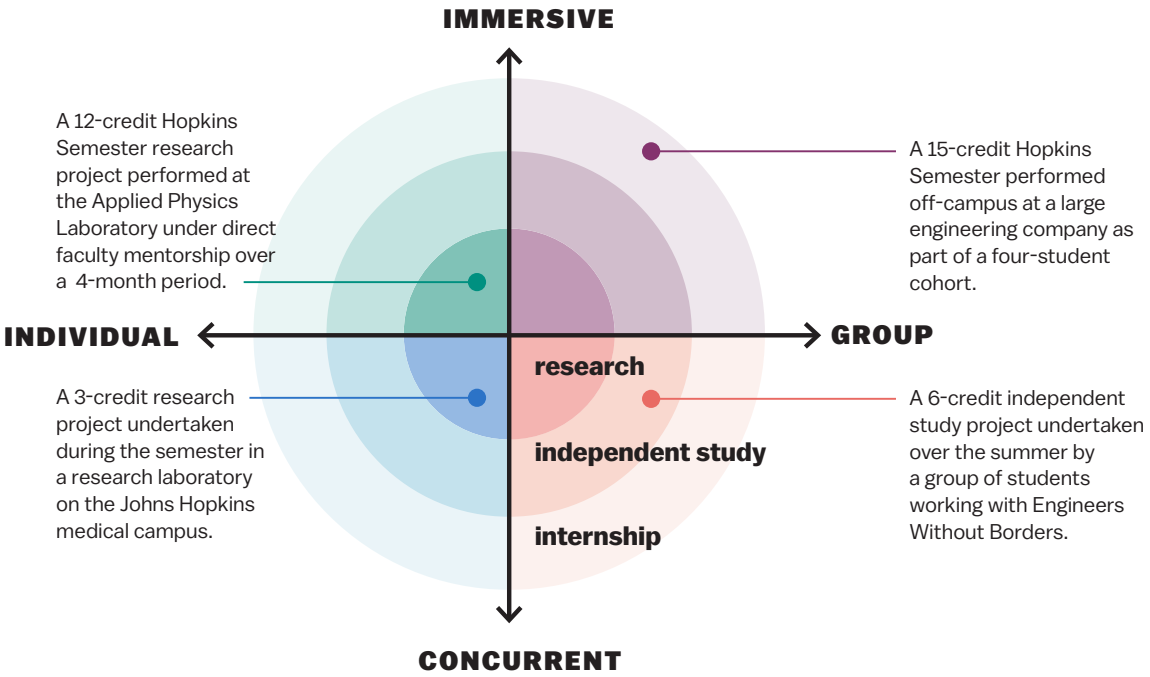
CUSTOMIZED ACADEMIC LEARNING: WSE'S SIGNATURE PRACTICE

THROUGHOUT THIS DOCUMENT, we utilize the term **Customized Academic Learning (CAL)** as an umbrella term for informal learning opportunities that are mentored and assessed by university faculty. As specified in the diagram below, **CAL** broadly includes research for credit, independent study projects, and faculty-mentored internships. These may be done independently or in groups. We refer to CAL undertaken alongside more traditional coursework or over the summer as "concurrent" to distinguish it from a Hopkins Semester (HS), proposed in CUE2 and discussed below, which is optional immersive work undertaken during a fall or spring academic term.

CAL is already ubiquitous in WSE, where upwards of 60% of students engage in research for credit during their time as an undergraduate, based on class of 2020 data. The recommendations in this report redouble our efforts to deploy CAL as our signature practice. The quality and centrality of CAL will increasingly distinguish what it means to have graduated as a Hopkins Engineer. Unlike classroom learning and instructional laboratories, CAL aligns learning objectives with students' interests to leverage unique opportunities for academic engagement.

By using "customized academic learning" to replace "non-course-based work," the terminology used in the discussions by the working groups for the WSE CUE2 Blueprint as well as the DUS working groups that developed this document, we define CAL for what it is rather than for what it is not. This terminology has been vetted by the Joint Administrative Committee on Academic Policies and Procedures that harmonizes policies between WSE and KSAS and will be the terminology used going forward in official publications such as the university catalogue.

Dimensions of Customized Academic Learning (CAL) with examples



TOUCHSTONES FOR STUDENT SELF-REFLECTION: THE CASE FOR EPORTFOLIOS

TO ACHIEVE THE ASPIRATIONS OF CUE2, this document recommends that each WSE undergraduate curates a digital collection of artifacts that characterizes their learning experiences. While written documents would likely be the dominant form of submission one would expect in such a portfolio — essays, theses, research reports, etc. — students may also want to share musical performances, video content, oral presentations, artwork, detailed plans and diagrams, or other evidence of their learning. There is an ever-expanding educational literature regarding the use of "folio thinking" to support student reflections and connections amongst coursework, extracurricular involvement, and work experiences.[4, 5] A number of colleges and universities have systematically incorporated portfolios into their pedagogical practices. Indiana University — Purdue University Indianapolis, notably, utilizes portfolios to support engineering transfer students.[6] Stanford University[7,8,9]

ePortfolio sample, courtesy of student Mareham Yacoub

[4] Cambridge, D., Cambridge, B. L., & Yancey, K. B. (Eds.). (2009). Electronic portfolios 2.0: Emergent research on implementation and impact. Stylus Publishing, LLC.
[5] Chen, H. L., Light, T. P., & Ittelson, J. C. (2011). Documenting learning with ePortfolios: A guide for college instructors. John Wiley & Sons.
[6] Cooney, E. M., Freije, E., & Zhao, M. A. (2020). Using ePortfolios to Facilitate Transfer Student Success. ASEE.; https://et.iupui.edu/departments/tlc/students/eportfolio-option
[7] Chen, H. L., & Black, T. C. (2010). Using e-portfolios to support an undergraduate learning career: An experiment with academic advising. Educause quarterly, 33(4).
[8] Stonaker, J., Cohn, J. D., Carpenter, R., & Chen, H. (2019). Metacognition across the curriculum. ePortfolio as curriculum: Models and practices for developing students' ePortfolio literacy, 169–190.
[9] https://eportfolio.stanford.edu/eportfolio-gallery

University of Washington,[10] and Purdue University[11] have also launched and piloted portfolio systems in engineering contexts. Proponents have promoted such systems as an emerging "high-impact practice."[12]

The plan below recommends that this practice be afforded within WSE by the adoption of an ePortfolio platform. Existing platforms enable easy adoption for diverse users, user-friendly graphic interfaces, portability upon graduation, compatibility with the existing Canvas learning management system, and privacy compliance with FERPA. Under the proposed recommendations, the ePortfolio will have two primary functions: to share and reflect upon development under the guidance of a faculty mentor, and to submit work as evidence of the fulfillment of some FA requirements.

Pertaining to personal reflection and faculty mentorship, students will have the opportunity to broadly incorporate work done within and outside the classroom into their ePortfolio. This curation of a student's learning journey will be instrumental for making purposeful decisions about academic and professional life. Apart from establishing a digital presence beyond social networks, the ePortfolio has the potential for becoming central to how students interact with their mentors, advisors, coaches, and future employers. Students' ePortfolios will provide faculty mentors and professional academic advisors with insight into each student's interests and their emerging life project. While no faculty mentor is likely to be a disciplinary expert in all the areas represented within a student's ePortfolio, a faculty mentor can be instrumental in helping students consider their educational journeys and weighing their choices for future endeavors.

In Fall 2023 WSE undertook a year-long pilot including a trial of the Digication platform while participating in the 2023–24 American Association of Colleges and Universities ePortfolios Institute. Documentation of our experiences and findings from this trial can be found at our ePortfolio "Meet The Flock: The Whiting School of Engineering's Mentoring Initiative" (https://jhu.digication.com/mentoring-initiative-at-wse/introduction)

touchstone

n. Fine-grained black stone upon which objects made of gold or silver can be rubbed to determine their purity.

n. figurative. Anything which serves to test genuineness or value; a criterion or reference point by which something is recognized.

adj. [attributive]. Acting as a reference point by which something is assessed; serving to test genuineness or value.

Ref. Oxford English Dictionary Third Edition, December 2016; most recently modified version published online March 2023

[10] Kilgore, D., Sattler, B., & Turns, J. (2013). From fragmentation to continuity: engineering students making sense of experience through the development of a professional portfolio. Studies in higher education, 38(6), 807-826.
[11] https://www.purdue.edu/cie/globallearning/badges.html
[12] Watson, C. E., Kuh, G. D., Rhodes, T., Light, T. P., & Chen, H. L. (2016). ePortfolios–The eleventh high impact practice. International Journal of ePortfolio, 6(2), 65–69.

Regarding the function of FA fulfillment, one working group noted:
Portfolios allow for various possible modalities to validate a given FA. These could include showing an assessment of a specific project-based assignment from a course or justifying with sufficient details how a particular product produced during research demonstrated certain FAs. This could perhaps be complemented with other evidence such as an evaluation letter from the internship supervisor. For transfer students, a portfolio entry could present how the work completed at a previous institution shows evidence of having achieved a given FA. Each such portfolio submission should be reviewed by a faculty course [or customized academic learning (CAL)] instructor... for assessment and submission. We do not feel that a panel review process is necessary or warranted.

If WSE implements ePortfolios, it seems sensible to leverage all the potential benefits, as these are not mutually exclusive. Here we enumerate the three primary categories of ePortfolio usage:

a. **Coursework and Customized Academic Learning (CAL):** Use in a class, research project, or independent study to document the work product arising from tasks assigned by the faculty or CAL.
EXAMPLE: Descriptive text, graphs, images, video, and other evidence arising from a design, research or independent study project.
REVIEW: Formal by faculty of research or an independent study or by a course teaching team (instructor/TA). Assessment may serve to demonstrate proficiency in a Foundational Ability necessary for graduation or to demonstrate levels of accomplishment to document growth and achievement, e.g. within a research project undertaken over multiple semesters.

b. **Mentoring and Advising:** Use by students to document their learning journey at JHU.
EXAMPLE: Reflective writing making connections between the curricular and co-curricular endeavors students have undertaken. These serve as a window for faculty mentors, academic advisors, and others to engage students in formative conversations and to write meaningful letters of recommendation.
REVIEW: Only informal.

c. **Employability and Professional Advancement:** Use to showcase accomplishments to others outside of the institution.
EXAMPLES: Highlights of design projects undertaken within courses, reflections on teamwork, leadership, volunteer activities, and/or co-curricular participation, presentations to external audiences, as part of business plan competitions, etc.
REVIEW: Primarily informal internal to the institution; possibly formal as part of a hiring or admissions decision.

In this regard, ePortfolios have potential as a mechanism to ensure that student work done toward the attainment of FAs is not a "one-and-done" affair, but instead involves the kind of iterative, longitudinal improvement discussed above. By providing numerous opportunities for practice,

and encouraging students to refine their portfolios, faculty can afford students clear milestones regarding their academic development. The recommendations below anticipate that WSE could define levels of achievement for ePortfolio work submitted for assessment along a scale such as shown in the diagram below.

In this way, assessment would be an invitation for students to aim higher on their next iteration, rather than a failing grade requiring a course retake.

A representative faculty body, the WSE CUE2 ePortfolio Board, will be charged with overseeing the ePortfolio effort by developing a rubric to define the levels of achievement and providing guidelines regarding the minimum requirements for each type of FA ePortfolio entry, e.g. pages for writing, length of oral presentation, assessment of contributions toward group work, etc. This assessment schema will be reviewed by the Directors of Undergraduate Studies and the WSE Curriculum Committee. This body will also convene annually to review a small representative selection of ePortfolio submissions to verify that these standards are being properly implemented, and to provide guidance to the WSE vice dean for undergraduate education regarding the maintenance of assessment standards.

Implementing such an ePortfolio system in WSE would be groundbreaking. Given the potential benefits and risks, systematic and wise implementation will require broad engagement of faculty and students in design, assessment, and iterative improvement.

ASSESSMENT OF EPORTFOLIO WORK

- **development**
  built a substantial foundation for growth
- **facility**
  progressed measurably from prior work
- **proficiency**
  presented evidence of basic capacity
- **mastery**
  demonstrated a capacity to undertake substantial work
- **achievement**
  completed substantial work
- **contribution**
  contributed in a unique and impactful way

“We do not learn from experience... we learn from reflecting on experience.”

JOHN DEWEY, 1933
Dewey received his PhD from Johns Hopkins University in 1884

COMPLEMENTARY SYSTEMS FOR STUDENT SUPPORT: PROFESSIONAL ACADEMIC ADVISING AND FACULTY MENTORING

SEVERAL IMPORTANT PROCESSES were underway at Hopkins when, in November 2020, CUE2 recommended that "each Hopkins undergraduate be provided with an integrated team of a faculty mentor, an academic advisor, and a life design coach." Almost exactly two years earlier, in November 2018, a $1.8 billion gift for undergraduate financial aid from Bloomberg Philanthropies enabled our university to commit to need-blind admissions and to guarantee every student aid free of loans to cover their full need toward the cost of attendance.[13] At the time of this gift, the university committed to increasing the percentage of WSE and KSAS undergraduate students who are first-generation students and/or from limited-income families (FLI). That percentage is now approaching 30%. To support these students, the Bloomberg Philanthropies provided funding to support the buildout by WSE, KSAS, and JHU Student Affairs of our Success Coaching Program in Academic Advising (SCAA) program that now serves all incoming FLI students. This was followed in early 2020 by an announcement that the university had ended the practice of legacy preferences in admissions in 2014.[14]

Earlier in 2018, shortly before the Bloomberg Gift announcement, WSE and KSAS had committed to engage in the Excellence in Academic Advising (EAA) process, a comprehensive review of advising and mentoring practices under the aegis of the National Academic Advising Association NACADA[15] and the Gardner Institute.[16] This process, which kicked off in January 2019, surfaced recommendations for improving academic support services for undergraduate students.

