ESF's Strategic Graduate Program Assessment Plan
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Background

Assessing ESF's graduate programs is challenging given their prescriptive to descriptive nature as illustrated by Figure 1a.

Prescriptive   Descriptive

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Professional Graduate Degrees   Professional Graduate Degrees   Research Graduate Degrees
Master of Forestry   Master of Professional Studies   Master of Science
Master of Landscape Architecture   Ph.D.
Etc.

Figure 1a. ESF's Graduate Program Continuum

Prescriptive graduate programs are, for example, the Master of Forestry and the Master of Landscape Architecture, where the curriculum must satisfy specific student learning outcomes as defined by the professional societies that accredit them. Likewise, the Master of Engineering program is prescriptive to help satisfy a year of credit toward professional licensure. Research graduate degree programs are on the descriptive end of the continuum. These programs specify the number of: i) thesis or dissertation credits, ii) seminar credits, or iii) the number of lower division vs upper division graduate course work credits required. However, because they are research driven, the courses that comprise an individual student's graduate program are specific to addressing the research concern. The Master of Professional Studies (MPS) lies between prescriptive and descriptive on the continuum. A more prescriptive MPS would define a specific set of core courses comprising approximately half of the total required credits with the remaining course work allowing the student to focus on an area of interest. An example of this type of MPS can be found in the Chemical Engineering Department. A more descriptive MPS would identify topic areas that must be addressed, such as analytical methods that would include statistics, geographic information systems, etc. These topic areas would define how many credits must be used to satisfy the requirement and often provide a list of acceptable graduate courses. In some cases, a few specific courses would be required.

The continuum described in Figure 1a leads to overlaying an assessment protocol that can encompass both ends of this continuum. This is illustrated by Figure 1b.
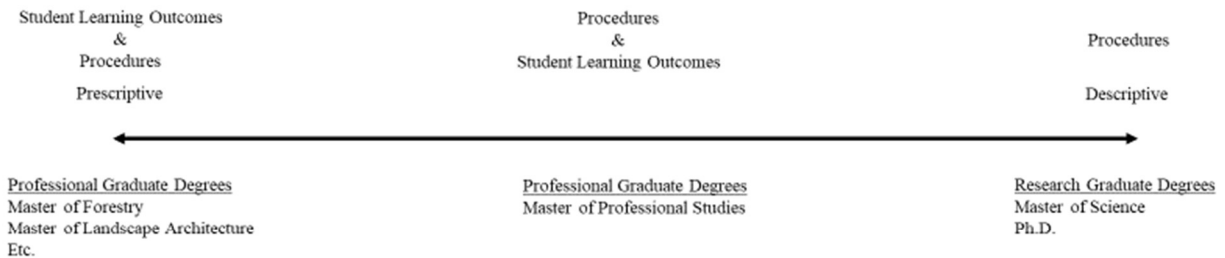
Figure 1b. Graduate Program Assessment Continuum

The assessment of SUNY ESF's graduate degree programs can comprise two assessment protocols. The first is a common student learning outcomes approach described by most professional societies and national accrediting bodies; for example, NWCCU (*https://www.nwccu.org/accreditation/standards-policies/standards/*), SACS (*http://sacscoc.org/app/uploads/2019/08/2018-POA-Resource-Manual.pdf*), MSCHE (*http://www.msche.org/wp-content/uploads/2018/06/RevisedStandardsFINAL.pdf*), and NECHE (*https://www.neche.org/resources/standards-for-accreditation/*).

The second is a procedures approach that draws on the Quality Management Systems (QMS) or International Standards Organization (ISO) method. A quality management system is repeatable, measurable, and constantly improving, structured way of delivering a service or product supported by documented information such as *procedures, policies and forms* which define both expectations, responsibilities, and actions to achieve the stated quality goals. A key component of this approach is being able to collect the appropriate data to improve the system continually.

