

APPENDIX ONE

Defining the Stetson Undergraduate Research Capstone Requirement

Undergraduate Research Committee

December, 2019

The strong emphasis on undergraduate research that permeates the Stetson University curriculum has gained national recognition through presentations made at various conferences in undergraduate research and curricular scholarship. At the same time, there are rising concerns among faculty in overtaxed disciplines whether we can sustain undergraduate research at the Capstone level in the form we currently use. The preferred structure in the College of Arts and Sciences has been to require every student to undertake a senior project. While some disciplines, especially in STEM, may use a team approach to consolidate the workflow the individual student is still expected to submit a final discipline-specific product to fulfill the Senior Project requirement.

At the same time, there is a desire to utilize more integrative learning in the Stetson curriculum. The map that we give our students in the “coherent progression from the FSEM to the JSEM to the senior project” which forms the CORE Academic Experience invites the Stetson student to broaden horizons, integrating experiences and perspectives from a breadth of coursework across the curriculum. For many of our students, the journey is as important (or more so) than the final product. Baxter Magolda examines the journey from introductory research to Capstone in an integrated learning structure as embracing ‘external formulas’ where authorities such as parents, teachers and textbooks form a knowledge base, to ‘crossroads’ when students discover the uncertainties and multiple perspectives that inform opinions and begin to create their own perceptions, to ‘self-authorship’, when students “accept knowledge as contextual, possess an internal belief system and sense of self, and show the capacity to engage in interdependent and authentic relationships.”¹ This integrative curricular experience should include the culminating Senior Project, and might help frame new approaches to the capstone project.

Business and Music

The Undergraduate Research Committee would like to propose a change in the General Education Program that would acknowledge the Senior Capstone as a universal General Education requirement with multiple ways that it can be fulfilled. Schools and departments will

¹ Baxter Magolda, M. B. (2004). Learning partnerships model: A framework for promoting self-authorship. In M. B. Baxter Magolda & P. M. King (Eds.), *Learning partnerships: Theory and models of practice to educate for self-authorship* (pp. 37–61). Sterling, VA: Stylus. Summarized by Haynes, Carolyn, and Jeannie Brown Leonard. "From surprise parties to mapmaking: Undergraduate journeys toward interdisciplinary understanding." *The Journal of Higher Education* 81, no. 5 (2010): 647.

have the right to determine the appropriate approaches for their students from the list below, but are free to accept a number of choices depending on the needs of that school or department.

All Capstones must demonstrate the following:

1. Research, analysis and interpretation appropriate to the discipline undertaken. This could come from lab, library, business or community based research. It could come from the study of skills in creative arts or music.
2. A physical artifact that meets the standards of the discipline. This could be a research paper, a researched portfolio, computer software, artwork, composition or an annotated music program. The artifact should demonstrate originality, self-authorship, and an understanding of the various perspectives or interpretations germane to the artifact.
3. Public oral communication of the Capstone. This could be an oral or poster presentation, an exhibition, a recital, or a demonstration

A Note on Terminology

At Stetson, most departments refer to this crowning work as the Senior Project or Senior Research. In academe, the term more commonly used is Capstone, commonly defined as “the culminating and usually integrative experience of an educational program”² The Glossary of Education Reform goes further, affirming that the goal of a Capstone is to challenge students to “think critically, solve challenging problems, and develop skills such as oral communication, public speaking, research skills, media literacy, teamwork, planning, self-sufficiency, or goal setting.”³ This could include performance, artistic exhibition and recital work as well, as students demonstrate in such capstones the ability to apply their learning to interpretation and communication of a vision or talent. For the purposes of this proposal, the terms ‘Senior Project’ ‘Senior Research’ and ‘Capstone’ will be applied interchangeably based on the definitions above. However, if this is to be a universal requirement, the term Capstone is preferred for the actual language of the requirement in the Catalog.

The Challenge

The Senior Capstone has become a burden for some departments as student numbers have risen while faculty resources have not. The option proposed by some overburdened faculty is to eliminate the mandatory senior research project in the College of Arts and Sciences, or to require it for students who meet some sort of gateway. The Undergraduate Research Committee contends that this could do damage to the school’s reputation. Several comments by members of the Undergraduate Research Program Directors (URPD) Division of the Council for Undergraduate Research (CUR) have concluded that few students in proportion to the whole will engage in capstone research if the activity is optional only⁴. Students perceive capstone work to be grade-lowering, time-consuming, expensive and – most of all- a lot of work. Those who take on senior projects in schools where the project is not mandatory are generally honors students or graduate school hopefuls, absorb the majority of faculty attention and create a class system even if that was never the intention.