EAA PARTICULARLY HIGHLIGHTED THE FOLLOWING SHORTCOMINGS OF THE EXISTING SYSTEM, WHICH RELIES PRIMARILY ON FACULTY ADVISING OF UNDERGRADUATES.

- Relying on faculty members to provide mentorship in addition to academic advising is a primary weakness of the current undergraduate academic advising model. For faculty, the job of undergraduate academic advising is one of many tasks that compete for their time and attention. Research-active faculty and teaching faculty who serve academic programs with high student-to-faculty ratios struggle to meet the needs of their advisees.
- There is confusion among undergraduate students about the overlap between faculty advisors, professional academic advisors/success coaches, and academic program staff in the departments and centers.
- Undergraduate student-to-faculty and undergraduate student-to-professional academic advisor ratios are too high and limit the depth and quality of critical interactions.
- Developmental connections between student and faculty are critical to a high-impact undergraduate student experience.

[13] https://hub.jhu.edu/2018/11/18/michael-bloomberg-record-financial-aid-gift/
[14] https://hub.jhu.edu/magazine/2020/spring/ending-legacy-admissions/
[15] https://nacada.ksu.edu/
[16] https://www.jngi.org/

As a result of these findings and in light of the CUE2 report, it was recommended that faculty assume the role of mentor and engineering role model, and professional academic advisors assume the primary responsibility of curricular advising for undergraduate students. Faculty mentors will meet with undergraduate students regularly, facilitating reflective conversations relevant to shaping students' lives and aspirations. Professional undergraduate academic advisors will engage with undergraduate students to assist with course selection for timely registration, promote their personal and academic development, ensure university policy compliance, and certify degree completion and graduation clearance. This will improve the faculty-student interaction in several ways:

- **By decoupling faculty mentoring from registration, mentor-mentee meetings can focus on reflective conversations** guided by an emerging literature on mentorship such as the 2019 National Academies of Sciences, Engineering, and Medicine publication "The Science of Effective Mentorship in STEMM" (https://doi.org/10.17226/25568). These sessions can also happen in a less restricted time frame.

- Assigning faculty mentors within school-wide parameters will **ensure that students receive similar attention from mentors whose caseloads are balanced**.

- **Workshops for both faculty and students will be developed** to clarify mentorship expectations and build the skills necessary for successful mentorship interactions.

- **The faculty mentor role will be that of a "startup mentor" who teaches how to be mentored**. In this way, we will explicitly acknowledge that the faculty mentor will be only the first of many mentors with whom a student will need to establish relationships to succeed. By acknowledging this, we relieve faculty mentors from the unrealistic expectation that they can meet all of a student's mentorship needs.

Significant staff hiring and leadership development has been undertaken within WSE Undergraduate Academic Affairs (UAA) to support the implementation of the EAA recommendations. This will connect students to professional academic advisors with significantly lower caseloads who will serve alongside the SCAA academic advising success coaches to provide world-class support in navigating the university, a complex institution offering abundant opportunities. It will also **furnish each department with a lead professional academic advisor.** This champion for student success will consult with the department about student support concerns in coordination with the department's Director of Undergraduate Studies and Academic Program Coordinator. Building this relationship between the UAA office and the departments' undergraduate leadership teams is a high priority in the new system.

Recommendations

1. **First-Year Seminars**
2. **Undergraduate Advising and Mentoring**
3. **Foundational Abilities**
4. **Hopkins Semester**

This section contains the recommendations for implementation of CUE2 school-level policies and graduation requirements for engineering undergraduates. It is recommended that, once these school-level requirements are established, overlapping major requirements that further restrict their fulfillment only be permitted with approval of the WSE vice dean for undergraduate education.

1 First-Year Seminars

First-Year Seminars

Background

The CUE2 report recommends a required first-year seminar to invite students into intellectual life and set them on a pathway toward developing their foundational abilities. Interdisciplinary exploration and a strengthened sense of student community were among the goals such a seminar would help to achieve. The WSE CUE2 Blueprint identifies two common aspirations for this first-year seminar: building cohort and community to support student success, and providing early interdisciplinary exploration contextualized in "design." Below are the summarized recommendations, including the development of an engineering design-based first-year seminar.

Given the multidisciplinary nature of the proposed course, an inclusive design approach has been deployed in its development. The research process began with a series of interviews with key stakeholders, including: faculty connected to design cornerstone courses in WSE, first-year students, and students taking capstone design courses. The vice dean for undergraduate education provided consultation throughout the process. These interviews served to develop a set of guiding questions and curricular considerations. Relevant literature was reviewed. The Center for Teaching Excellence and Innovation was consulted, guiding the use of the "backwards design" approach to develop the curriculum.[17] The working group identified course learning outcomes and created an assessment plan to measure learning outcomes. Finally, we planned a sequence of lessons, projects, and experiences that prepare students to successfully meet established learning objectives.

The fully developed pilot plan can be found in Appendix F. Assessment was undertaken in spring 2024. The revised course will be scaled up in the fall of 2024 to serve one-third of the WSE entering class on the assumption that one-third will choose to take discussion-based first-year seminars which will also be offered. A similarly sized offering in spring 2025 will serve those students who did not enroll in a first-year seminar the previous fall, students who need to retake the class, and students who opted for the discussion-based first-year seminar but who also feel they would benefit from an introduction to engineering through design.

[17] Bowen, R. S. (2017). Understanding by Design. Vanderbilt University Center for Teaching. Retrieved from https://cft.vanderbilt.edu/understanding-by-design/

1 FIRST-YEAR SEMINARS

1.1 First-Year Seminar Requirement

All WSE primary majors, starting with the class entering in the fall of 2024, will be required to complete a first-year seminar with a grade of S. Students may choose a discussion-based first-year seminar offered by either KSAS or WSE or an engineering design-based first-year seminar offered by WSE. Major requirements may not restrict students to a particular type of first-year seminar with the exception of Biomedical Engineering, which is anticipated to require the completion of a design-based first-year seminar. The first-year seminar requirement will be waived for students who transfer into the Whiting School of Engineering after the first year.

1.2 Discussion-Based First-Year Seminars

Discussion-based first-year seminars are three-credit courses offered with a S/U-only grading option. Their enrollment target is 12 students. Students may only enroll in one discussion-based first-year seminar. They are only offered in the fall term.

In the fall of 2023, WSE offered 13 discussion-based first-year seminars, sufficient to accommodate 156 students, approximately one-third of our entering class. We will continue to refine and adjust the kind and number of offerings to meet the demand of our students for this version of first-year seminar. We aspire to achieve a system in which students from both schools may enroll in a discussion-based first-year seminar in either school. Such a system would afford the broadest range of intellectual options and provide students with opportunities to interact with peers from across the entire first-year Homewood undergraduate class.

1.3 Engineering Design-Based First-Year Seminars

The engineering design-based first-year seminar is a two-credit course offered with a S/U-only grading option that was piloted in fall of 2023. The full details of the engineering design-based first-year seminar pilot are provided in Appendix F. The initial offering served 11 first-year students. After assessment and revision in the spring of 2024, the course will be scaled to meet the anticipated demand, approximately 300 students, and section sizes will be increased to 15 students, requiring 20 sections. Each department will be expected to devote a mix of teaching-track and tenure-track faculty to this effort. Students who do not satisfactorily complete a first-year seminar in their first year may petition to enroll in an engineering design-based first-year seminar in their second year.

2 Undergraduate Advising and Mentoring

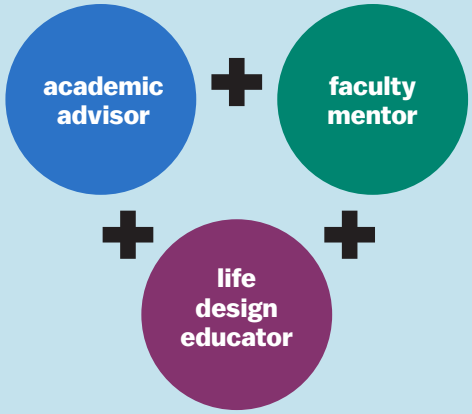
Student Advisory Board for the ePortfolio Pilot in AY 2023/24

Undergraduate Advising and Mentoring

Background

As described in the Foreword and Cross-Cutting Concepts portions of this document, the recommendations below flow from the Excellence in Academic Advising (EAA) process. These yielded a mission for undergraduate academic advising at JHU and established learning outcomes specific to undergraduate academic advising. Appendix G contains the mission statement, and Appendix H contains the learning outcomes for JHU Academic Advising.

NEW ENGINEERING SUPPORT TEAM (NEST)



The working groups considered the following guidelines in developing recommendations for the new structure for undergraduate academic advising.

- Honor the Whiting School's commitment to **deliver a world-class undergraduate academic experience**
- **Respect the school's deep departmental identity**
- Ensure **every student is assigned at least one WSE faculty mentor**
- **Centralize all undergraduate major academic advising** functions in the WSE Office of Engineering Advising
- Provide each academic department with the **highest level of service** from WSE Undergraduate Academic Advising
- Ensure that **every student will receive the same standard of care**
- **Eliminate single points of failure** where possible and cross-train all undergraduate professional academic advisors and academic advising success coaches on all WSE curricula

The New Engineering Support Team (NEST) undergraduate academic advising model proposed for WSE supports the holistic development of the student while honoring the Whiting School's deep departmental identity. A system was envisioned where students are advised by a team consisting of a faculty mentor, a professional academic advisor or academic advising success coach, and a life-design educator who work closely with one another and the department's director of undergraduate studies and academic program staff in coordination with the assistant dean of undergraduate academic advising and the assistant dean for faculty undergraduate mentoring.

2 UNDERGRADUATE ADVISING AND MENTORING

2.1 Establish clear roles within the NEST undergraduate academic advising model

WSE Office of Engineering Advising (OEA): Embedded in WSE Undergraduate Academic Affairs, the Office of Engineering Advising, provides curricular advising and general academic support to all undergraduate engineering students.

In the NEST undergraduate academic advising model, the Office of Engineering Advising will:

- onboard incoming first-year and transfer students and facilitate course registration
- oversee degree completion, including degree clearance, for all undergraduate engineering students
- administer academic standing determination for undergraduate engineering students each term
- develop and implement academic interventions for undergraduate students
- facilitate the External Course Review process
- establish policies and procedures to support undergraduate curricular advising
- compile and distribute data on student success (i.e., academic standing, course performance trends, and student engagement) for academic departments and other university partners
- provide systems and technologies to support academic advising operational functions
- supervise the professional development and coaching of academic advising staff

Professional Academic Advisor: Professional academic advisors are assigned to students upon matriculation and maintain a durable relationship with them during their time at Johns Hopkins. Each professional academic advisor is closely affiliated with only one or a small number of academic departments.

Professional academic advisors will:

- assist with course selection and timely registration
- ensure university, school, and departmental academic policy compliance
- certify degree completion and graduation clearance
- engage with undergraduate students to promote their personal and academic development

The professional academic advisor-to-student ratio will be approximately 175:1.

Most professional academic advisors will serve as a **lead advisor** to a department. The

lead advisor becomes an expert in advising students pursuing those programs. The lead advisor coordinates closely with the department or academic program through the academic program staff and director of undergraduate studies of those departments, particularly on the development of the undergraduate advising manual. For most departments (AMS, CaSE, ECE, EHE, MSE, ME) students who declare their major at matriculation will be served by the lead advisor. As academic advisors may advise undergraduate students from multiple departments, they will be trained on all WSE undergraduate curricula. The lead advisor is also the expert responsible for cross-training professional academic advising staff on the nuances of the curriculum for the department for which they serve as the lead.

Academic Advising Success Coaches (AA/SC):

AA/SCs are professional academic advisors who support first-generation and/or limited income (FLI) undergraduate students. Their caseloads are significantly smaller because they engage FLI students in a success coaching curriculum in addition to serving as the single point of contact for all their academic advising needs. The academic advising success coach-to-student ratio will be approximately 80:1.

Director of Undergraduate Studies (DUS):

The DUS, or their designee, will remain responsible for the following undergraduate academic advising tasks:

- transfer course review and articulation
- departmental academic policy interpretation and review
- production of departmental undergraduate advising manual in coordination with academic program staff and lead advisor
- departmental new student orientation
- faculty mentor assignments

DUS faculty may also have other responsibilities as assigned by their department head.

Academic Program Staff (departmental):

The academic program staff will continue to:

- advise minors
- manage course production
- produce departmental undergraduate advising manual in coordination with DUS and lead advisor
- maintain departmental entries in the university catalogue
- manage course TA assignments
- manage departmental new student orientation
- organize departmental involvement in student-centered events such as Design Day

Faculty Mentor:
Faculty mentors aid students in their engineering identity development. Mentors focus on providing:

- academic guidance related to learning opportunities
- reflection regarding academic socialization, personal development as an engineer, and professional growth
- an opportunity for students to practice the skills needed to develop a relationship with a mentor
- a supportive engineering role model

2.2 Faculty assume the role of mentors
Beginning in AY 2024/25, faculty will shift their attention to the mentorship of undergraduate students as described above. This has been enabled by the provisioning of professional academic advisors and academic advising success coaches who will assume the primary responsibility of curricular advising for WSE undergraduate students.

2.3 Design and delivery of mentoring workshops for faculty
A skill-based modular curriculum for WSE faculty will be created and implemented by WSE UAA taking the results of the field research process into account. This will take the form of short in-person workshops as well as online supporting materials.