Assessing ESFs Graduate Programs – Currently
The current responsibility for maintaining and improving the academic quality of the graduate programs lies primarily in the departments with the departmental faculty, graduate coordinators, and chairs. Responsibility for the quality of each student's learning experience is left to the faculty through the appointment and activities of students' advisors (major professors) and steering committees. The current system of data collection and analysis prevents institution-wide efforts to assess its graduate programs and close the assessment loop. The Assistant Dean for Graduate Programs has engaged in institution-level data analysis in a more centralized manner that will facilitate the implementation of evidence based continuous improvement efforts.

Moving Forward – The Procedures Approach
The procedures approach which ESF will use to ensure program quality will be modeled after Cornell's.[1] This approach will be based on milestones and timelines that are codified through a series of forms, which must be approved by the student and/or departmental representatives. Using this approach is supported by ESF's graduate school website (https://www.esf.edu/graduate/graddegreq.htm accessed 21 November 2021), ((https://gradschool.cornell.edu/about/program-metrics-assessments-and-outcomes/learning-assessment/ accessed 21 November 2021), which contains information on forms and timing.

Using a milestones and timelines approach, SUNY ESF graduate students are expected to complete all degree requirements within the following timeframes:

- Full-time (FT) Master's: three years
- Part-time (PT) Master's: determined in consultation with steering committee based on needs of student
- Ph.D.'s: seven years

Extensions may be granted by submitting a petition for extension of time limit for degree completion.

Program milestones, corresponding forms and typical timelines for completion are found in Table 1.

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[1] We also recognize that with the current financial hardships facing ESF, any proposed graduate program assessment plan must be least cost and built on the foundation of the KISS of Success – Keep it Simple Stupid.

Table 1. Graduate Degree Timelines and Milestones[‡]

Degree	Appointment of Steering Committee (2A)	Program of Study Plan (3B)	Dissertation Proposal		Capstone	Dissertation/ Thesis Defense Results (5E/8)
Ph.D.	Steering committee appointed before the end of the 3rd semester.	Program of study approved by steering committee before the end of the 4th semester	Must be approved by steering committee at least 1 semester prior to Candidacy (the exception is Chemistry's use of candidacy exam format 3).	Candidacy Exam taken when majority of coursework is completed. Must be successfully completed within 3 years of matriculation and at least 1 year prior to dissertation defense.	Public presentation of dissertation research required prior to the defense.	Successful defense of dissertation required at conclusion of study and research program.

Degree	Appointment of Steering Committee (2A)	Program of Study Plan (3B)	Thesis Proposal	Candidacy Exam Results (6E/8)	Capstone	Dissertation/ Thesis Defense Results (5E/8)
MS	Steering committee appointed before the end of the 2nd semester.	Program of study approved by steering committee before the end of the 3rd semester	Must be approved by steering committee 2 semesters prior to defense.	n/a	Public presentation of thesis research required prior to the thesis defense.	Successful defense of thesis required at conclusion of study and research program.
MLA	Steering committee appointed during first semester.	Program of study approved by steering committee by 3rd semester.	n/a	n/a	Must complete an integrative experience, participate in capstone studio during the final semester and disseminate results of integrative studies through capstone seminar.	n/a

Degree	Appointment of Steering Committee (2A)	Program of Study Plan (3B)	6E/8	Capstone	5E/8
MPS	FT: Steering committee appointed by end of first semester. PT: After 12 credits completed.	FT: Program of study approved by steering committee by end of 3rd semester. PT: Program of study approved by steering committee by final semester.	n/a	Public presentation of topic, chosen in consultation with MP and steering committee	n/a
MF	FT: Steering committee appointed by end of first semester. PT: After12 credits completed.	FT: Program of study approved by steering committee by end of 3rd semester. PT: By last semester.	n/a	n/a	n/a

[‡] If a graduate student completes a dual degree or certificate programs with SU, all the deadlines will be delayed by 1 year.

ESF has not historically nor routinely collected or disseminated data about their graduate programs in a centralized manner, although each department has established their own norms and processes for delivery of quality graduate education. Developing and implementing an institution-wide procedural approach to graduate program assessment will facilitate data collection, analysis, and interpretation. It will allow for continuous improvement of graduate programs under a more centralized system; for example, aligning graduate degree timelines at the institutional level rather than at the department level.