² Marcus Ford; Marcus Peter Ford (2006). Beyond the Modern University: Toward a C. IAP. p. 44

³ <https://www.edglossary.org/capstone-project/>

⁴ The URPD holds a biennial conference on the promotion of undergraduate research. In general, the discussions among research program directors reflect a frustration with encouraging undergraduate research when it is not required for a major.

On the other hand, myriad studies suggest that students who pursue capstone projects seem to gain important benefits for careers and life skills⁵. Certainly in Stetson's case, Stetson students have demonstrated a mastery of their academic interests that increases their chances to attend the graduate school of their choice, and puts them well ahead of their graduate school peers in research, analytical, interpretation and communication skills. In the workplace, the abilities to research, organize, parse large amounts of data and communicate the results clearly are also highly valued. In the creative arts and music, Stetson students enter the cultural community with strong skills that have given our students advantages in graduate conservatories, performance and graphic design.

It remains in Stetson's best interest to maintain the senior project capstone requirement in all three undergraduate schools and colleges. But how do we balance the requirement with genuine staffing concerns as numbers in some fields continue to grow? Also, how do we frame the Capstone requirement in a way that captures the goals of all three schools?

The Way Forward

What we propose would allow flexibility in the choice of a capstone without denying those with strong interests in a single field the opportunity to carry out a methodologically rigorous disciplinary capstone should they wish to do so or require one for their post-graduate plans. We see several approaches, all couched in the assumption that the Capstone becomes a general requirement in the university, and not just a requirement in the College of Arts and Sciences.

There are ground rules that must be put into place with this proposal:

1. The University CORE must honor the lack of universal standards among departments. Faculty in English must not feel that their requirements must now meet those in History or Chemistry, which are all quite different.
2. A student's choice to pursue a capstone beyond the major must not impact other requirements in the major unless faculty in that department allow a reasonable waiver. If there are multiple semester sequences, all students must work through them.
3. Assessment strategies must be put into place to evaluate if all three goals (see above) have been met in a way that satisfies University needs. Each department or school would be responsible to offer evidence of achieved skills, artifact and evidence of appropriate and acceptable communication.

The proposed categories allowed for Capstone would be:

1. **The traditional capstone in major**, which requires rigorous methodology and shows mastery in a subject. This category would be required for all showing interests in

⁵ Several of these are listed in the provided bibliography, as well as in the CUR publications, *CUR Quarterly* and *SPUR*. The general conclusion of case studies across the country is that undergraduate research has multiple benefits that align with the skills Stetson also promotes as learning goals. One of the best is E. Lee Coates, et al, "Charting a Required Senior Capstone: Diverse Scaffolding for Transformative Experiences" *CUR Quarterly* 34.4 (2014). Pp. 10-15

graduate work, but open to all students in a major. There would be a mentor within the major.

We recommend the traditional capstone for students who intend to pursue a graduate degree in the field. As graduate programs are increasingly selective about the number and qualifications of successful candidates, mentors should emphasize the need for the traditional approach. Departments would have to option of making the traditional capstone mandatory for these students, using whatever selective triggers it deems important for making the decision.

2. **A team project**, for students whose work is best utilized as a component. The team would come to workload agreements ahead of the project, and share the same grade if the agreements are honored. Team capstones would be a viable option for those whose work is best represented as part of a greater effort. Such flexibility will make this final project more attractive and relevant. Another team approach is a topical Senior Capstone Class. These are more restrictive, but essentially gear a classroom of students towards a single interdisciplinary theme in which papers will be written. It is somewhat similar to a JSEM, but requires even more writing and a professorial commitment to think outside the box (eg combining chemistry with social justice, or economics with English literature or religious studies with public health or history with just about anything). The team capstone is already being used in the School of Business.