Faculty mentors will be prepared to serve as "developmental mentors" who can assist students with their transition to college and intellectual life in the Whiting School. Mentors serving first-year students will be prioritized for training starting in Spring 2024. Mentors transitioning into the role who had formerly served as faculty advisors will receive training starting in Fall 2024. Mentor workshops will be based on an existing and emerging base of academic literature in this area.[18]

2.4 Design and delivery of a mentoring curriculum for undergraduate students
WSE UAA will design a skill-based workshop to clarify the expectations for being mentored including how to document their educational journey, engage in reflective practices, and develop proper etiquette to become a successful mentee.

2.5 Establish a standard mentee-to-faculty mentor ratio and frequency of meetings
To establish equitable student access to faculty mentoring an expectation will be established that mentors meet with any first-year students twice per semester and students beyond their first year at least once per semester. To further establish balanced faculty mentoring caseloads, the number of required in-person one-on-one sessions per mentor will be capped at 26 with a target that mentors average 15 required sessions per year over any 4-year window. Each department will be afforded the flexibilty to allocate faculty mentoring roles within these guidelines. It may take several years to achieve the target of fewer than 15 required sessions per

[18] National Academies of Sciences, Engineering, and M. (2019). The Science of Effective Mentorship in STEMM. The National Academies Press. https://doi.org/10.17226/25568

year per mentor as we transition to the new system and grow our faculty. In some cases, departments with high student-faculty ratios may partner with other departments to serve their first-year students. The mentors for these first-year students may be drawn from both the Center for Leadership Education and departments with disciplinary overlap. Mentorship session frequencies and caseloads will be assessed to inform program development and may be adjusted over time.

WSE UAA will contact each department's DUS in January to request the names of faculty mentors who can be assigned to mentor first year students. Matching first-year students with faculty mentors will be managed by the Undergraduate Academic Affairs office. In departments where reassigning students to faculty members in their interest area after their first year is a practice, these reassignments will be managed by the departments.

Because of the importance of durable mentoring relationships, we do not anticipate re-assigning current students to new mentors upon transitioning to the new system. Rather, our current students' faculty advisors will transition to a faculty mentor role. Departments may, at their discretion, reassign students to rebalance faculty mentor caseloads as they see fit, keeping in mind the potentially disruptive impact of such reassignments. Workshops to train faculty transitioning to the faculty mentor role from their faculty advisor role will be launched in Fall 2024.

2.6 Deploy ePortfolios as a window into each student's academic and professional development

In the fall of 2023, WSE completed a year-long pilot and a trial of the Digication platform while participating in the American Association of Colleges and Universities 2023-24 ePortfolio Institute. As discussed on pages 12–15, ePortfolios afford:

- showcasing and reflecting on integrative work in curricular, co-curricular, and extra-curricular settings
- documenting and assessing learning experiences undertaken through CAL, as described above
- construction of a life project, an internationally researched framework that enables holistic discussion and reflection about the future across the various dimensions of a student's life

Documentation of our experiences and findings from this trial can be found at our ePortfolio "Meet The Flock: The Whiting School of Engineering's Mentoring Initiative" (https://jhu.digication.com/mentoring-initiative-at-wse/introduction)

2.7 Develop a system for communication and accountability within the new mentoring system

One persistent concern voiced by both faculty and students is the desire for accountability to ensure that students meet with their faculty mentors. Another question has been whether faculty mentors will be engaged in advisement on critical matters that involve navigating the

content of the curriculum. We will implement the following solution to these concerns:

- At the start of each term the school will place a HOLD on registration that can be lifted by the student's academic advisor and a faculty mentor meeting ALERT that can be lifted by the faculty mentor.
- Faculty mentor meetings will be expected to happen in the first nine weeks of the term, and faculty mentors should release their ALERT at that time.
- Academic advisors will send all students a reminder to meet with their faculty mentor.
- Academic advisors will meet with students during the advising period, the 3 weeks prior to registration, but advisors will not release the registration HOLD unless the student's mentor ALERT has been lifted or extenuating circumstances arise.
- First-year students' faculty mentor ALERT will be placed back on their accounts at the end of the registration week.
- First-year students will not be able to see their grades in SIS early unless the faculty mentor ALERT has been lifted.
- Academic advisors will cc the student's faculty mentor on emails to students summarizing any discussions they have relevant to navigating the content of the curriculum. This will include discussions of which course(s) to drop at times of academic distress and alternative/ exceptional pathways toward degree completion that would require approval of the department.

2.8 Develop ad hoc mentoring systems within departments with second majors and minors

While each student will have an assigned mentor from their primary major department, they may have questions from other departments related to a second major or minor of study. Each department will designate faculty to address questions that students pursuing second majors or minors may have related to navigating the content of the curriculum.

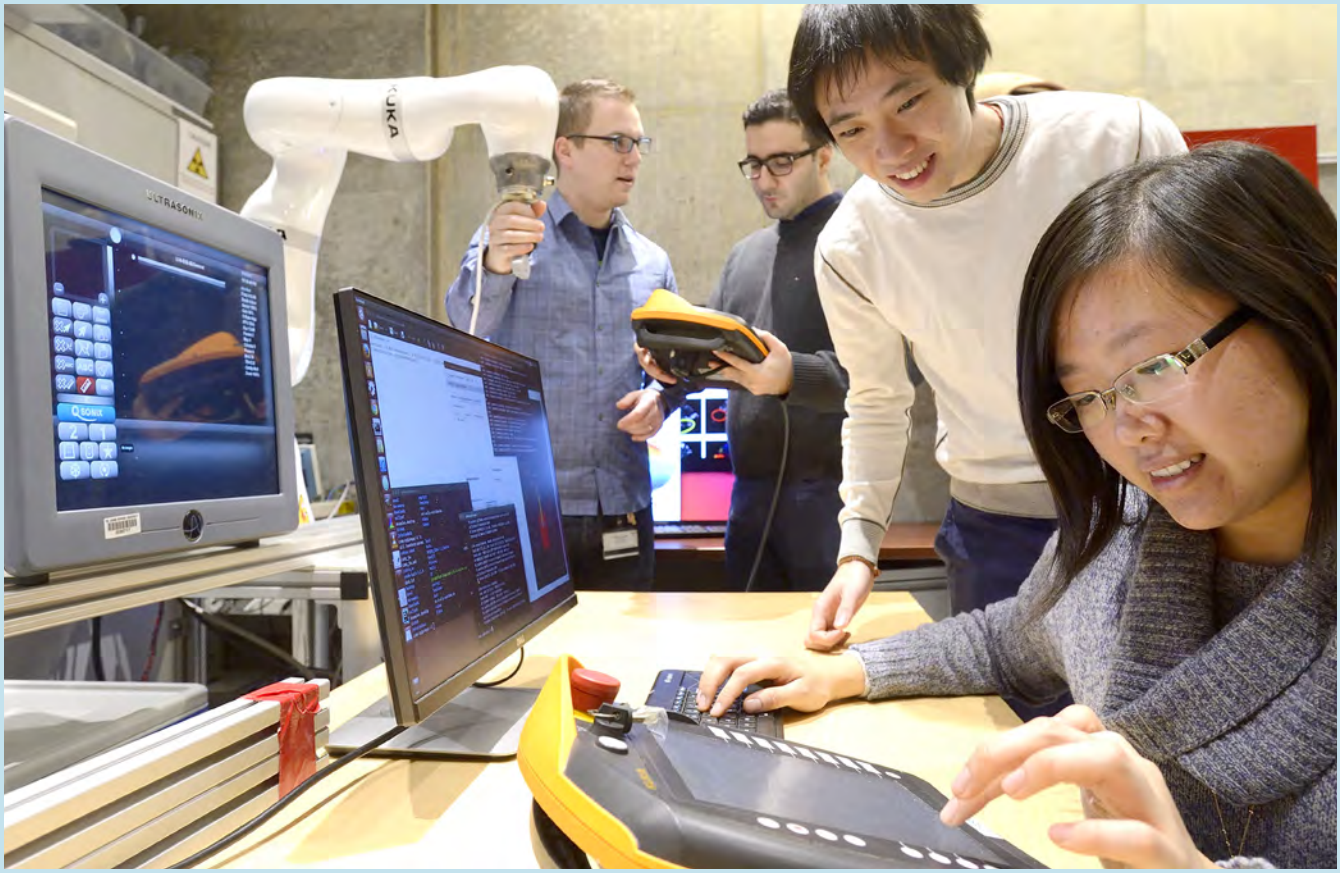
2.9 Coordinate and orchestrate with pertinent units around Johns Hopkins

The Office of Engineering Advising will work in coordination with units such as JHU Student Affairs, the Center for Student Success, the Life Design Lab (formerly Career Services), the Center for Teaching Excellence and Innovation, and the Center for Design and Learning Technologies to increase impact and coordination in student support through advising, mentoring and coaching.

2.10 Undertake annual formative assessment of the advising and mentoring systems and revise policies in response to these assessments

Our advising and mentorship systems will be be assessed annually. These assessments will be used to adjust various aspects of the system including but not limited to: student satisfaction, student and mentor engagement, achievement of advising learning objectives, adequacy of advisor caseloads, frequencies of required mentor meetings, and accountability procedures.

3 Foundational Abilities



Foundational Abilities

Background

THE WSE CUE2 BLUEPRINT made several recommendations for FA implementation that pointed to a multi-modal implementation that consisted of course requirements, enrollment in courses chosen from designated groupings, and an ePortfolio requirement. While the first two of these are common and familiar to most faculty, ePortfolios are a newly emerging high-impact educational practice[19] related to a traditional portfolio common in writing, rhetoric and composition, fine arts, and architecture programs, that seek to foster longitudinal reflection on student learning. Since this practice was less familiar to faculty, a good amount of the deliberation of the committee focused on understanding the affordances of ePortfolios, particularly their benefits and burdens. It is worth noting that an ePortfolio is also considered in section 2 of these recommendations as a supporting technology for devising a faculty undergraduate mentoring system. Therefore, implementing FAs within such a system could foster synergies between degree satisfaction and mentorship.

[19] Watson, C. E., Kuh, G. D., Rhodes, T., Light, T. P., & Chen, H. L. (2016). ePortfolios–The eleventh high impact practice. International Journal of ePortfolio, 6(2), 65–69.

The following aspirations and practices will guide the implementation of the Foundational Abilities for undergraduates matriculating in 2025 and beyond.

Develop a T-shaped curriculum;
The committee endeavored to align its recommendations with the CUE2 report's emphasis on developing a T-shaped education. The authors of that report noted that "T-shaped education affords students with the opportunity to develop deep disciplinary knowledge in at least one area as well as the competencies associated with forming connections between disciplines that allows them to become adaptive innovators."

Build connections across students' pursuits in engineering with linkages to their wider education and personal growth: The committee believes that implementing an ePortfolio will align with the CUE2 aspiration that the WSE FA implementation be more than a "box-checking exercise," a major criticism of our current distribution requirement. It has the potential to foster students' academic and professional identities, self-reflection on their growth, and sharing of their accomplishments in pursuit of their careers and broader aspirations.

Allow for flexible fulfillment of FAs through Customized Academic Learning (CAL):
The CUE2 Final Report and the WSE CUE2 Blueprint support providing opportunities that encourage students to pursue independent inquiry through CAL and/or a HS as a mechanism toward the fulfillment of the FAs.

Pursue an implementation timeline that permits deliberative review by faculty bodies: At the recommendation of the WSE Faculty Senate, **Foundational Abilities requirements will be planned for implementation starting with the class matriculating in Fall 2025**. This timeline will permit the establishment of criteria that will be used to determine the scope, expected proficiency, and assessment mechanisms for the artifacts that must be submitted via ePortfolios. In addition, individual departments and the senate will have an opportunity to review and provide feedback on these plans.

Establish two new school bodies to guide and sustain FA implementation. Both will be chaired by the Vice Dean for Undergraduate Education and served by the Associate Dean for Undergraduate Academic Affairs in an ex-officio manner.

The WSE CUE2 Implementation Advisory Committee will be comprised of a Faculty Senate liaison, two additional faculty, and at least one student, one departmental academic program administrator, and one representative from undergraduate academic advising. This body will deliberate plans as they are finalized and review the results of early assessments. This body will be dissolved no sooner than two years after initial implementation of all CUE2 recommendations.

The WSE ePortfolio Board will be comprised of five faculty with two-year terms that rotate among the WSE academic departments and one faculty member from the Center for Leadership Education. This board will articulate and oversee the academic aspects of ePortfolio implementation going forward in perpetuity.

The requirements presented in this section are initial recommendations that will be refined prior to formal adoption and publication in the 2025/26 university catalogue.

3

FA1: WRITING AND COMMUNICATION

Students should recognize the importance of language and have a command of it as readers, writers, and speakers.

LEARNING OBJECTIVES

- Students will demonstrate the ability to communicate effectively in different modes including, but not limited to, written and oral forms.
- Students will demonstrate the ability to adapt to varied audiences and purposes.
- Students will demonstrate the ability to understand and interpret the communications of others.

3.1 Written and Oral Communication Foundational Coursework for FA1

All WSE primary majors will be required to earn a letter grade of C- or better in both a three-credit course in written communication and a three-credit course in oral communication or to demonstrate equivalent proficiency through a transfer course equivalency.

- Students will have the flexibility to take the written communication course from KSAS or WSE (CLE).

- A CLE written communication course will be developed that will also partially satisfy the foundational requirements of FA5, Ethical Reflection. (see Appendix A) This will align with the accreditation requirements of our ABET accredited programs.