The College has identified five issues that must be addressed to adopt a procedure-based quality improvement/assurance program for graduate education at ESF.

1. **W**hile limited procedure-based data are available, they have not been analyzed in any systematic manner. Limited OIGS staff time is currently focused almost exclusively on inputting current and historic data in a consistent form so it can potentially be analyzed and disseminated. Furthermore, formal structures will need to be developed for the graduate school to inform the College administration, department chairs, graduate program coordinators, and major professors about how the system is performing.

2. **R**esponsibility for analyzing the procedure-based data should be coordinated across The Graduate School, Assessment Office, and Graduate Program Coordinators from each department.

3. **T**hrough effective collaboration between the various offices responsible for graduate program assessment, rubrics will need to be developed and established for institution-wide use; these rubrics should honor assessment work that has been ongoing under the decentralized model and be elastic enough to apply to the variety of degrees and programs involved. Such rubrics will be vital to inform the college administration, department chairs, graduate program coordinators, and major professors of how well the system is performing relative to desired outcomes.

4. **O**nce the proposed assessment approach is implemented, establishing college-wide mechanisms to review the assessment plan, performance metrics, and implement performance improvements will allow stakeholders to "close the loop" on graduate program assessment. Currently, OIGS's central role in processing, monitoring, and coordinating student progress through their programs, and in implementing graduate policies and procedures, well situates it to collect and disseminate assessment data and to coordinate and oversee the graduate assessment process. The Assistant Dean has, over the past year and a half, taken a lead in monitoring the timeliness of the forms described in Table 1. These timeliness data can be and will be used to evaluate the procedural efficiency of our graduate programs in completing graduates. In addition, the data collected on forms 6E/8, Proposal, Capstone, and 5E/8 described in Table 1 can be and will be used to evaluate the procedural quality of our graduate programs, which is managed by the major professor, graduate steering committee, reader, and defense chair. These data have also been shared with the departments at various times and in various forms.

5. Going forward, we need to more clearly articulate a process for using these data to assess and improve our graduate programs, as well as the important and interconnected roles and responsibilities of the Assistant Dean, Assistant Director, Department Chairs, Graduate Coordinators, IT and others in conducting ongoing assessment and improvement of our graduate programs.

An operational plan needs to be put forth to address the issues identified above. Addressing this full slate of issues will move ESFs graduate programs forward and be essential to maintaining college accreditation in 2022.

We propose adopting the following learning proficiencies, based on those found Cornell's graduate school website, to address the third concern.[2]

Learning Proficiencies for all ESF Graduate Students

SUNY ESF is dedicated to the study of our environment in all its complexity, from the basic and applied sciences, to engineering, design, and planning of both natural and human communities. Because of this, and in order to facilitate the range and depth of graduate education provided at ESF, learning outcomes vary across the graduate academic programs. However, common to these programs is a set of three overarching goals, which characterize the ESF graduate educational experience:

Doctoral and Master's students
- Ambassadors for providing environmental solutions and affecting change through exemplary scholarship, teaching and research
- Engage effectively as leaders and stewards of the natural and designed environments through various forms of outreach
- And recognize and seek diversity and inclusion as a source of strength, creativity, and innovation

Doctoral Proficiencies

A candidate for a doctoral degree will demonstrate mastery of knowledge and skills in their chosen field and synthesize and create new knowledge in an appropriate timeframe.
- Make an original contribution to the discipline, which impacts the environment, the individual, society, or ideas
  - Think originally and independently to develop concepts and methods
  - Identify new research opportunities within one's field
- Demonstrate advanced research skills
  - Synthesize existing knowledge, identifying and accessing appropriate resources and other sources of relevant information and critically analyzing and evaluating one's own findings and those of others
  - Apply existing research methods, techniques, and technical skills
  - Communicate complex information effectively and in multiple ways (including both oral and written), to diverse audiences and in a style appropriate to the discipline
- Demonstrate commitment to advancing the values of scholarship

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[2] Appendix A provides a general outline of the five categories of learning for each degree level, defines proficiencies basic to each area of learning, and describes their relationship to one another.