Historically students have done individually mentored projects in the STEM disciplines (Science, Technology, Engineering and Math) at Stetson University. However, due to considerable growth in the number of science majors as a percentage of total enrollment, this has become untenable in certain departments, especially in Health Sciences, Biology and Environmental Sciences and Studies. Recently Health Sciences has moved more toward encouraging group projects. Many project mentors in the department have used a model where students work on a common set of equipment or a common data set, but each student takes ownership of analyzing and writing up one aspect of the larger project. Another option Health Sciences is considering is using an off-campus internship practicum as the senior project (three 2-credit practicums plus a 2-credit seminar where the practicum experiences are presented and written up). This option would only be allowed for a planned BA health science track for targeted at students that are planning to enter the work world directly after Stetson and are unlikely to be considering graduate school.

A number of senior project mentors in Biology have also used group projects where students work in teams but each student takes ownership of a particular aspect of a larger project. Often this is done with students working on projects tied the faculty members own research agenda. This is also generally true in Environmental Science and Studies (including the Environmental Health concentration).

In the Physics and Chemistry and Math/CS departments, students are generally still encouraged to pursue individually tailored and mentored projects due to the relatively smaller number of majors. However, in Physics students are allowed to count external National Science Foundation – Research Experience for Undergraduates (NSF-REU) internships as their senior project as long as they keep a detailed laboratory notebook that is submitted for the grade. They often need to do additional data analysis when they

return to Stetson in the fall under the guidance of a Stetson mentor. However, these internships are highly competitive and only a small number of students are accepted each summer compared to the number of applicants.

Undergraduate group projects have long been accepted practice in the STEM fields, especially in the engineering disciplines where often the undergraduate capstone is a hands-on team project (with teams of 2-4 students). The rationale is that engineers rarely work alone and experience contributing to a team effort is crucial for success in the work environment. This argument is also applicable in other STEM fields where research groups are very common and lone investigators are a rarity. Care needs to be given in mentoring these projects to monitor group dynamics to ensure that each student is benefiting from the experience. However, each student should submit their own written work documenting the project.

Each of the STEM departments have been using the capstone sequence to assess a number of departmental level learning outcomes at the mastery level. This often includes writing in the discipline, oral communication, and a number of research methodologies such as the use of statistical methods or other quantitative tools. This needs to be taken into account if the capstone project is no longer strictly considered to be tied to a particular major or department.

One example of how assessment might work would be the following:

1. Teams will be no larger than four
2. The research topic will be assigned to a group in class, and will be described by a stakeholder (which may be the instructor, another professor, or a non-faculty university or community stakeholder) for whom the team will complete the project.
3. The stakeholder will evaluate progress, as will the instructor if he is not acting as your stakeholder, and this evaluation will become 20% of the evaluation of the group's final project grade.
4. There will also be two peer evaluation days, where each member of a group will evaluate the contribution of their, and their teammates', contributions to the project thus far.
5. The research paper (60% of the final project grade) must have the following sections completed the following way:
 - a. An Introduction (group completed, min. 4 pages) presenting the background for addressing the question.
 - b. A Question, Hypotheses and Objectives section for one to two students that will identify the question arising from the Introduction and provided by the stakeholder, set the null and alternative hypotheses
 - c. A Materials and Methods section for one to two students presenting the scientific approach the group used, including any needed statistical methods
 - d. A Results section for one to two students presenting the data-based results of the group's work (including graphs, charts, and/or tables) and basic observations concerning the data
 - e. A Conclusions section (group completed, min. 4 pages) presenting the hypotheses supported or rejected by the work, the objectives completed, the interpretation of the

- results and their implications for the original question, and recommended next steps in this line of research
- f. References (group completed, length as needed)
 6. The group can decide based on individual skills which student in the group will take the various sections, so long as each student in the group has one of those three sections to complete. All students in the group can work on the Introduction, Conclusions, and References.
 7. The oral project presentation will be a formal 40 minute presentation of project work and conclusions (30 minutes of presentation, 10 minutes for questions). The presentation should follow the section organization of the paper, and the sections of the presentation should be prepared and given by those students who wrote the individual sections. Presentation will be 20% of the grade.⁶
3. **An outreach capstone** that takes experiential learning, outreach and community-based learning into account. This approach would allow students active in engagement and outreach to demonstrate an academic learning component to their community service. As several of the CBR projects are monitored by a CLaSS staff member, the student would have to identify and work with a teaching faculty member.
- Outreach capstone courses offer students the ability to integrate academic studies and current practices in the field. Outreach experiences can provide a structure that enables students to gain experience in initiating and developing ongoing relationships in their community.⁷ Service learning, a combination of classroom experiences and community-based service experiences, may be one part of a capstone outreach course.⁸ Outreach capstones courses may also combine traditional research and field experiences which may be in the form of field trips, community service partnerships, and independent and team projects with specified community organizations. However, the capstone course must provide an opportunity for students to practice the skills learned throughout their studies in the major curriculum by designing and completing a senior project under the guidance of a faculty advisor (<https://catalog.stetson.edu/undergraduate/arts-sciences/>).
- Outreach capstone courses unify skills learned during coursework completion as students practice creativity, self-direction, teamwork, collaboration and cooperation while offering students the ability to apply classroom-based practices in real-world settings.⁹ Because students may self-select an outreach capstone course that includes opportunities to demonstrate their mastery of their major field of study beyond a research paper, they