- Students will be required to take a CLE oral communication course. (see Appendix A). This course will also partially satisfy the foundational requirements of FA4 in diversity, equity, and inclusion. The associated learning objectives will align with newly proposed accreditation requirements of our ABET programs.

3.2 FA1 via Written and Oral Communication within the Disciplines in the ePortfolio

All WSE primary majors must further demonstrate their capacity for writing and oral communication within their engineering coursework by completing at least one writing sample and one oral communication sample that have been independently assessed to demonstrate the ability to communicate effectively, the ability to adapt to varied audiences and purposes, and the ability to understand and interpret the communications of others.

- This work may be completed as part of a student's engineering coursework or through CAL.

- Each department will articulate which courses will include these assignments

and may work with CLE to develop the assignments and assessment rubrics.

- It is recommended, but not mandated, that courses that contain ePortfolio assignments designed to satisfy FA1 be sequenced after the written and/or oral communications foundational courses described in requirement 3.1.

- Students must submit evidence of this work to their ePortfolio, and this work must be deemed to demonstrate proficiency by the course or CAL instructor.

- An ePortfolio submission that demonstrates learning outcomes relevant to multiple FAs may be assessed with respect to all applicable criteria and satisfy multiple FA requirements.

3

FA2: SCIENTIFIC AND QUANTITATIVE REASONING

Students should develop facility with scientific, numerical, and algorithmic reasoning and be able to use computational and analytical methods.

LEARNING OBJECTIVES

- Students will demonstrate the ability to reason scientifically and quantitatively.
- Students will demonstrate the ability to both construct and evaluate arguments and hypotheses as supported by data, sound theory, and evidence.

3.3 Required Mathematics, Science, and Computing Foundations for FA2

All WSE primary majors enrolled in B.S. programs will be required to earn a letter grade of C-, S or better in the following courses or demonstrate proficiency in the subject areas covered in the course through an approved placement examination, transfer course equivalency, or AP credits.

- Calculus I
- Calculus II
- Probability and Statistics (together or separately)
- Gateway Computing
- One introductory-level physics, chemistry, or biology course with associated laboratory

See Appendix B for examples of JHU courses in each of these areas.

3.4 Optional Evidence of FA2 Advanced Proficiency in the ePortfolio

Students are additionally encouraged, but are not required, to demonstrate advanced proficiency in FA2 by submitting artifacts to their ePortfolio.

An ePortfolio submission that demonstrates learning outcomes relevant to multiple FAs may be assessed with respect to all applicable criteria and satisfy multiple FA requirements.

3

FA3: CREATIVE EXPRESSION

Students should recognize the importance of complex creative expressions and cultivate their intellectual and emotional responses to aesthetic and cultural experiences.

LEARNING OBJECTIVES

- Students will demonstrate the ability to interpret complex creative expressions, in some cases by undertaking such endeavors themselves.
- Students will demonstrate the ability to articulate the cultural, historical, and contemporary contexts of these works along with their social and cultural implications.

FA4: ENGAGEMENT WITH SOCIETY

Students should engage effectively as citizens of a diverse world informed by an understanding of historical inequities, bigotry, prejudice, and racism in our society.

LEARNING OBJECTIVES

- Students will demonstrate the ability to engage effectively and thoughtfully with societies in which they live and work and with people of different cultures, backgrounds, and values.
- Students will demonstrate the ability to understand how history and current events inform efforts to make societies humane, equitable, and unprejudiced.

3.5 Credit Requirement for FA3 and FA4

All WSE primary majors enrolled in B.S. programs will be required to earn a grade of S or C- or better in 12 credits of coursework and/or CAL in these areas. All WSE primary majors enrolled in B.A. programs will be required to earn a letter grade of C- or better in 12 credits of coursework and/or CAL in these areas. All WSE primary majors must earn at least three of these credits in the areas of FA3 and at least three of these credits in the areas of FA4.

3.6 FA3 or FA4 via Coursework

WSE primary majors satisfying FA3 or FA4 through coursework must do so by undertaking coursework labeled as satisfying FA3 or FA4 and achieving grades as described in section 3.5. Students pursuing this option may, but are not required to, further demonstrate proficiency in FA3 or FA4 by submitting a coursework sample to their ePortfolio.

3.7 FA3 or FA4 via Customized Academic Learning in the ePortfolio

WSE primary majors satisfying a portion of their FA3 or FA4 requirement through CAL must do so by undertaking work under a faculty member deemed to have demonstrated expertise in this area who assesses the work to demonstrate proficiency in FA3 and/or FA4. This option requires that the work assessed by the faculty instructor of the CAL be included in the student's ePortfolio. For work in the fine or performing arts satisfying FA3, the faculty instructor may be from a suitable partner school such as the Peabody Conservatory of Music or Maryland Institute College of Art.

An ePortfolio submission that demonstrates learning outcomes relevant to multiple FAs may be assessed with respect to all applicable criteria and satisfy multiple FA requirements.

3.8 Diversity, Equity, and Inclusion in Professional Practice as part of FA4

All WSE primary majors are required to demonstrate capacity to constructively engage with issues of diversity, equity, and inclusion as they relate to professional practice. This requirement aligns with newly proposed accreditation requirements of our ABET programs. This may be satisfied through their required Oral Communications course (see Appendix A) or other coursework or CAL that incorporates the required learning outcomes.

3

FA5: ETHICAL REFLECTION

Students should be reflective, effective ethical agents.

LEARNING OBJECTIVES

- Students will demonstrate the ability to act with ethical agency in their personal and professional lives by exploring various perspectives along ethical, moral, and social dimensions and applying these considerations to their decision-making.

3.9 Ethics Foundational Coursework for FA5

All WSE primary majors must earn a grade of C-, S or better in a course that introduces students to the practice of ethical reflection. This requirement may also be satisfied by an approved transfer course equivalency.

3.10 FA5 via Ethics within the Disciplines in the ePortfolio

All WSE primary majors must demonstrate their capacity for ethical reflection within their engineering coursework by completing at least one ethical reflection that has been independently assessed to demonstrate an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.[20]

- This work may be completed either as part of a student's engineering coursework or through CAL.
- Each department will articulate which courses will include these assignments and will work with CLE to develop the assignments and assessment rubrics.
- It is recommended, but not mandated, that courses that contain ePortfolio assignments designed to satisfy FA5 be sequenced after the ethics foundational courses described in requirement 3.9.
- Students must submit evidence of this work to their ePortfolio that must be deemed to demonstrate proficiency by the course or CAL instructor.
- An ePortfolio submission that demonstrates learning outcomes relevant to multiple FAs may be assessed with respect to all applicable criteria and satisfy multiple FA requirements.

[20] Language derived from ABET

3

FA6: CONCEIVING OF AND REALIZING PROJECTS

Students should be able to independently conceptualize and complete large-scale, consequential projects.

LEARNING OBJECTIVES

- Students will demonstrate the ability to conceptualize, develop, and deliver consequential projects with ambitious scope, individually or in collaborative teams.

3.11 FA6 via Project Work in the ePortfolio

All WSE primary majors will engage in at least two approved projects.

- Each student's ePortfolio must include relevant deliverables from assessed projects deemed to demonstrate the student's abilities to conceptualize, develop, and reflect on such projects.
- This assessment will be performed by the instructor of the course within which the work was produced or by the CAL faculty instructor.
- This work may be performed within or outside of the student's primary major.
- An ePortfolio submission that demonstrates learning outcomes relevant to multiple FAs may be assessed with respect to all applicable criteria and satisfy multiple FA requirements.

[20] Using language derived from ABET criteria, here we define inclusion, diversity and equity:
• Inclusion is the intentional, proactive, and continuing efforts and practices in which all members respect, support, and value others.

SUMMARY OF FOUNDATIONAL ABILITIES RECOMMENDATIONS

FOUNDATIONAL ABILITY	Course Requirements	CAL in ePortfolio in lieu of coursework	ePortfolio Work
FA1 **Writing & Communication** (6 credits / 6 "unique" credits*)	• 3 credit writing course • 3 credit oral communication course (also satisfies FA4 DEI requirement)	No	Required: • 1 writing sample from engineering course or CAL • 1 oral communication sample from required major course or CAL
FA2 **Scientific & Quantitative Reasoning** (19–20 credits / 0–4 "unique" credits*) †	• Calculus 1 (4 credits) • Calculus 2 (4 credits) • Probability and Statistics (4 credits) • Gateway Computing (3 credits) • Introductory Physics, Chemistry or Biology with Laboratory (4–5 credits)	No	Encouraged
FA3 **Creative Expression**			
FA4 **Engagement with Society** (12 credits / 12 "unique" credits*)	• 12 credits of FA3 or FA4 coursework or CAL of which at least 3 credits must be FA3 and 3 credits must be FA4. • DEI in professional practice (may be fulfilled via oral communications course in FA1).	Yes	Encouraged
FA5 **Ethical Reflection** (1–3 credits / 0 "unique" credits*)	• Course introducing the practice of ethical reflection (may be fulfilled via CLE written communication course or other coursework)	No	Required: • 1 ethical reflection from engineering course or CAL
FA6 **Conceiving and Realizing Projects** (4–6 credits / 0–6 "unique" credits*)‡	• 2 approved and assessed projects	Yes	Required: • Both projects must be featured in the student's ePortfolio

TOTAL FOUNDATIONAL ABILITIES
(42–47 credits / 18–24 "unique" credits*)

* "Unique" credits refers to credits required that are not included in an earlier listed FA in the table or a major-specific requirement

† Probability and Statistics are not currently required for the BA degree in BME or the BS degrees in Chemical and Biomolecular Engineering, Civil Engineering, or Systems Engineering; no introductory science course is currently required for the BA in Applied Math and Statistics.

‡ The impact of the FA6 requirement will depend on the extent to which departments embed projects within existing required disciplinary courses versus requiring students to take project-based courses outside of their major discipline.

4 Customized Academic Learning and Hopkins Semester

Customized Academic Learning and Hopkins Semester

Background

The WSE CUE2 Blueprint noted that the HS can be considered a future extension of CAL that is immersive and eligible to receive significantly more credit. For this reason, recommendations are made to improve the rigor, consistency, and guardrails for CAL generally. Clearer, more prescribed, and transparent policies for CAL support the implementation of the HS framework recommended by the Blueprint working groups.

Some of the issues surrounding CAL currently:

CAL is often considered "an easy A" with students receiving little to no formal feedback or rigorous evaluation.

Students sign up for three credits at the start of the semester but then drop to two (or one) later in the semester. Unlike other academic experiences, **students are not always held to a clearly preestablished set of expectations**.

These scenarios illustrate that **there is no current mechanism for acknowledging progression toward exemplary achievement** in research and other CAL endeavors that may extend over semesters or years.

- Jane, who has just joined a research lab, signs up for three credits of research and spends the semester eagerly shadowing a PhD student who is running experiments; she earns an A.
- Mary, who has been in a lab for three semesters, signs up for three credits of research and undertakes an independent investigation culminating in a peer-reviewed publication; she earns an A.

Currently, credit for CAL may not be used to satisfy distribution requirements, i.e. engineering students must pass a certain number of courses labeled "H" for humanities or "S" for social science. Under the FA requirement recommendations presented in this document, in some cases CAL may be used to fulfill FAs. In such cases, learning outcomes should be intentionally aligned with FAs. To ensure rigorous assessment, the faculty member overseeing assessment must have demonstrated expertise in the discipline of the learning being assessed.

As per current policies, **CAL undertaken for academic credit can be paid or unpaid.** Credits vary from 1–3 credits and may be letter graded or S/U (satisfactory / unsatisfactory) graded. Each credit hour should reflect 40 hours of work on the project.

Establish a new school body to guide and sustain CAL and HS implementation:
in addition to the aforementioned WSE CUE2 Implementation Advisory Committee discussed in Section 3 above, a WSE Customized Academic Learning Board will be established. This board, chaired by the vice dean for undergraduate education and comprised of six faculty with two-year terms appointed from amongst the WSE departments, will articulate and oversee the academic aspects of CAL and HS going forward in perpetuity. The associate dean for undergraduate academic affairs will serve as an ex-officio member of this board.

4 CUSTOMIZED ACADEMIC LEARNING

4.1 Expanded Opportunities

To provide students with more opportunities to pursue CAL, increase the number of credits that can be earned during the regular academic year and summer, even for students who are not pursuing a HS.

- No more than 6 credits may be earned for CAL in one semester or summer (sessions I and II combined) unless a student is enrolled in a HS. [Note: The current limit is 3 credits.]

- No more than 12 credits may be earned for CAL in one academic year, which runs from the first summer session to the conclusion of following spring semester, unless a student is enrolled in a HS. [Note: The current limit is 6 credits.]

- No more than 30 credits of CAL may be earned during a student's time of enrollment as an undergraduate outside of any such credits earned during a HS.

Permitting students to pursue more CAL will require us to establish rigorous guardrails to ensure that grades for CAL are transparent and fairly assigned across the school in a standardized process. At the same time, establishing a total limit helps ensure that students do not abuse the policy by devoting too many of their credits to unstructured learning.

4.2 Add Deadline for CAL registration

To ensure that students and faculty establish plans sufficiently early in the term to permit the full academic term to be utilized productively, the deadline to add CAL will be moved to be earlier in the semester than the current sixth-week deadline. A date between the second and fourth week of the semester will be determined after deliberation by the WSE Customized Academic Learning Board described above. [Note: The second week of classes is date for all other forms of coursework.]

4.3 Deadline for Credit Changes

Establish that the number of credits for CAL must be set at the time of registration and cannot be altered after the CAL add deadline (see 4.2) except by permission of the vice dean for undergraduate education.