- o Keep abreast of advances within one's field and related areas
- o Show commitment to professional development through engagement in professional societies, publication, and other knowledge transfer modes
- o Participate in creation of an environment that supports learning through teaching, collaborative inquiry, mentoring, or demonstration
- Demonstrate professional skills
    - o Adhere to ethical standards in the discipline
    - o Listen, give, and receive feedback professionally
    - o Show ability to adapt to unexpected needs and opportunities
    - o Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- Demonstrate commitment to ESF's vision that all people have much to contribute and that all perspectives deserve respect
    - o Recognize the diversity of stakeholders when developing new and innovative solutions
    - o Support and help create ESF's climate of inclusiveness and diversity as teachers, scholars, and researchers.

Research Master's Proficiencies

A candidate for a research master's degree will demonstrate knowledge in the chosen discipline and ability to synthesize and apply knowledge, making a contribution to the field in an appropriate timeframe.

- Make a contribution to the scholarship of the field.
- Learn advanced research skills
    - o Synthesize existing knowledge, identifying, and accessing appropriate resources and other sources of relevant information and critically analyzing and evaluating one's own findings and those of others
    - o Apply existing research methods, techniques, and technical skills
    - o Communicate both orally and in writing in a style appropriate to the discipline
- Demonstrate commitment to advancing the values of scholarship
    - o Keep abreast of current advances within one's field and related areas
    - o Show commitment to personal professional development through engagement in college clubs, professional societies, and other knowledge transfer modes
    - o Show a commitment to creating an environment that supports learning through teaching, collaborative inquiry, mentoring, or demonstration
- Demonstrate professional skills
    - o Adhere to ethical standards in the discipline
    - o Listen, give, and receive feedback professionally
    - o Work effectively as a part of a team
- Demonstrate commitment to ESF's vision that all people have much to contribute and that all perspectives deserve respect
    - o Contribute to ESF's climate of inclusiveness and diversity as teachers, scholars, and researchers.

Procedural data (of the type currently collected by the OGIS) will allow some inferences on the above proficiencies. Additional indicator data should be collected to strengthen these inferences such as current and historic demographics of graduate students, membership (and the college financially supporting membership) in professional societies, attending (and the college financially supporting attending) conferences, numbers of presentations and conferences, numbers and types of publications resulting from the research, etc. Tables 2 and 3 map the proficiencies and skills listed in Table 1 to process and supporting metrics.

Table 2. Ph.D. Proficiency Mapping for the Procedural Assessment Approach

Proficiency or Skill	Evidence	Process Metric	Acceptable Value	Supporting Metrics
Contribute substantively to discipline	1) Think originally and independently to develop concepts and methods. 2) Identify new research opportunities within one's field.	Research proposal accepted. Successful dissertation (8A) and defense (5E & Form 8).	To be determined by the ad hoc committee defined in "Developing an Operational Assessment Plan".	Number and type of publications. Awards for scholarship
Research skill development	1) Synthesize existing knowledge, identifying and accessing appropriate resources and other sources of relevant information and critically analyzing and evaluating one's own findings and those of others. 2) Apply existing research methods, techniques, and technical skills 3) Communicate complex information effectively and in multiple ways (including both oral and written), to diverse audiences and in a style appropriate to the discipline	Research proposal accepted Candidacy (6F & 8) Capstone presentation. Successful dissertation defense (5E & 8). Dissertation approved (8A) Ph.D. awarded	To be determined by the ad hoc committee defined in "Developing an Operational Assessment Plan"	Publications Presentations Awards for scholarship Classes taught Courses taught, including course evaluations