⁶ My thanks to Dr. Michael Reiter for providing an example of team capstone research that has been tested successfully in a classroom setting.

⁷ Clark, Greg, Josh Russell, Peter Enyeart, Brant Gracia, Aimee Wessel, Inga Jarmoskaite, Damon Polioudakis et al. "Science educational outreach programs that benefit students and scientists." *PLoS biology* 14, no. 2 (2016): e1002368.

⁸ Wei, Kangning, Jane Siow, and Diana L. Burley. "Implementing service-learning to the information systems and technology management program: A study of an undergraduate capstone course." *Journal of Information Systems Education* 18, no. 1 (2007): 125.

⁹ Hefferan, Kevin Patrick, Neil C. Heywood, and Michael Earl Ritter. "Integrating field trips and classroom learning into a capstone undergraduate research experience." *Journal of Geography* 101, no. 5 (2002): 183-190.

may demonstrate greater motivation in the preparation for and implementation of the experience.¹⁰

Possible outreach capstone goals must be agreed upon by the faculty of the department. Students complete the work, either individually or cooperatively, depending on the completion plan of the capstone as determined by the student and faculty. Assessment of the outreach capstone may be individual, team based, or a blend of both, however, all assessment tasks must align with the overarching goal of students demonstrating mastery of the content within their major. Individual assessments may include creation of semester action plans, weekly journals, individual project reports or portfolios, and contributions to team projects. Team projects may include a team semester action plan, final presentation, and a final report on project.¹¹

4. **An interdisciplinary capstone** for students of high grade merit or who show high creativity beyond any one major. For the extraordinary students whose creativity both crosses disciplinary bodies and shows innovative academic promise, the Interdisciplinary capstone will allow imaginative endeavors that are too easily stifled currently by the departmental rules even with best mentor intentions. There would be an application and a GPA requirement to take on such a project. It rewards the better students with the opportunity to design a capstone project in their junior year to undertake in their senior year. Here is an interesting hybrid used by Stanford University: <https://undergrad.stanford.edu/advising/student-guides/what-are-interdisciplinary-honors>. In this proposal, there is an application and a GPA requirement to take on such a project. It might reward the better students with the opportunity to design a capstone project in their junior year to undertake in their senior year. It is promotable as well.

The Interdisciplinary Capstone reflects a growing concern that traditional disciplinary boundaries may be inhibiting some of our most creative thinkers. One approach in higher education has been to acknowledge that we have entered a period of ‘supercomplexity’, a state of understanding that universities have been slow to embrace except in the promotion of various topical studies majors (Africana, Asian, Jewish, American, Food, etc). As Barrett describes it, supercomplexity is a new epistemology “that is open, bold, engaging, accessible, and conscious of its own insecurity. It is an epistemology for living amid uncertainty.”¹² One study suggested that students who take on interdisciplinary undergraduate research receive the same benefits in cognitive learning, critical thinking, problem-solving, and analysis as students in disciplinary research, but also develop strong synthetic and higher-order thinking skills due to the complexity of interdisciplinary thought.¹³

¹⁰ Wei, Siow, and Burley, 125.