4.4 Grading

To ensure that students earning grades that have bearing upon their GPA engage in rigorously assessed work, establish the following grading options and associated expectations for CAL:

S/U grading, which will require that:

- To register, a student must receive preapproval from a faculty member with appropriate expertise who has agreed to supervise the work and has reviewed and approved the proposed learning outcomes and assessment mechanisms.

- At least one learning outcome is designated per credit. These may be chosen from a bank of learning outcomes (see Appendix C) or may be developed by the supervising faculty member.

- An assessment mechanism is associated with each learning outcome. These may be chosen from a bank of assessment methods (see Appendix C) or may be developed by the supervising faculty member.

- At least one of the assessment mechanisms must be formative, with check-ins between the student and their faculty instructor at least once every two weeks, although weekly check-ins are recommended.

A letter grade which will require all the aspects listed above for an S/U grade plus:

- At least one of the assessment mechanisms must involve the production and rigorous assessment of a final document or presentation. This work product and the assessment will be collected and archived as part of the submission of the final grade.

- Letter grades must be assigned by a Johns Hopkins faculty member based upon their assessment. Letter grades cannot be based upon assessments by external parties with the Johns Hopkins faculty member only serving in the role of an endorser.

4.5 ePortfolios for CAL

To provide students with improved mechanisms for sharing and reflecting upon their CAL experiences, encourage the use of ePortfolios for documentation and assessment of CAL. Establish a longitudinal mechanism of assessment that allows faculty supervising CAL to annotate an ePortfolio as representing work on a scale. Articulate rubrics for such longitudinal assessment. An example scale is shown on the bottom of page 15.

Note that: ePortfolios will be required for cases in which CAL is being used to satisfy an WSE FA requirement as per the recommendations for FA fulfillment above. Refer to pages 12–15 for more details.

4 HOPKINS SEMESTER

Note that since the HS is considered a type of CAL, all the above policies apply to the HS. The policy recommendations below are specific to the HS.

4.6 HS Student Eligibility

The Hopkins Semester (HS) is an optional experience potentially available to all students in either their junior or senior year, but not in their final semester. Students must be in good academic and disciplinary standing to apply for a HS. Applications will only be approved if:

- the endeavor is deemed to be academically meritorious,
- the plan provides mechanisms for the student's effort to be well-supported, and
- the student can demonstrate that they will maintain progress toward timely degree completion.

4.7 HS Credits

A HS is envisioned as a full-time, immersive experience. As such, a student may earn 12-15 credits for a HS experience. Credit hours must be agreed upon prior to the start of the HS as part of the application and approval process. These time guidelines should be followed in determining the appropriate number of credits for the HS itself.

- Duration: A HS will take place over a minimum of 13 weeks and maximum of six months, potentially including parts of summer and/or intersession terms. A HS may not overlap both a fall and spring term.
- Weekly/Overall Time Commitment: A HS will entail a minimum of 37 hours/week and at least 480 hours total for 12 credits based upon the current practice of one credit hour earned for 40 hours of work.
- Time Reporting: Students are required to maintain a log of their work hours, which will be reviewed regularly by their HS faculty mentor (see 2.10 below).
- Blocks of Credits: Where HS credits and their learning objectives are associated with disparate areas of expertise fulfilling different graduation requirements (e.g. communication, aesthetic expression, or particular major-specific technical content), the HS credits should be subdivided into blocks of credits each associated with distinct learning objectives, and a grade will be earned independently for each block of credits.

4.8 HS Credit Limit for Concurrent Courses

Students may also enroll in up to two courses during the HS for a maximum total of 18 credits. This option is encouraged if the addition of one or two classes would significantly help the student meet degree requirements in a timely fashion. Whether or not the student chooses to enroll in a class, the number of credits for the entire semester is capped at 18.

4.9 HS Tuition and Financial Aid

Since students engaging in a HS rely on the university for faculty mentorship, assessment, and oversight, one semester of full tuition will be incurred while enrolled in a HS. Students will be eligible for financial aid per standard eligibility requirements, regulations, and deadlines. [Note: If the student is off campus and not using many student services (athletic facilities, etc.), it is recommended that the university explore a tuition discount.]

4.10 HS Faculty Roles and Responsibilities

Faculty oversight of the HS and faculty mentoring of the student from inception to final assessment is critical to its meaningful success. Faculty are required to be engaged in both formative and summative assessments of the learning for the HS to be a meaningful academic experience. Each HS will engage one HS faculty mentor and one or several HS instructors, the latter being responsible for overseeing assessment. These must be Johns Hopkins faculty members. Each HS will also designate one or several HS supervisors who are responsible for direct oversight of the HS experience. HS supervisors may or may not be the HS instructors and may or may not be Johns Hopkins faculty members.

- **HS instructors:** Each HS instructor is responsible for assessing one or more blocks of learning objectives and assigning grades for each associated block of credits. The level of involvement will vary depending on the type of experience, particularly if the HS is undertaken at a site external to JHU. To ensure rigorous assessment, the HS instructor must be a member of the university faculty with substantial expertise in the discipline of the learning being assessed.

- **HS supervisors**: HS supervisors are responsible for directly overseeing the work associated with one or more blocks of learning objectives. For the duration of the HS, the student is expected to meet with each HS supervisor weekly to monitor progress. The HS supervisor may be the HS instructor responsible for assessing these same learning objectives. When this is not the case, such as when the HS is undertaken as part of an internship at an external site, the student will meet with their HS supervisor weekly and check in with their HS instructor at least every other week.

- **HS faculty mentor**: Each student pursuing a HS will engage a HS faculty mentor who may be the student's regular faculty mentor or one of the student's HS instructors. This faculty member will commit to communicate with the student at least every two weeks to reflect upon their experiences and check in on their progress and well-being.

EXAMPLE: As part of a HS, a Computer Science student is undertaking software development with a Mechanical Engineering faculty member. The student plans, with departmental approval, to apply the credits towards an upper-level CS degree requirement. A CS faulty member serving as a HS instructor must assess the student's work to determine the grade. They may rely in part on input from the MechE faculty member who is serving as one of the student's HS supervisors.

4.11 HS Learning Outcomes

As with all forms of CAL (see recommendation 4.4, above), HS learning outcomes must be articulated from the outset that clearly define the skills and knowledge students will demonstrate at the end of the HS, and must include both formative and summative forms of assessment. All learning outcomes must be SMART — specific, measurable, attainable, relevant, and time-bound and must be agreed upon by both the student and the HS instructor assessing the learning outcome. The student's HS proposal must clarify how and when each will be assessed. HS learning objectives may come from two categories: general and tailored.

- **General Learning Outcomes:** General learning outcomes are broad and applicable to many types of HS experiences. They can be drawn directly from a pool of general learning outcomes (see Appendix C) that students, with the guidance of their HS instructor, may adapt to align with their HS proposal. Some of these learning outcomes will map to Foundational Abilities. All will ensure that learning is tied to measurable outcomes.

- **Tailored Learning Outcomes:** Students and their HS instructors may work together to devise their own learning objectives tailored to the goals of their individualized HS. These will be developed in consultation with their HS instructors and with input from their HS supervisors when applicable.

4.12 HS Assessment, Grading, and Additional Responsibilities

Responsibility for assessment and grade assignment for each block of credits always lies with the JHU faculty member serving as the HS instructor. The HS instructor's expertise must be aligned with the associated learning objectives. The HS instructor may also be serving as the HS supervisor directly overseeing the student's work, or they may need to coordinate closely with the HS supervisor in performing their assessment. In the latter case, the HS supervisor may be external to the university, e.g. during an industrial internship. The grading options, which may be chosen independently for each block of credits, are articulated in recommendation 4.4, above. Students pursing a HS are also required to:

- Maintain a lab notebook, design journal, or work diary in their ePortfolio throughout the semester to record designs, plans, activities, learned concepts and skills, applications, reflections, and relevant work.
- Meet weekly with their HS supervisors to discuss progress and receive feedback.
- Check in biweekly with each of their HS instructor with updates on their work.
- Reflect on their experiences biweekly with their HS faculty mentor.
- Enroll in a one-credit online course to reflect on their experiences (see 2.13 below).
- Submit monthly progress reports using an online template.
- Submit a final report online.
- Present a poster at the HS mini-symposium the immediately following semester.

4.13 HS Advising

Each department will create a sample schedule for each of their majors that details a recommended course sequence for students who wish to undertake a HS. This sample schedule will assume the student has taken no prior college-level coursework and will be published in the departmental advising manual and the university catalogue.

All students participating in a HS will be required to enroll in a one-credit online course, developed by CLE and the Life Design Laboratory. This course will provide a mechanism for students to reflect on their HS experience, develop students' project management skills, and will provide support for productive engagement in in-depth, independent work. A sample syllabus for a related course is provided as Appendix D.

4.14 HS Deadlines and Application Process (Sample Application: Appendix E)

Fall semester HS

- Application due February 15
- Decision by April 15, prior to undergraduate registration for fall

Spring semester HS

- Application due August 31
- Decision by November 1, prior to undergraduate registration for spring

Students in good academic and disciplinary standing may apply. Their application package must include:

PROPOSAL: The applicant will provide thorough background information regarding the proposed experience and a detailed timeline.

DEGREE COMPLETION PLAN: The applicant will provide a plan that reasonably demonstrates their capacity for timely completion of degree requirements. This plan will also detail how the HS credits will be applied towards this end.

A clear plan demonstrating the number of credits and how they will be applied to degree requirements is a crucial component of the application process and will be different for each planned experience. The degree completion plan will undergo a detailed review and approval from the faculty mentor as well as the student's academic advisor. Depending on the nature of the HS and how it aligns with a student's major, the credits assigned for a HS may be used to satisfy some major requirements, but this is not a necessity. HS credits may be applied toward the fulfillment of FA requirements and/or as credits toward the minimum required for graduation.

- **Academic/Professional Relevance:** The applicant will submit a statement that indicates how this project will enhance the student's academic experience at JHU, reinforce their learning in relation to their major, minor, or foundational abilities, and/or impact their future career goals.

- **Learning Objectives/Goals:** The applicant will detail the learning objectives for the proposed HS in keeping with the rules for all CAL (recommendation 4.4, above). These should be specific, measurable, appropriate, realistic, and time-bound. A bank of learning objectives will be provided from which students can select and/or revise objectives that best match their aspirations (Appendix C).

- **Grading Method:** The applicant must specify the grading method and HS instructor for

each block of learning objectives and their associated credits. Only blocks of credits directly assessed by a HS instructor are eligible for letter grading. Students must contact faculty prior to the submission of the application to confirm their willingness to serve as a HS instructor.

- **Two Recommendation Letters**: The applicant must request a recommendation letter from their proposed HS faculty mentor and from a HS instructor who will be assessing their work. If their HS faculty mentor is also one of their HS instructor, the second recommendation may come from another Johns Hopkins faculty member who knows their work well.

- **Commitment Forms**: A commitment form is required from each person serving as a HS faculty mentor, HS instructor, or HS supervisor. If the HS supervisors are from institutions external to Johns Hopkins University, a commitment form must also be submitted by their institution as well.

Each application will be reviewed by the WSE Customized Academic Learning Board (see 4.16 below). The student will Customized Academic Learning notified regarding the status of their application in a timely manner, i.e. prior to registration for courses for the upcoming semester. In exceptional cases, students may be given provisional acceptance contingent upon approval of a resubmitted application package that has been refined or expanded.

4.15 HS Faculty Incentives

It is recommended that policies be put in place to account for faculty time in supervising a CAL and HS as a mode of teaching. We recommend that mentoring, assessing, and supervising nine students' 15-credit CAL or HS experiences count as the equivalent of one teaching load for a faculty member. This would (1) ensure excellent mentoring for the students, (2) encourage the faculty to support CAL and cohorts of HS students, and (3) incentivize faculty to be invested in the CAL and HS endeavors.

4.16 HS and CAL Oversight

As recommended in the WSE CUE2 Blueprint WSE will:

- Create a **Hopkins Semester Office** within WSE Undergraduate Academic Affairs to provide guidance, oversight, and to market the HS program. This office will have, at minimum, a director who administrates and guides the establishment of the program, along with appropriate staff support.

- Establish a standing **WSE Customized Academic Learning Board** composed of faculty with staggered rotating terms (as described above on page 45) who meet to review applications for HS experiences from WSE students and routinely assist the Hopkins Semester Office in program and policy reviews. The first task of this board will be to refine and finalize the CAL and

HS policies. They will also work with the Director of the Hopkins Semester Office and the WSE Vice Dean of Undergraduate Education to establish procedures for vetting Hopkins Semester proposals and mechanisms for engaging academic departments in Hopkins Semester proposal reviews and mentoring.

Prior to the launch of the HS in Fall 2026 the WSE Customized Academic Learning Board and the Hopkins Semester Office will work closely with the Office of Undergraduate Academic Affairs to create a Hopkins Semester Student/Faculty Handbook website.

Implementation Timeline

IMPLEMENTATION TIMELINE

The following timeline describes the anticipated rollout of the CUE2 recommendation in WSE at a high level. Further refinements will be developed in consultation with the WSE CUE2 Implementation Advisory Committee, the WSE Customized Academic Learning Board and the WSE ePortfolio Board.

SPRING/SUMMER 2024

- Publish 2024/25 university catalogue with revisions for required first-year seminar.
- Establish WSE CUE2 Implementation Advisory Committee, WSE Customized Academic Learning Board and WSE ePortfolio Board.
- Refine Policies regarding FAs, CAL and ePortfolio assessment.
- Assign mentors for first year students and provision mentorship workshops for these faculty to atttend.