Commitment to Scholarship	Keep abreast of current advances within one's field and related areas. Show commitment to professional development through engagement in professional societies, publication, and other knowledge transfer modes. Participate in creation of an environment that supports learning through teaching, collaborative inquiry, mentoring, or demonstration	Research proposal accepted. Successful dissertation (8A) and defense (5E & Form 8).	To be determined by the ad hoc committee defined in "Developing an Operational Assessment Plan"	Conferences attended and conference presentations. Professional organization membership. Publications - number and type. Classes taught. Students mentored. Seminars Awards for scholarship Awards for public service
Professional skills	1)Adhere to ethical standards in the discipline 2) Listen, give, and receive feedback professionally 3) Show ability to adapt to unexpected needs and opportunities 4) Function effectively on a team whose members together provide leadership, create a collaborative	Research proposal accepted Annual meetings with steering committee. Capstone seminar. Candidacy exam. Dissertation defense.	To be determined by the ad hoc committee defined in "Developing an Operational Assessment Plan"	Co-authored papers. Presentation rubric (https://www.purdue.edu/science/Current_Students/curriculum_and_degree_requirements/oral_rubrics_gray.pdf) Graduate Colloquium completion.

	and inclusive environment, establish goals, plan tasks, and meet objectives			
Diversity, Equity, and Inclusion	1) Recognize the diversity of stakeholders when developing new and innovative solutions 2) Support and help create ESF's climate of inclusiveness and diversity as teachers, scholars and researchers.	Completing the Graduate Colloquium We have identified a gap and a required DEI seminar has been suggested by the GSA.	To be determined by the ad hoc committee defined in "Developing an Operational Assessment Plan"	Study, work or research abroad. Students receiving Title IX and Anti-harassment/anti-discrimination training. Research relevant to DEI issues or involving underserved populations and/or inequalities. Participation in outreach activities relevant to advancing equity and access to higher ed.

Table 3. M.S. Proficiency Mapping for the Procedural Assessment Approach

Proficiency or Skill	Evidence	Process Metric	Acceptable Value	Supporting Metrics
Scholarship in the field	1) Identify research opportunities within one's field. 2) Complete research project and report findings and	Research proposal accepted. Successful thesis (8A) and defense (5E & Form 8).	To be determined by the ad hoc committee defined in "Developing an Operational Assessment Plan"	Number and type of publications. Awards for scholarship

	implications for further research.			
Advanced research skills	1) Synthesize existing knowledge, identifying, and accessing appropriate resources and other sources of relevant information and critically analyzing and evaluating one's own findings and those of others. 2) Apply existing research methods, techniques, and technical skills 3) Communicate both orally and writing in a style appropriate to the discipline	Capstone presentation. Successful thesis defense (5E & 8). Thesis approved (8A) M.S. awarded.	To be determined by the ad hoc committee defined in "Developing an Operational Assessment Plan"	Publications Presentations Awards for scholarship Classes taught
Commitment to Scholarship	Keep abreast of current advances within one's field and related areas. Show commitment to personal professional development through engagement in college clubs, professional societies, and other knowledge transfer modes.	Research proposal accepted Capstone presentation. Successful thesis defense (5E & 8). Thesis approved (8A) M.S. awarded.	To be determined by the ad hoc committee defined in "Developing an Operational Assessment Plan"	Conferences attended and conference presentations. Professional and student organization membership. Publications - number and type. Awards for scholarship Classes taught. Students mentored. Seminars

				Awards for public service
	Show a commitment to creating an environment that supports learning through teaching, collaborative inquiry, mentoring or demonstration			
Professional skills	1)Adhere to ethical standards in the discipline 2) Listen, give, and receive feedback professionally 3) Work effectively as a part of a team	Annual meetings with steering committee. Capstone seminar. Thesis defense.	To be determined by the ad hoc committee defined in "Developing an Operational Assessment Plan"	Co-authored papers. Presentation rubric (https://www.purdue.edu/science/Current_Students/curriculum_and_degree_requirements/oral_rubrics_gray.pdf) Graduate Colloquium completion
Diversity, Equity, and Inclusion	1) Contribute to create ESF's climate of inclusiveness and diversity as teachers, scholars and researchers.	Completing the Graduate Colloquium We have identified a gap and a required DEI seminar has been suggested by the GSA.	To be determined by the ad hoc committee defined in "Developing an Operational Assessment Plan"	Study, work or research abroad. Successfully complete Title IX and Anti-harassment/anti-discrimination training. Research relevant to DEI issues or involving underserved populations and/or inequalities. Participate in outreach activities relevant to advancing equity and access to higher ed.

