Saint Louis University
Program Assessment Plan

Program (Major, Minor, Core): Ph.D.
Department: Integrated & Applied Sciences
College/School: A&S
Person(s) Responsible for Implementing the Plan: Vasit Sagan (graduate program director) and IAS Administrative Committee: Istvan Kiss (Chemistry), Susan Spencer (Biology), David Wisbey (Physics)
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Program Learning Outcomes	Curriculum Mapping	Assessment Methods	Use of Assessment Data
What do you expect all students who complete the program to know, or be able to do?	*Where is the outcome learned/assessed (courses, internships, student teaching, clinical, etc.)?*	*How do students demonstrate their performance of the program learning outcomes? How does the program measure student performance? Distinguish your direct measures from indirect measures.*	*How does the program use assessment results to recognize success and "close the loop" to inform additional program improvement? How/when is this data shared, and with whom?*

Students will use scientific principles underpinning the primary scientific discipline in which their concentration is based and by applying basic research methodology, demonstrate their application to their particular field of interest (chemistry, biology, physics, environmental science, sustainability science).	Students complete a coursework sequence tailored to their research project and guided by their primary and secondary faculty mentors. Coursework options are detailed in the IAS graduate program handbook. At the end of their 2nd year or start of 3rd year of studies, students take comprehensive written exams. In the middle of their 3rd year, students undergo an oral examination to defend an original research proposal. Upon completion of studies, students undergo an oral examination to defend their dissertation.	***Student*** Students are expected to: 1) perform advanced quantitative calculations using experimental data; 2) have an advanced recognition of the methods and tools used in their concentration; 3) connect observations with prior information. ***Faculty*** Courses: graded by faculty based upon a rubric given in the course syllabus. Comprehensive written exams: students are tested on their knowledge gained through their coursework. Questions are written by faculty committee members in each of three specific subject areas. Students are expected to score 70% or above to pass each part. Scores in the 50-70% range are considered conditional passes, with the conditions for passing set by the faculty committee member concerned (reattempt incorrectly answered questions, provide additional material or information, etc.). Students who do not pass are given an opportunity to retake part or all of the exam, following discussion with committee member(s). A Dissertation Research Proposal Assessment rubric has been developed and has been appended (Appendix A1). This should be used by all members of the Dissertation Research Proposal Committee. Dissertation Assessment and Final Defense Assessement rubrics have been developed and appended (Appendices A2 and A3). They should both be used by all members of the Dissertation Defense Committee.	Coursework offerings are reviewed every 3 years by the Program Director in consultation with faculty active in the IAS program and IAS Administrative Committee. Outcomes of comprehensive written exams are discussed by faculty members active in each concentration area and shared with the graduate program director. These outcomes are assessed and used to modify comprehensive exams as needed. Results from comprehensive exams are also used to evaluate our advising practices for students in their 1st and 2nd year in terms of graduate coursework they should take and undergraduate courses they may want to sit in on or review. Data from the Dissertation Research Proposal, Dissertation and Final Defense assessments should be used to inform faculty (not students) of both weaknesses and strengths in achieving learning objectives.

Students will demonstrate advanced creativity in scientific research methodology in their concentration and appropriately use techniques in a laboratory and/or field setting – including experimental, theoretical, and computational methods. Students will integrate methods, theories, paradigms, concepts etc. from more than one discipline.	Annual student reviews are completed by student (self-evaluation) and primary mentor and forwarded to the graduate program director. During their 3rd year, students prepare an original research proposal that is based upon their preliminary laboratory and/or field findings. Students enroll in 12 hours of Dissertation Research during their 3rd-5th years in the program; during this time, students meet regularly with their faculty advisor to review research progress and discuss experimental design and data. Throughout their studies, students prepare abstracts for meeting presentations and work on manuscripts submitted for peer review (publications are expected). Students prepare a final dissertation with defense that is based upon their research findings.	***Student*** Students should be able to: 1) independently design experiments to investigate a scientific hypothesis; 2) carry out experiments safely, using proper equipment and techniques; 3) independently conduct data analysis. ***Faculty*** Primary mentors give student feedback in annual reviews that include goals for the next year. Secondary mentors may also contribute, thus providing a means to assess the interdisciplinary skills demonstrated by the student. These are also reviewed by the graduate Program Director. Oral examinations: students demonstrate knowledge by answering questions posed by faculty members who are on their committees. Questions assess student knowledge of concentration topics covered in their course work and research area. After the examination, committee members discuss the student's performance and assess if the student demonstrated knowledge that would be expected for a student at a comparable level. The committee chairperson will complete a ratings form ranking student performance in the areas of scientific merit and communication skills and also report specific weaknesses in the student's research methodology that need to be addressed. Submitted manuscripts are reviewed by accomplished scientists in the relevant research area. Peer reviewers provide feedback on the manuscript and assess if the manuscript is acceptable for publication in the journal the manuscript was submitted to. The dissertation committee evaluates the research votes to pass or not pass the student in the final defense. A Dissertation Research Proposal Assessment rubric has been developed and has been appended (Appendix A1). This should be used by all members of the Dissertation Research Proposal Committee. Dissertation Assessment and Final Defense Assessement rubrics have been developed and appended (Appendices A2 and A3). They should both be used by all members of the Dissertation Defense Committee.	Annual reviews give the student honest feedback on their research performance and how they are progressing to their degree milestones. The 3rd year original research proposal provides feedback to the student by the committee on research productivity, the proposed future direction of the research project, and the research completion goals for the completion of the PhD. Outcomes of oral examinations at the end of a student's studies (positive results leading to a degree) are shared with the program director and IAS administrative committee in order to provide final assessment of student performance and productivity. Data from the Dissertation Research Proposal, Dissertation and Final Defense assessments should be used to inform faculty (not students) of both weaknesses and strengths in achieving learning objectives.