FALL 2024

- Launch "Meet The Flock" Day and other aspects of our new mentorship program to induct undergraduates into the advising and mentoring system.
- Launch first-year seminars sufficient to serve all WSE first-year students including new design-based first-year seminar.
- Provide draft of revised and refined recommendations regarding FAs, ePortfolios and CAL to WSE departments and Faculty Senate and WSE Curriculum Committee for review.
- Pilot ePortfolio implementation including mechanisms for assessment and incorporation into systems of record.
- Develop CAL workflows for faculty and students.

SPRING 2025

- Finalize CUE2 policies regarding FAs, ePortfolios, and CAL in the 2025/26 university catalogue.
- Departments begin development of ePortfolio FA work, which will become a requirement when students who matriculate in 2025 encounter these upper-division courses.
- Refine ePortfolio workflows through second generation pilots.
- Pilot CAL workflows to streamline processes.
- Implement course tagging for FA navigation in collaboration with departments and Krieger School of Arts and Sciences.
- Program and test Stellic degree audit system with FA and ePortfolio elements.

FALL 2025

- Advise and mentor incoming students whose school requirements include FYS and FA fulfillment through and ePortfolio mechanism.
- Establish Hopkins Semester Office and appoint Director.
- Begin articulation of policies and procedures for Hopkins Semesters.

SPRING 2026

- Solicit Hopkins Semester proposals from students interested in pursuing an a HS in the 2026/27 school year.

FALL 2026

- Launch our first WSE Hopkins Semesters.

Appendices

APPENDIX A. LEARNING OBJECTIVES FOR WRITING AND ORAL COMMUNICATIONS

Course Learning Objectives for a New CLE Writing Course:

- Write clear, concise, and audience-sensitive documents appropriate for professional and technical settings.
- Respond to the needs of diverse professional audiences, especially decision-makers.
- Identify the main message, craft an appropriate narrative or "story," and determine the most effective genre/medium to use for any given situation.
- Support ideas with appropriate evidence.
- Quote, paraphrase, and cite in an appropriate style.
- Learn how to identify, work with and write for specific audiences, important stakeholders, and subject-matter experts.
- Edit and revise written work strategically and effectively.
- Deliver and respond to feedback effectively.
- Experience the different dynamics of writing individually versus collaboratively.
- Collaborate effectively in team-based communication projects.
- Build self-awareness through reflection on personal strengths/weaknesses as a communicator.
- Articulate problems with complex ethical dimensions, dispassionately expressing the competing perspectives and interests of diverse stakeholders.

Course Learning Objectives for a New CLE Oral Communication Course:

- Develop an authentic, personal speaking style that puts the audience's needs first.
- Be able to speak confidently and compellingly for a wide variety of audiences.
- Have the capacity to identify, understand, and leverage skillfully the right kind of evidence for each particular audience you address.
- Be able to tell a great story that hooks your audience.
- Know how to edit the message of your speeches down to their core components.
- Be able to deploy skillful slide design that avoids "Death by PowerPoint."
- Increase your emotional intelligence and listening skills.
- Be able to give a persuasive speech outside your area of expertise.
- Be adept at drawing audience-appropriate conclusions from information, data, or trends related to a given topic.
- Respond to audience questions, especially challenging ones, diplomatically.
- Give and receive constructive feedback.
- Demonstrate an awareness of diversity, equity, and inclusion as it relates to professional practice[19]

- Diversity is the range of human differences, encompassing the characteristics that make one individual or group different from another. Diversity includes, but is not limited to, the following characteristics: race, ethnicity, culture, gender identity and expression, age, national origin, religious beliefs, work sector, physical ability, sexual orientation, socioeconomic status, education, marital status, language, physical appearance, and cognitive differences.
- Equity is the fair treatment, access, opportunity, and advancement for all people, achieved by intentional focus on their disparate needs, conditions, and abilities.

APPENDIX B. COURSES APPLICABLE FOR FULFILLING REQUIREMENTS

EXAMPLES OF COURSES THAT MAY BE USED TO SATISFY THE FA REQUIREMENT:

Calculus I:
- AS.110.106 Calculus I (Biology & Social Sciences)
- AS.110.108 Calculus I (Physical Sciences & Engineering)

Calculus II:
- AS.110.107 Calculus II (Biology & Social Sciences)
- AS.110.109 Calculus II (Physical Sciences & Engineering)

Calculus I & II (combined):
- AS.110.113 Honors Single Variable Calculus

EXAMPLES OF EXISTING PROBABILITY & STATISTICS COURSES THAT MAY BE USED TO SATISFY THE FA2 REQUIREMENT:

Non-calculus-based:
- AS.280.345. Public Health Biostatistics
- EN.553.111 Statistical Analysis I and EN.553.112 Statistical Analysis II
- EN.553.211 Probability and Statistics for the Life Sciences

Calculus-based:
- EN.560.240 Uncertainty, Reliability, and Decision-Making
- EN.553.310 Probability & Statistics for the Physical Sciences & Engineering
- EN.553.311 Probability and Statistics for the Biological Sciences and Engineering
- EN.553.420 Introduction to Probability and EN.553.430 Introduction to Statistics
- EN.540.382 Statistical Modeling and Analysis with Python

EXAMPLES OF EXISTING COURSES THAT MAY BE USED TO SATISFY THE FA2 REQUIREMENT:

Biology
- AS.020.151 General Biology I + AS.020.153 General Biology Laboratory I

Chemistry
- AS.030.101 Introductory Chemistry I + AS.030.105 Introductory Chemistry Laboratory

Physics
- AS.171.101 General Physics: Physical Science Major I + AS.173.111 General Physics Laboratory I
- AS.171.103 General Physics I for Biological Science Majors + AS.173.111 General Physics Laboratory I
- AS.171.107 General Physics for Physical Science Majors (AL) + AS.173.111 General Physics Laboratory I

EXAMPLES OF EXISTING COURSES THAT MAY BE USED TO SATISFY THE FA5 REQUIREMENT:

- A written communications course offered by CLE (see Appendix A)
- EN.660.310 Cases in Workplace Ethics
- EN.660.463 Engineering Management & Leadership
- EN.661.310 Culture of the Engineering Profession
- EN.601.104 Computer Ethics
- EN.601.124 The Ethics of Artificial Intelligence and Automation
- AS.150.114 Introduction to Environmental Ethics
- AS.150.219 Introduction to Bioethics

APPENDIX C. GENERAL LEARNING OUTCOMES

The below banks of learning outcomes are not meant to be comprehensive and will be expanded and refined by the WSE HS Oversight Board.

APPLICABLE TO ALL CAL

LEARNING OUTCOME	ASSESSMENT	FOUNDATIONAL ABILITY
L01 Select and use appropriate methodologies and skills for a project	Informational interview, faculty selected readings (S/U only)	FA6
	Lit review; proposal considering constraints	FA6
L02 Apply iterative problem-solving	Submit weekly project updates and final written report	FA6 or FA1
L03 Work collaboratively while delineating their own contribution	Self and peer reflections AND observations by mentor	FA6
L04 Communicate effectively with a range of audiences	Final report (S/U only)	FA6 or FA1
	Final report + poster at DREAMS	FA6 or FA1
L05 Manage time (and other resources) efficiently	Gantt chart for the semester; weekly oral updates (S/U only)	FA6
	Detailed Gantt chart for the semester with accompanying plan; weekly written updates	FA6
L06 Produce site-relevant reports and/or records	Document experience using Lab notebooks, design journal, ePortfolio or another tool.	FA6
L07 Work ethically and responsibly	Lab safety and general ethics with bi-weekly written reflections; mentor evaluation (S/U only)	FA5 or FA6
L08 Articulate the relevance of their experience to their coursework at JHU and their professional future	Oral reflection with faculty member (S/U only)	
	Students' articulation of their project in a written proposal; biweekly written reflections	

APPLICABLE TO HS

LEARNING OUTCOME	ASSESSMENT	FOUNDATIONAL ABILITY
LO1 Propose a large-scale consequential project that provides time for a focused, deep, and rigorous exploration of a complex subject or endeavor.	Comprehensive proposal that outlines the project by demonstrating significant planning, close collaboration with your proposed mentor and consideration of constraints. Included in this proposal will be your own set of specific Learning Outcomes (and associated measures) for your personal HS.	FA6
LO2 Develop a project plan for completing the project in a single semester.	Detailed project plan including a timeline in proposal	FA6
LO3 Report progress (formative assessment) on a regular basis as defined with mentor/faculty	Regular documented meetings with HS instructor	FA6 or FA1
LO4 Submit final product or report for evaluation by review team/faculty mentor	Final report/thesis detailing the entire scope of your project and addressing all your personal LOs. Present your results publicly, to small group including HS instructor and with a poster at a JHU symposium for HS.	FA6
LO5 Reflect on the ethical and social impact or implications of the work being undertaken.	Self-reflection (and peer-reflection if team-based) in final report	FA5
LO6 Synthesize and apply key disciplinary knowledge, skills, and abilities (KSAs) in a comprehensive project	Final report and presentation.	FA6 (depends on nature of the project)
LO7 Relate this learning experience to their course-based academics and professional goals	Project proposal.	

APPENDIX D. LIFE DESIGN SUMMER EXPERIENCE PRACTICUM SYLLABUS

COURSE DESCRIPTION

The Life Design Summer Experience Practicum provides students with a structured opportunity to apply Life Design to a summer immersive experience. Over the course of 8-weeks, students will use the principles and processes of design thinking to reflect upon their values, identities, habits, and experiences and their relationship to the world of work; to deepen their understanding of potential professional pathways through conversations with colleagues, supervisors, and alumni; and to test out these pathways through storytelling and the designing of new habits. By the end of the course, students will be able to articulate the ways in which their summer experience informs and supports their academic, professional, and personal ambitions.

Students in the course are expected to participate in an approved summer experience (internship, volunteer work, research, etc.). Course material and assessment will be delivered through a mix of asynchronous and synchronous lessons and activities, group discussion, and individual reflection and design. Course may be repeated for credit.

LEARNING OBJECTIVES

By the end of the course, students will be able to:

1. Articulate their values, aspirations, and identities, and describe the ways in which these relate to the position, place of work, and/or industry for their summer experience.
2. Identify stakeholders (co-workers, supervisors, local alumni, etc.) related to their summer experience, develop targeted questions to ask of these stakeholders, and conduct "curiosity conversations" with these stakeholders to gain insight into potential careers and life paths
3. Identify habits linked to success in their role, workplace or industry and design their own set of habits for personal and professional success.
4. Identify key experiences and skills gained over the course of the summer, describe these experiences and skills in a variety of professional documents(resume, cover letter, etc.), and articulate the ways in which these experiences inform their personal and professional story.

GRADING AND ASSIGNMENTS

In addition to participating fully in four synchronous meetings and online discussion, students will complete four learning modules, each consisting of a combination of asynchronous content and short assignments.

Be Curious: Understanding Yourself and Your Summer Experience through Autoethnography Mapping (10 points total)

- Autoethnography Mapping (10 points) – due June 12

Talk to People: Networking at Work using Stakeholder Maps and Curiosity Conversations (15 Points Total)

- First Curiosity Conversation (5 points) – due July 14
- Second and Third Curiosity Conversations (10 points) – due July 31

Take Action: Identifying and Designing Habits (15 points total)

- Identifying Your Summer Roles and Responsibilities (5 points) – due June 30
- Articulating Your Summer Goals (5 points) – due June 30
- Fall 2023 Habits (5 points) – due July 24

Show Your Work: Telling Your Story in Resume & Interviews (25 points total)

- Relational Accomplishment Statements (10 points)
- Summary and Synthesis (15 points)

The course is graded Satisfactory/Unsatisfactory (S/U). To receive a Satisfactory final grade, students must attend at least 3 of the synchronous sessions and successfully complete all assignments by the end of the course, earning at least 70% of the available

points on all assessed work.

COURSE SCHEDULE

*Prior to the first class, complete the tasks in your "Getting Started" Canvas Module, including

Week 1 **June 5** **Introduction (synchronous)**	**Class Content** • Introduction to the LDSEP • Peer Networking Chats	**Post-Class Assignments** NA
Week 2 **June 12** **Mapping the Environment (asynchronous)**	**Class Content** • Review Autoethnography Course Instruction • Complete Step 1 of Auto-ethnography Module in Canvas	**Post-Class Assignments** • Review "Networking at Work: an Overview" • Review Curiosity Conversation Handout • Listen to BJ Fogg Podcast • Read: Christie Hunter Arscott, "A Better Approach to Networking"
Week 3 **June 19** **Behavior Design & Networking (synchronous)**	**Class Content** • Designing Professional Habits • Asking the Right Questions-Curiosity Conversations • Alumni Networking	**Post-Class Assignments** • Complete Take Action: Designing Successful Habits, Steps 1 & 2 • Complete Talk to People: Stakeholder Maps, Steps 1–3
Week 4 **June 26** **Put to Practice: Take Action! (asynchronous)**	**Class Content** • Begin scheduling Curiosity Conversations • Begin tracking Tiny Habits on Miro	**Post-Class Assignments** • Add your Summer Roles and Responsibilities to Sutori (due June 30) • Add your Behavior Goals to Sutori (due June 30)
Week 5 **July 3** **Take Action! cont. (asynchronous)**	**Class Content** • Begin Conducting Curiosity Conversations	**Post-Class Assignments**
Week 6 **July 10** **Midpoint check-In (asynchronous)**	**Class Content** • Continue conducting Curiosity Conversations and tracking Tiny Habits on Miro • 1:1 check-ins with Instructional Team (optional)	**Post-Class Assignments** • Post Write up of First Curiosity Conversation to Sutori (due July 14) • Synthesis & Reflection Discussion Post (Canvas) • Review Life Design Lab Resume Guide • Bring a job description for a future role that interests you
Week 7 **July 17** **Telling Your Story: Resume Building (synchronous)**	**Class Content** • Three-Step Resume Accomplishment Statements	**Post-Class Assignments** • Complete Internship Accomplishment Statements • 5:3:1 Habit Development — Fall 2023 (Sutori)
Week 8 **July 24** **Telling Your Story: Resume Building (synchrnous)**	**Class Content** • Alumni Mock Interviews • Developing Mentors • Habit Review & Next Steps	**Post-Class Assignments** • Complete Autoethnography Timeline • Complete Life Design Summary and Synthesis on Sutori (due July 31) • Complete your Stakeholder Map and add Curiosity Conversation #2 and #3 to Sutori (July 31) • Complete Post-Course Survey

APPENDIX E. PROPOSED APPLICATION FORM FOR HOPKINS SEMESTER

HOPKINS SEMESTER APPLICATION INFORMATION

About the Hopkins Semester

The Hopkins Semester (HS) is an optional semester-long (fall or spring only), mentored immersive experience. Students opting to participate can receive 12-15 credits on completion of the semester and all required components. The availability of funding encourages students to broaden their educational experience and ensures that all participants reinforce the foundational ability to identify, conceptualize and complete large-scale projects.