¹¹ Ibid

¹² Barnett, Ronald. "University Knowledge in an Age of Supercomplexity." *Higher Education* 40, no. 4 (2000): 409-22. For a fuller explanation, see Barnett, R (2000b) *Realising the university in an age of supercomplexity*. Buckingham: Society for Research into Higher Education and Open University Press

¹³ For a longer discussion on the benefits of interdisciplinary undergraduate research, see Haynes, Carolyn, and Jeannie Brown Leonard. "From surprise parties to mapmaking: Undergraduate journeys toward interdisciplinary understanding." *The Journal of Higher Education* 81, no. 5 (2010), p. 646.

The Interdisciplinary Capstone, nonetheless, will remain a self-selected option. Most students remain confused about what an interdisciplinary project entails. It must not be viewed as simply connecting two or more disciplines together in a paper. Traditional capstones already acknowledge transdisciplinary perspectives. Instead, the student proposing an Interdisciplinary Capstone must be able to demonstrate well ahead of beginning the project that multiple perspectives from several disciplines must be used to tackle a wicked problem, a supercomplex situation or a creative challenge.

For assessment, the parameters used by interdisciplinary majors and by the Honors program at Stetson would be a good place to begin. Capstones in these areas often require more than one mentor, in separate fields. A student who wishes to apply for the option of the Interdisciplinary Capstone must make a proposal by the final semester of the junior year. This proposal must include an explanation of why the proposed project does not fit into any one discipline, and must be accompanied by the names of two faculty members willing to guide and assess.¹⁴

5. A Senior Recital in Music currently a requirement for degree completion and graduation at all NASM (National Association of Schools of Music) accredited institutions in this country. Long considered to be the culmination of four's years of intensive individual study on an instrument or voice or composition, the Senior Recital is an integration and synthesis of numerous subjects from across various university disciplines thus making it a true educational capstone experience.

All music majors are required to perform a short public recital of seven minutes for each semester of study with the exception of first semester first year students. This once-a-semester performance experience starts them on the road to the larger and longer junior and senior recital experiences. The student begins working on the same skills necessary for a successful senior recital although in smaller and less intensive settings. Some music majors, such as the performance major, also are required to perform a junior recital of twenty-five minutes in length. Other majors, such as the Music Education degree, offer the Junior Recital as an option for the added experience of preparing more music and performing. This recital would be analogous to a junior seminar experience for the rest of the university population and serves as a good introduction to the rigor needed for a successful Senior Recital performance.

The Senior Recital at Stetson University is a requirement for all music majors. The length of this recital is fifty minutes of music for performance majors and twenty-five minutes for all other music majors such as the music education and outside field. The preparation for this recital typically starts a year in advance with the selection of significant literature in terms of quality and length. Literature is carefully selected by the professor and student to reflect the highest musical and performance levels possible for each individual student. The quality of the music selected generally involves many more

¹⁴ For one example of how such a project is guided, see Widmann, James, Lily Laiho, and Richard Savage. "Initiating and sustaining an interdisciplinary capstone design course." In *Capstone Design Conference*, pp. 2-4. 2014. See also Aktas, Can Baran. "Reflections on interdisciplinary sustainability research with undergraduate students." *International Journal of Sustainability in Higher Education* 16, no. 3 (2015): 354-366, Table 1 on proposal and assessment of an interdisciplinary project.

subject areas other than just music. For example, students must research the historical background of the composers, the particular composition as well as the general time period in which the composition was written and performed. A performance of a Classical era composer will differ greatly from a Romantic era composer. History is an important component of a convincing performance. Language is also an important part of performance. Voice majors are required to perform music in a variety of languages such as Italian, German, French, Russian as well as their native English. This involves the study of correct pronunciation and translation of all the texts which are being sung by the student. Other majors also must encounter foreign languages as most composers use Italian and sometimes German terminology to indicate certain music events. All students must provide written notes for each piece on their program. These notes are provided to the audience to better inform them of the content of the works being performed. Therefore, they must show competence in writing about music using the English language. Also present in the performance of music is the area of physiology. Students, with the help of a professor, must train the body to do the correct physical movements necessary for the performance of music. The training of the body to consistently perform precise large and small muscle movements is a large part of what the professor and student do in individual lessons from the first year to the fourth year and even beyond. Psychology is also an important component in the performance of music. Students must train their minds for the rigors of performing for up to fifty minutes. Most students also struggle with performance anxiety and psychological concepts must be studied and practiced in order to overcome this debilitating condition. Lastly, students must research performances of the works by listening actively to other performances made by professional musicians. Various streaming platforms allow for the study of numerous performances of the works. This active listening, or watching, is an important step in the growth and development of a student's concept of a composition.