The proficiencies and their mapping into Tables 2 and 3 provide a starting point for developing a detailed operational procedural assessment plan outlining the procedures, data, and rubrics for assessing the graduate programs and for "closing the loop" to improve the graduate programs. Developing relevant rubrics will support interpreting these procedural data to improve the system by providing mutually agreed upon benchmarks[3] For example, making sure all the required forms are processed in a timely manner or time to completion is within defined norms. These could be as simple as: greater than 90% of graduates required forms turned-in in a timely manner or 90% complete their degree within the defined norms is successful; 89% to 80% is adequate; and below 79% is inadequate. Additional metrics (and accompanying benchmarks) to be developed and assessed may include annual measurements of candidacy exam completion, including number of students achieving candidacy, and success/failure rates for written and oral exam components by degree program. Similar metrics may also be assessed for Master's thesis and Ph.D. dissertation defense completions. Example metrics that could help are https://gradschool.cornell.edu/about/program-metrics-assessments-and-outcomes/facts-figures/ and https://gradschool.cornell.edu/about/program-metrics-assessments-and-outcomes/doctoral-career-outcomes/ accessed 25 September 2020. Methods for "closing the loop" would focus on improving mentoring for faculty and graduate students to address performance levels on an as needed basis.

Developing an Operational Procedural Assessment Plan
The material provided in the previous section provide a starting point for developing an operational assessment plan. The logical office to lead this undertaking is OIGS. However, within OIGS currently there is no individual responsible for graduate program assessment or to assist in addressing the remaining four concerns identified in the previous section. OGIS is short staffed. Additional resources should be provided to OIGS (i.e., additional staffing of approximately 0.50 FTE) to help develop and implement an operational procedural graduate program assessment plan. It is recommended these resources be secured within calendar year 2022.

The primary lead within OIGS will be provided by the Assistant Dean of Graduate Studies working in coordination with Assistant Director of Assessment and Institutional Research (Assistant Director) and assisted by the additional OIGS staff person to develop a detailed operational procedural assessment plan as described above briefly. We recognize that the Assistant Dean and Assistant Director, will not be able to accomplish this task without significant input and support from the college community. Thus, an ad hoc college faculty committee charged with this responsibility will be formed, co-chaired by the Assistant Dean, and a faculty member or the Assistant Director and populated from members of the Graduate Council or their surrogates. We recommend the ad hoc committee be formed by the end of calendar year 2022 with the operational procedural assessment plan finished by calendar year 2023.

The Assistant Dean and additional staff person will also work with college Information Systems staff to identify and propose a web based tool to assist in analyzing the collected assessment data

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[3] The Degree Qualification Profile (https://www.luminafoundation.org/files/resources/dqp.pdf accessed 29 November 2021) provides examples of rubrics for undergraduate and graduate level assessment.

drawn from Slate, Banner, Degree Works, and/or additional graduate student data and records systems, and provide reports to OIGS, the college administration, department chairs, graduate program coordinators, and major professors and display these data in a dashboard located on appropriate college graduate school web site. We recommend this task be accomplished in calendar years 2022 to 2024. Examples that could help are https://gradschool.cornell.edu/about/program-metrics-assessments-and-outcomes/facts-figures/ and https://gradschool.cornell.edu/about/program-metrics-assessments-and-outcomes/doctoral-career-outcomes/ accessed 25 September 2020.

The Assistant Dean and additional staff person will compile the first set of reports containing the analysis and interpretation to be distributed to the college administration, OIGS, department chairs, graduate program coordinators, and major professors no later than calendar year 2024. A close the loop analysis will be prepared by the Assistant Dean, Assistant Director and ad hoc committee, in concert with college administration, OIGS, department chairs, graduate program coordinators, and major professors no later than calendar year 2024. Any proposed changes will be brought to the college community, discussed and, those accepted, implemented in calendar year 2024 to 2025. After this assessment plan is in place and completed the first time, a continuous process will be put in place including ongoing collection, organization and analysis of data, dissemination of reports, and generation, selection and implementation of improvements.