Eligibility

Current and rising engineering juniors and seniors in good academic standing may apply by proposing an immersive, supervised research project, service project, entrepreneurship project or internship (paid or unpaid). The Hopkins Semester can be spent at Hopkins or elsewhere and may be either an individual or a team-based project.

Applying for the Hopkins Semester

All applicants should review the information shared under the Project Guidelines section of this document and complete all the items requested. Applicants are responsible for setting up their projects and making all the necessary arrangements to re-locate if needed. Applicants have the freedom to propose any project they choose, as long as it meets the parameters of the project guidelines.

Selection Criteria:

The following factors will be taken into consideration when evaluating proposals:

- The amount of planning and details regarding project shared
- Firm commitment from the hosting organization/lab/company
- Academic component: impact on the applicant's studies, degree completion and future plans
- Level of faculty endorsement, sponsorship, or connection
- Students must be in good academic and disciplinary standing

Timeline:

- By the time of submitting your application it is expected that you have confirmed with your academic advisor that you can still graduate within the desired timeline and fulfill all your degree requirements
- If applying to complete a HS in the fall, applications (all components) are due by Feb 28th (July 31st for Spring)
- Register for upcoming fall (spring) classes as if you were not taking a HS, you will be informed by May 1st (Sept 1st) if your HS has been approved at which point you will have 1 week to accept
- Your HS proposal may not be immediately approved, in such situations you may consider all the feedback you are given and resubmit for re-consideration

Project Guidelines

General Guidelines:

- Projects must span an entire semester and be considered full-time
- Both paid and unpaid projects are acceptable.
- Although not a technical report, do note that your proposal submission should not be a creative essay; instead, it should have a professional tone.

- If your project changes before your Hopkins Semester commences, you MUST contact your HS instructor and the HS committee and have your new project approved. If you fail to contact the committee, you risk not receiving a satisfactory grade.
- You will maintain a design notebook or project journal for the semester that will be periodically evaluated by your HS instructor
- You will write a detailed final report as well as monthly progress reports
- You will be required to present a poster at the HS mini-symposium.

Receiving credit:

- You may receive 12–15 credits for your HS. If your project is based at JHU and is being intimately advised by a JHU WSE faculty member you may request a letter-grade if both student and faculty mentor agree, otherwise you will be graded S/U. Learning Objectives (general and specific) will be assessed in order to determine grade outcome.
- Depending on the nature of the experience, the credits may be used to fulfill core degree requirements, otherwise they can be used as free electives. These details must be included in your Degree Completion Plan.

Application Components

When submitting your application, these components below will be assessed:

1. **A description of the activity.** Include some background information on the proposed experience. Be as specific about your proposed role as possible, including what steps you have taken in the planning process. Also, note why the project is of interest to you and what you hope to gain from the experience. (The explanation of the proposed project can be technical in nature.)
2. **Degree Completion Plan.** You must demonstrate how you will complete your degree requirements and rationalize how you plan on applying your HS credits towards your degree requirements.
3. **Academic/professional relevance.** Include a statement of how this project will enhance your academic experience at Johns Hopkins, reinforce your learning in relation to your major, minor or foundational abilities, and/or impact your future career goals.
4. **Learning Outcomes.** Compose 3–4 learning objectives for your HS. These should be tailored very carefully for your experience and should concisely describe what you will learn and be able to accomplish by the end of your HS. Your Learning Outcomes should be specific, measurable, appropriate, realistic and time-bound.
5. **Two (2) recommendation letters.** The first recommendation should come from a JHU faculty member who knows you well and the second will be from your Hopkins Semester instructor who will be actively engaged in planning, supervising and evaluating the HS experience. You want someone who can speak to your attributes, skills, and character and provide support as to why the project would be a good experience for you. It is your responsibility to make sure the faculty recommendations are part of your application.
6. **HS Supervisor commitment.** Please have your direct supervisor complete the Commitment Form. This person may or may not be the same as your HS instructor... In the case of an internship or community project, somebody from the organization is expected to complete this form.
7. **Your resume.**

APPENDIX F. WSE ENGINEERING DESIGN-BASED FYS PILOT PLAN

Course Logistics

COURSE NAME: FYS: Design Cornerstone

CREDITS: 2

GRADING SCHEME: A/E Ugrad Letter

TIME: Wednesdays 1:30 to 4 p.m.

LOCATION: FastForward University

PROPOSED ENROLLMENT: 36–48 (3–4 sections of 12 students)

DESIGNATIONS (IF APPLICABLE): E (engineering course)

COURSE DESCRIPTION:
Discover how multidisciplinary engineering design results in more effective engineering, communication, and problem solving with teams. This hands-on, project-based course gives students the ability to understand, contextualize, and analyze engineering designs and systems. By learning and applying the multidisciplinary design process, students will be more prepared to solve complex problems in a variety of engineering disciplines. Lectures focus on teaching a tested, iterative design process as well as techniques to sharpen creative analysis. Guest lectures from all disciplines illustrate different approaches to design. This course will culminate in a cornerstone design project.

GUIDING QUESTIONS
To develop the goals for the course, a set of guiding questions inform the design process. The questions represent a synthesis of a variety of stakeholder interviews and collective understandings about the nature of the course.

RATIONALE:

The big questions this course helps students answer:

- What is engineering design, and how can I use the engineering design processes to solve problems?
- How do I work productively as part of a team with people who have a variety of backgrounds, skills, and interests?
- What tools and techniques can engineers use to communicate solutions to big problems?

The course helps students locate the critical dialogues and key arguments within their future disciplines by:

- Learning to work through a design process, which is helpful for any kind of problem-solving challenge.
- Practicing skills and techniques of collaboration and communication that are relevant to all disciplines.
- Exposing students to different disciplines within engineering and offering insight into further areas of potential study.

This course lays a foundation for courses that follow it by:

- Referencing the ABET-criteria three-student outcomes which will be continually built upon such as problem solving, the application of engineering design, communication skills, ethical considerations, teamwork and collaboration, experimental design, and learning strategies.

STUDENT OUTCOMES:

Which authentic (real-world practice or research) tasks will students be able to perform?

- Design-research including user interviews, mood boards, and observational sketching
- Analysis and synthesis skills including root cause analysis and triangulation
- Prototyping skills include sketching, mold making, and physical computing
- Communication skills such as technical write-ups, ePortfolios, data/information visualizations, and oral presentations

What concepts will students be able to apply?

- Design-process as a concept; understanding that there are many ways to understand and apply design thinking/process
- Systems-thinking concepts like recognizing relationships/connections and considering multiple perspectives
- How to design and carry out an experiment
- How to go from a lo-fi to hi-fi prototype
- How to work on a team and divide responsibilities
- How to communicate project ideas and results to an audience

What kinds of analysis will students be able to carry out?

- We will cover several examples of relevant design analysis tools focusing on how to choose the right analysis tool for the project. Examples: root cause analysis, SWOT analysis, prototyping as analysis, flowcharts, etc.

What types of problems will students be able to solve?

- In theory, learning a design process will prepare students to be able to solve any kind of problem, not necessarily from personal skill or experience, but how to leverage a community, utilize resources, and inspire teamwork to develop solutions.

What intellectual abilities (or qualities) will students develop?

- Empathy for others, how to consider multiple perspectives, and how to appreciate lived experiences that inform user perspectives
- Self-regulated learning strategies such as goal setting, project/time management, and record-keeping best practices
- The abilitiy to synthesize information to improve decision making

COURSE LEARNING OUTCOMES

At the completion of this course, students will be able to:

- Apply a multidisciplinary design process to solve complex problems in various engineering disciplines.
- Demonstrate a working knowledge of technical skills used in design prototyping.
- Communicate engineering ideas through visual communication, sketching, technical writing, and oral presentations.
- Collaborate and effectively manage project work with a multidisciplinary team of students.
- Analyze and address ethical and safety considerations among engineering disciplines, demonstrating a commitment to responsible conduct.
- Employ self-regulated learning strategies through the design and development of an independent problem-solving project.

The course Learning Outcomes align with recommendations about foundational abilities and are broken down by overarching course goals.

1. Goal 1: Design Process

a. Objective: Apply a multidisciplinary design process to solve complex problems in various engineering disciplines

b. Expose students to the ways engineering design is practiced and applied across disciplines

c. Help students contextualize engineering design and systems by reviewing the design process and practice

2. Goal 2: Technical and Professional Skills

a. Objective: Demonstrate a working knowledge of technical skills used in design prototyping

b. Include skills repeatedly mentioned as valuable across disciplines: CAD, prototyping/digital fabrication, soldering, mold making, circuits, and physical computing

c. Engage in real-world projects and hands-on learning as corroborated across stakeholders

3. Goal 3: Communication

a. Objective: Communicate engineering ideas through visual communication, sketching, technical writing, and oral presentations

b. Meet needs consistently communicated throughout stakeholder meetings, the CUE2 report, and the WSE Blueprint

c. Encourage the exploration of a variety of communication methods from low-stakes writing to delivering summative presentations to understanding the potential of visual communication to ensure clarity

d. Use ePortfolios as a mechanism for archiving reflections about coursework and documentation of course projects

4. Goal 4: Collaboration

a. Objective: Collaborate and effectively manage project work with a multidisciplinary team of students

b. Include skills of collaboration, as highly valued among stakeholders, along with communication

c. Desirable collaboration skills included:

i. Project/time management

ii. Conflict resolution

iii. How to work on a team/division of responsibilities

iv. Etiquette and how to collaborate and speak with faculty/experts/clinicians/partners

d. Team-based, collaborative projects as major focus of the course with the occassional opportunity for individual work.

5. Goal 5: Ethics and Culture

a. Objective: Analyze and address ethical and safety considerations among engineering disciplines, demonstrating a commitment to responsible conduct

b. Expose students to different engineering disciplines and the ways in which design is engaged in each as a foundation for multidisciplinary design coursework.

c. Explore the ethos of life-centered design, a concept Bruce Mau describes as "designing for the welfare of all of life in order to sustain human life." This may include discussions of:

i. Ethical/responsible and safe conduct in engineering design

ii. Social justice, diversity, and citizenship in engineering culture

iii. Sustainability problems and solutions

iv. Personal Identity/beliefs and how that relates to being part of an inclusive engineering community

6. Goal 6: Self-Regulated Learning

a. Objective: Employ self-regulated learning strategies through the design and development of an independent problem-solving project

b. Self-regulation (or self-regulated learning) results from self-generated thoughts and behaviors that are systematically oriented toward the attainment of their learning goals. Self-regulated learning involves goal-directed activities that students instigate, modify, and sustain; for example, attending to instruction, processing information, rehearsing and relating new learning to prior knowledge, believing that one is capable of learning, and establishing productive social relationships and work environments.[21]

c. Reflection through low-stakes writing assignments and group feedback sessions

d. The course will culminate in a team-based cornerstone design project in which students will work through a design process on a problem-solving challenge of their choosing.

i. Students will be given topical parameters and encouraged to seek out a compelling project within those constraints.

ii. Teams will use learned and practiced skills of project management, collaboration, and communication to execute their design project.

COURSE OUTLINE

Design projects will build in complexity resulting in an opportunity to explore concepts of interest more deeply. The course will consist of four units, each of which will culminate with a group design challenge, a short group presentation, personal and group reflections, and a brief ePortfolio write up. The units represent different aspects of multidisciplinary design and offer an opportunity to learn and apply the design process to a variety of challenges. In order to build students' understanding of the disciplinary roots of engineering design, we plan to engage a broad cross-section of faculty as visiting lecturers, visiting judges, or potential design partners in the final project.