This synthesis and integration of history, language, writing, physiology, and psychology is what makes the Senior Recital a truly significant event in the life of a music major which would be similar to what other university students refer to as their capstone experience.

6. **Business Capstone.** Currently, the capstone model is found in MGMT 495 "Strategic Management. From the syllabus: "The course introduces students to the role of a "strategic manager," someone (like a CEO or a head of a business unit of a company) who is concerned with the problems of and/or responsible for the overall well-being of a firm or a business unit. Implicitly or explicitly, every firm must define the scope of its operations and, within the chosen scope, how the firm will compete against its rivals. Decisions about the scope of the business (i.e., in what markets or industries a firm wants to compete) constitute the firm's corporate strategy. Decisions about how to compete (e.g., cost leadership or differentiation) within the chosen market (s) reflect the firm's business-level strategy. This course focuses on how a firm can formulate effective business-level and corporate-level strategies to achieve competitive advantage and earn above average profits.

As an integrative management exercise, students will compete as a team in the Capstone ® strategy simulation. The Capstone simulation will help you to close the knowing and doing gap. You will be able to apply what you have learned in this and other business courses to make better strategic decisions and compete against other

companies in the same industry. Capstone is an interactive online platform that provides you with the opportunity to test assumptions and learn from mistakes, so you are better prepared to make a significant contribution in a real-world job.”

Students use Capstone, ® a strategy simulation that is used by many leading universities as well as by companies such as Microsoft, GE, Johnson & Johnson, Goldman Sachs, and Samsung. Each student is assigned to a team. Each team will have a company to run, and strategic decisions to make. Individual decisions as well as the decisions of the other teams will be processed throughout the semester (6 decision rounds, each round represents one year in the life of the company) to provide ongoing feedback on how your company is performing in the competitive struggle.

The Capstone simulation has two components: 1) Individual Preparation and 2) Team Competition. While each individual will be competing as part of a team, each student is required to work through the individual components prior to competing in the teams. The individual component will help each of students learn the mechanics of Capstone so that you can be an effective contributor to your team. Team grades are based on competitive performance vis-à-vis other teams in the same industry.

In addition, because it is a capstone class, students take a discipline assessment test. This is a test developed and administered by the Dean’s office. Students will take this test at the beginning of the course which consists of questions from each of the CORE business school courses that students have completed so far in the program. The goal of this test is to assess students' ability to retain basic business concepts. Students receive a grade and a detailed individual assessment from the Dean’s office.

7. **Capstone decoupled from Major.** This option was not recommended by the Undergraduate Research Committee, but strongly endorsed by some faculty. The idea is that, as a Capstone becomes a General Education University Requirement, the Senior Project need not be taken in the student’s major and need only be fulfilled once. Double majors would not have to complete more than one Capstone. The student would still have to complete a 499 in the major, but it need not be a capstone requirement. This option would eliminate the need for double or triple majors to complete more than one intensive senior project, although less strenuous departmental 499’s could still be a CAS requirement. The option would also help transfer students who are unable to complete the sequence needed in some majors in time to take on the departmental project. In Digital Arts, for example, transfer students may need an extra year of study under the traditional senior project to accrue the needed exhibition portfolio.

This variant has the potential to redistribute load more equitably across disciplines, allowing students options outside the major, and relieving double majors of the stress of two capstones. The URC, on the other hand, believes that this devalues the importance of the capstone as a culminating demonstration of undergraduate-level mastery of a subject and methodology within a discipline. Stetson has a firm reputation among graduate programs for the quality of senior research and creativity. This may be a

step backward. However, it does have the advantage of alleviating stress in majors if resources are not forthcoming to broaden faculty resources in the more populated majors.

By taking the Capstone to a university level requirement, and by offering alternative paths to fulfilling that Capstone, the URC hopes that some of the following issues may be addressed:

1. There will be a university wide recognition of the valuable skills of research, analysis, interpretation and presentation acquired by Capstone in whatever form it takes.
2. Capstone will be seen as the culmination of a integrative learning philosophy that embraces the Stetson journey as much as the end product.
3. Team, outreach and interdisciplinary projects should improve work load for in STEM and Creative Arts, the majors with the most students per faculty.