Appendix A

The Cornell proficiencies are consistent with Articulating Learning Outcomes in Doctoral Education (https://cgsnet.org/publication-pdf/4923/ArticulatingLearningOutcomesinDoctoralEducationWeb.pdf accessed 30 September 2020). A more specific articulation of learning outcome is provided by Degree Quality Profiles (https://www.luminafoundation.org/files/resources/dqp.pdf accessed 30 September 2020). This is outlined briefly below.

Specialized Knowledge
- Elucidates the major theories, research methods and approaches to inquiry and schools of practice in the field of study, articulates their sources and illustrates both their applications and their relationships to allied fields of study.
- Assesses the contributions of major figures and organizations in the field of study, describes its major methodologies and practices and illustrates them through projects, papers, exhibits or performances.
- Articulates significant challenges involved in practicing the field of study, elucidates its leading edges and explores the current limits of theory, knowledge and practice through a project that lies outside conventional boundaries.

Broad and Integrative Knowledge
- Articulates how the field of study has developed in relation to other major domains of inquiry and practice.
- Designs and executes an applied, investigative or creative work that draws on the perspectives and methods of other fields of study and assesses the resulting advantages and challenges of including these perspectives and methods.
- Articulates and defends the significance and implications of the work in the primary field of study in terms of challenges and trends in a social or global context.

Intellectual Skills
- *Analytical Inquiry*: Disaggregates, reformulates and adapts principal ideas, techniques or methods at the forefront of the field of study in carrying out an essay or project.
- *Use of Information Resources*: Provides evidence (through papers, projects, notebooks, computer files or catalogues) of contributing to, expanding, evaluating or refining the information base within the field of study.
- *Engaging Diverse Perspectives*: Investigates through a project, paper or performance a core issue in the field of study from the perspective of a different point in time or a different culture, language, political order or technological context and explains how this perspective yields results that depart from current norms, dominant cultural assumptions or technologies.
- *Ethical Reasoning*: Articulates and challenges a tradition, assumption or prevailing practice within the field of study by raising and examining relevant ethical perspectives through a project, paper or performance. Distinguishes human activities and judgments particularly subject to ethical reasoning from those less subject to ethical reasoning.
- *Quantitative Fluency*: Uses logical, mathematical or statistical methods appropriate
- to addressing a topic or issue in a primary field that is not for the most part quantitatively based. Or, articulates and undertakes multiple appropriate applications of quantitative

methods, concepts and theories in a field of study that is quantitatively based. Identifies, chooses and defends the choice of a mathematical model appropriate to a problem in the social sciences or applied sciences.

- *Communicative Fluency*: Creates sustained, coherent arguments or explanations summarizing his/her work or that of collaborators in two or more media or languages for both general and specialized audiences.

Applied and Collaborative Learning

- Creates a project, paper, exhibit, performance or other appropriate demonstration reflecting the integration of knowledge acquired in practicum, work, community or research activities with knowledge and skills gleaned from at least two fields of study in different segments of the curriculum. Articulates the ways in which the two sources of knowledge influenced the result.
- Designs and implements a project or performance in an out-of-class setting that requires the application of advanced knowledge gained in the field of study to a practical challenge, articulates in writing or another medium the insights gained from this experience, and assesses (with appropriate citations) approaches, scholarly debates or standards for professional performance applicable to the challenge.

Civic and Global Learning

- Assesses and develops a position on a public policy question with significance in the field of study, taking into account both scholarship and published or electronically posted positions and narratives of relevant interest groups.
- Develops a formal proposal, real or hypothetical, to a non-governmental organization addressing a global challenge in the field of study that the student believes has not been adequately addressed.
- Proposes a path to resolution of a problem in the field of study that is complicated by competing national interests or by rival interests within a nation other than the U.S.