1. Unit 1: Systems Design

a. Overview: This unit will introduce students to various engineering design processes and how design is used in different engineering disciplines. Systems thinking will be emphasized to begin making connections between engineering disciplines and applications of the engineering design process.

b. Design Challenge: Mod a familiar game to improve game-play experience.

i. Examples of familiar games: tic-tac-toe, the card game "war," rock/paper/scissors, etc.

ii. Student teams will analyze, synthesize, and modify the structure of an existing game as a way of practicing systems thinking/design. Systems design (by way of game design) requires flexibility in thought and approach, attention to the human experience, and productive collaboration.

c. Design Process Focus: This short intro project will take students through the full engineering design process. The focus will be on understanding the role of process in design and the ways in which an iterative engineering design process—the cycle of researching, prototyping, testing, and analyzing—is a useful model for designing anything.

d. Technical Skill: Students will practice making testable, lo-fidelity prototypes of their game concepts and learn to use a variety of materials for quick testing.

e. Visual Communication: Students will learn how to organize content on a page for clarity and to avoid confusion. Both the group presentation and the ruleset for the game offer an opportunity to practice effective visual communication.

f. Deliverable:

i. PRESENTATION:

1. A title page that includes the names of the designers as well as an abstract that gives an overview of the game in a few sentences
2. A set of complete and edited game rules
3. Photos of the game being played
4. A design process statement—a short description of the group's process in getting to the final design

ii. REVIEWS AND REFLECTION:

1. Students will present the actual game/materials and ruleset to the class for playtesting and feedback.
2. Each student will complete a self-reflection of their work, what they learned, and how they worked on a team. This reflection will be posted in the ePortfolio.

g. Potential for Additional Engagement with Faculty: In this unit, it would be ideal to have a visiting faculty member join us for playtesting who works in systems engineering or computer science as it may relate to designing for the public or game theory.

2. Unit 2: Design of Experiments

a. Overview: In this unit, students will learn how to design and conduct an experiment. Design of experiments (DOE) is a systematic, efficient method that enables scientists and engineers to study the relationship between multiple input variables (a.k.a. factors) and key output variables (a.k.a. responses). It is a structured approach for collecting data and making discoveries. [source]

b. Design Challenge: Design a recipe for a moldable biomaterial that can be used to sustainably prototype moldable objects.

i. Student teams will begin with recipes for existing open-source biomaterials such as bioplastic, mycelium, or paper composites and run experiments to change the material properties.

ii. The resulting material will be molded into an object of their choice by way of a 3D printed and modeled mold.

c. Design Process Focus: In this challenge, students will focus on observational research and synthesis of collected information. Students will also be prompted to make connections between the DOE process and the engineering design process.

d. Technical skill: Students will learn a mold-making process that uses 3D modeling and 3D printing as well as an open-source biomaterial.

e. Visual Communication: Teams will focus on using techniques of data visualization to communicate the results of their material experiments.

f. Deliverables:

i. PRESENTATION:

1. A title page that includes the names of the designers as well as an abstract that gives an overview of the material in a few sentences
2. Results of experiments/material tests using appropriate charts/graphs
3. A usable recipe for recreating the modified material
4. Photos of the material/process molds and results of the molding experiments
5. A design process statement—a short description about which aspects of the design process made the most impact on the team

ii. REVIEWS AND REFLECTION:

1. Students will present the actual materials and molded objects to the class for review and feedback.
2. Each student will complete a self-reflection of their work, what they learned, and their reflections on working with DOE.

g. Potential for Additional Engagement with Faculty: In this unit, it would be ideal to have a visiting faculty who works in material science give a lecture about material design or sustainability in material design. Additionally, a faculty member who works with DOE could give a presentation on how the design of experiments is applied in their own research. Faculty from material science would also be a welcome addition to the in-class feedback sessions.

3. Unit 3: Interaction Design

a. Overview: In this unit, students will explore the world of "smart" paper mechanisms by creating a low-fidelity actuator. Students will combine paper with nitinol wire (a shape-memory alloy that changes shape when heated to an activation temperature) and learn to control linear or rotary motion with the use of actuators, programmable sensors, and an energy source.

b. Design Challenge: Design a foldable or moveable paper mechanism that is controlled by a sensor (light, temperature, sound, or air pressure).

i. Student teams will begin by creating a basic paper mechanism such as a paper hinge or curl (see self-folding paper example) that is activated with a simple circuit using nitinol wire and a nine-volt battery. Next, students will learn how to incorporate an Arduino into the circuit to control the power by way of a sensor.

ii. Students will be asked to consider how the interaction with their mechanism is designed. Is it user-centered? Is it clear how to interact with it without instructions? What elements of the design could make interaction efficient and enjoyable?

c. Design Process Focus: In this challenge, students will focus on skills of prototyping and understanding the relationship between iterative prototypes and the rest of the design process. They will also be asked to consider the needs of a user and how to design user-centered interaction.

d. Technical Skill: This is a technically heavy project where students will learn the basics of working with a physical, programmable circuit board (Arduino) including skills of: programming, circuit design, soldering and sensor operation.

e. Visual Communication: Teams will focus on reading and drawing schematics and circuit diagrams.

f. Deliverables:

i. PRESENTATION:

1. A title page that includes the names of the designers as well as an abstract that gives an overview of the mechanism in a few sentences

2. Instructions on how to build their mechanism including appropriate schematics and circuit diagrams
3. Video that demonstrates a user interacting with the mechanism
4. A design process statement—a short description about which aspects of the design process made the most impact on their team

ii. REVIEWS AND REFLECTION:

1. Students will present the actual mechanism to the class for review and feedback.
2. Each student will complete a self-reflection of their work, what they learned, and their reflections on working with physical computing and paper mechanisms.

g. **Potential for Additional Engagement with Faculty:** In this unit, it would be ideal to have a visiting mechanical engineering professional give a lecture about actuators and a materials science faculty member speak about the development of smart or responsive materials. Additionally, a faculty member who could speak to the basics of electrical circuits and how to work safely with electricity or do a workshop onsoldering would be welcome.

4. Unit 4: Life-Centered Design

a. **Overview:** In this unit, student teams will participate in the Make:able challenge, a 3D printing and assistive technology design challenge, sponsored by PrintLab, Autodesk, and partners. This is a real design competition that offers an interactive curriculum and tool kit for students to develop their design and fabrication skills in a self-regulated way.

b. **Design Challenge:** Design and make a 3D printed product or prototype that improves the day-to-day life of someone with a disability or the elderly.

i. The full brief and guidelines are outlined in the challenge toolkit, but the key rules are as follows:

1. Students can work in teams with up to five participants.
2. The design process must include the use of either Tinkercad or Fusion 360 software and the digital 3D model produced should be 3D printable.
3. A physical 3D printed prototype must be created.
4. Teams can either design a product for a real end user (e.g. someone in the local community) or design a product for a Make:able Champion. Make:able Champions are people with disabilities who have shared their story and day-to-day challenges in a series of videos within the Make:able challenge toolkit.

c. **Design Process Focus:** In this challenge, students will undergo the full design process as articulated by the challenge but will likely spend the most time empathizing with the end users. The design process in the challenge toolkit is essentially the engineering design process, but as is common, uses slightly different language to describe the different components of the process. Students will be asked to reflect on how different explanations of the design process resonate with their own instincts on how to solve big problems.

d. **Technical skill:** Students will work directly with official Autodesk training modules to gain skills in 3D modeling and printing that they can apply to their own unique assistive device.

e. **Visual Communication:** Teams will focus on skills of storytelling using video and still images to communicate their product/solution.

f. **Deliverables:** Teams are asked to prepare a full submission to the Make:able challenge. This is a great opportunity for students to practice the skills of archiving and project hand-off, which is a common practice for designers in industry. Their submission will include:

i. Video: Teams will create a short (under two minutes) video that documents their solution, their design process, and their user information in a compelling narrative.

ii. Design Files: Teams will submit their original CAD files (either TinkerCad or Fusion360).

iii. High-Quality Images: Teams will submit a

high-resolution image that best shows off their solution. This might be an image of it in use, or it might be a powerful rendered image.

iv. Bill of Materials and Assembly Instructions: Students will create a short document that details the exact materials used in their solution, together with instructions on assembling it.

v. Creative Commons Consent: Students will be designing for one specific person but can make the choice to offer their design as open source so that it may benefit multiple people in need. This is optional and up to the team.

5. Potential for Additional Engagement with Faculty:
In this unit, it would be ideal to connect each team with a consulting faculty member who works in medical device development or with disability research. Alternatively, if there is a faculty member who identifies a person with a disability and would like to serve as a co-designer on the project, that is also an option. The challenge provides real users with identified needs but encourages students to co-design with a person in their own life if possible.

ASSESSMENT AND EVALUATION

This course will make use of a combination of formative and summative assessment strategies to evaluate how the learning is going (formative) and how well students are meeting the objectives of the course (summative).

Formative assessments will take place through student reflections at four different intervals throughout the semester. Each project ends with a self-reflection in which students are asked to reflect on their own learning in the project and to which faculty will respond with their own observations of student's strengths and weaknesses. Other examples of formative assessment that will take place throughout the semester include:

- Design feedback sessions, also known as critiques. These accompany oral presentations of design solutions, and students will be encouraged to give each other constructive feedback on the nature of their design.
- ePortfolio submissions which will outline everyone's perception of their learning and work on a particular project.

Summative assessments will also take place at four intervals, aligning with each project, and will reflect the degree to which students are meeting the objectives of the unit. These assessments will take the form of a portfolio and will be evaluated by means of a community designed rubric. A community designed rubric reflects the feedback needs of the project as defined by both students and faculty.

IMPLEMENTATION PLAN

It is the recommendation of this working group, and a reflection of stakeholder interests, that the course content be delivered in a hands-on, active learning manner. The course will meet once a week for 2.5 hours with no more than 40 minutes of lecture-based format. Instead, course time will be based around active demos, group working time, and meetings with faculty mentors.

Teaching Team: The pilot will be taught as a team-teaching experience whereby lectures, demos, and workshops will be delivered collectively to the entire cohort, and each faculty member will mentor a group of 12 students in small teams through their design challenges.

Flipped Classroom: When possible and appropriate to the course, video or online course delivery of certain concepts will be offered as homework so that class time can be spent with teams working on their design challenges. This isn't always possible or ideal, but faculty will be investigating the efficacy of this model for the pilot.

Classroom Space: The pilot will be taught in FastForward University which is a flexible and active learning space. Students will be able to join all together for coursewide information/lectures, etc. but also have space to split up into their design teams to work on challenges and meet with their mentors.

Budget: A preliminary budget of $7,500 has been allocated for the purchase of supplies, materials, and resources relevant to the hands-on projects.

SUMMARY

The goals of the curricular working group were to design a first-year seminar in multidisciplinary engineering design that was hands-on, supported student needs with community and cohort building, and enabled interdisciplinary design exploration early in a student's career. It is our belief that the proposed pilot will meet these goals while also supporting the development of core foundational abilities and creating opportunities for first-year students to make meaningful connections to faculty.

Each unit of the course engages the full design process but naturally emphasizes different aspects depending on the nature of the design challenge. It is our hope that this circular deployment of process-based instruction will emphasize that the design process is not linear nor static and that the key takeaway from learning a process is learning to be flexible about how it is used. Additionally, it is our hope that the projects are all engaging and challenging design prompts that reflect a broad range of exciting possibilities within the world of engineering design.

At the conclusion of the pilot, we will conduct a programmatic assessment, including recommendations on how to scale the course and further engage faculty from multiple departments to deliver the course.

APPENDIX G. JHU UNDERGRADUATE ACADEMIC ADVISING MISSION STATEMENT

THE MISSION OF ACADEMIC ADVISING at Johns Hopkins University is to provide quality advising that calls on the expertise of faculty, staff, and administration who work with students to identify and explore the unique curricular, co-curricular, and extracurricular opportunities that define the Johns Hopkins University undergraduate experience.

Advisors use evidence-based and pedagogically sound approaches to empower students and support their holistic well-being as they navigate their academic choices, explore meaningful experiential learning opportunities, and engage in a richly diverse campus community that cultivates inclusivity and promotes intellectual curiosity.

Through collaborative efforts across the various campuses and schools, advisors work to ensure that all students can define and pursue their personal, academic, and professional goals.

APPENDIX H. WSE UNDERGRADUATE ACADEMIC ADVISING LEARNING OUTCOMES

GOALS	OBJECTIVES	OUTCOMES
Develop a curricular plan to achieve their academic goals and University degree requirements	Demonstrate responsibility for their education by monitoring their academic progress	Make use of Degree Audit system
		Outline an adaptable flexible four-year academic plan
		Make informed decisions that align with academic goals and time to degree completion
Normalize academic help-seeking behavior	Identify opportunities for academic growth and development	Discern when it is necessary to engage academic support resources
	Cite examples of academic support resources	
	Participate in academic support programming	
Engage in experiential learning and contribute to the intellectual life of the School/ University	Identify and connect with mentors within academic discipline	Join a research group
	Participate in undergraduate research	Attend academic talks and conferences in the department, within the school, and across the University
	Pursue professional development opportunities	Attend local, regional, or national conferences
	Explore discipline-specific student groups and organizations	Identify and secure internship opportunities
Devise a leadership and personal development plan	Identify civic engagement opportunities that align with core values	Incorporate diverse perspectives in personal and professional development
	Explore ways to cultivate and nurture life skills	Respect values, ethics, rights, and dignity of others
	Develop a working definition of personal ethics and describe how those ethics will inform work and life choices	Lead with honesty, integrity, trust, and fairness
Engage in activities and practices to support overall well-being	Identify university resources that promote self-care and how to access them	Integrate healthy choices regarding diet, sleep, exercise, stress management, alcohol/drug use into daily life
		Take responsible risks, mitigating the fear of making mistakes
		Advocate for personal needs

“The real value in failure is what you learn from it… You learn in the moments when nature or a device is not behaving the way you think it should… It took a while for me to get to the point where I would accept that and find those moments to be interesting instead of frustrating. This removed the fear of failure from my work… It was one mistake after another that led us to the invention of the electret microphone at Bell Labs in the early 1960s.”

JAMES WEST, 2015

Reflection from an interview with Jim Duffy in the HUB Gazette. West is a JHU electrical and computer engineering professor. The electret microphone remains the dominant technology to this day.