Students will demonstrate an ability to communicate (oral and written) results and conclusions from their research, describe techniques and methodology used, and apply their experiences in the greater world in which we live.	In their 3rd year of studies, students give an oral presentation on their proposed research. Students typically present posters or talks on their research at SLU's annual Graduate Research Symposium. It is the expectation that students also present a poster or a talk on their research at a scientific conference at least once during their studies. Students will assist in the preparation of manuscripts for publication of results in peer review journals. Students must enroll in a Current Topics (IAS 6030) course each semester in their 3rd and 4th years where they give oral presentations on recent research from current literature not directly based their own specific research topic. They are expected to project their own independently crafted research ideas based on the chosen research presentation subject. At the end of their studies, students give an oral presentation to defend their research.	Oral presentation on the PhD proposed research is given to the committee and feedback is provided by the committee as described above. Presentations given at scientific conferences are public. Students may receive informal feedback and advice from peers and faculty from other institutions. Annual student reviews are completed by the student that list presentations and publications given. The quality may be partially assessed in terms of the size and prestige of the conference (regional, national or international) for presentations, or journal impact factor for publications. Oral presentations given as part of Current Topics (IAS 6030) course requirements are evaluated by the course instructor and graded by a rubric given in the course syllabus. Students are given feedback to help them refine and improve their oral presentation and communication skills. Oral presentations given at the end of studies are public presentations; feedback is mainly provided by the research mentor and committee as described above. A Dissertation Research Proposal Assessment rubric has been developed and has been appended (Appendix A1). This should be used by all members of the Dissertation Research Proposal Committee. Dissertation Assessment and Final Defense Assessement rubrics have been developed and appended (Appendices A2 and A3). They should both be used by all members of the Dissertation Defense Committee.	Oral presentations within the program (degree defenses and PhD proposed research presentation) are assessed by research mentors and committee members. Faculty observations of student presentation skills are discussed on occasion in faculty meetings and are used to enact steps to improve student performance. Specific communication issues encountered are noted from ratings forms and can then relayed back (anonymously) to other students in venues such as other oral dissertation proposal exams and Current Topics (IAS 6030) classes as a means of providing both positive and negative examples of scientific communication. Data from the Dissertation Research Proposal, Dissertation and Final Defense assessments should be used to inform faculty (not students) of both weaknesses and strengths in achieving learning objectives.

1. **It is <u>not recommended</u> to try and assess (in depth) all of the program learning outcomes every semester. It is best practice to plan out when each outcome will be assessed and focus on 1 or 2 each semester/academic year. Describe the responsibilities, timeline, and the process for implementing this assessment plan.**

   Assessment will be implemented continuously and reported annually.

2. **Please explain how these assessment efforts are coordinated with Madrid (courses and/or program)?**

   The Madrid campus does not have any science graduate programs.

3. **The program assessment plan should be developed and approved by all faculty in the department. In addition, the program assessment plan should be developed to include student input and external sources (e.g., national standards, advisory boards, employers, alumni, etc.). Describe the process through which your academic unit created this assessment plan. Include the following:**

   Prepared by the IAS Program Director and reviewed, critiqued and amended by the IAS Administrative Committee (listed above). Assessment plan will be reviewed every three years. External sources: University of West Florida Interdisciplinary Sciences, University of Missouri – Kansas City Interdisciplinary PhD Studies.

Appendix A1
SLU IAS Program – Dissertation Research Proposal Assessment Rubric (Written Proposal and Oral Defense)

	1 (Poor)	2 (Fair)	3 (Good)	4 (Excellent)	Score
Research Proposal Format	*The organization of the proposal is confusing and/or the length is not appropriate. More than one of the required sections is missing. The references may not be appropriately formatted.*	*The organization of the proposal is, in places, confusing and/or the length is not appropriate. References may not be appropriately formatted. One of the required sections is missing or more emphasis should be placed on several of the required sections.*	*The research proposal is well-organized and is of appropriate length. References are appropriately formatted. More emphasis should be placed on several of the required sections.*	*The research proposal is well-organized and is of appropriate length. All required sections (background, significance, related preliminary results (or examples from literature), broader impacts, and a concise summary) are included. References are appropriately formatted.*	
Aims/Objectives	*The proposal fails to adequately describe the aims/objectives and the rationale for the proposed project is unclear.*	*Aims/objectives are described, however, the rationale for the aims/objectives is unclear.*	*Aims/objectives are described. A rationale for the aims/objectives is included.*	*The proposal aims/objectives are clearly described and provide a logical framework to address a problem. A compelling rationale for the aims/objectives is included.*	
Background Knowledge	*Demonstrates limited knowledge of concentration principles and the current literature.*	*Demonstrates adequate knowledge of concentration principles and an awareness of the current literature, but does not identify unanswered questions in the field.*	*Demonstrates sufficient knowledge of the current literature and concentration principles. Correctly identifies and understands the importance of unanswered questions in the field.*	*Demonstrates the ability to apply fundamental concepts to advanced topics and in-depth knowledge of the current literature. Correctly identifies and illustrates the importance of unanswered questions in the field and presents the proposal within the context of these questions.*	
Experimental Approach	*The experimental approach is neither clearly defined nor logical. The expected outcomes are not discussed.*	*The experimental approach is clearly defined and logical, however the expected outcomes are either not discussed or are not plausible.*	*The experimental approach is clearly defined and logical. The expected outcomes are discussed and plausible. Alternative outcomes have not been sufficiently addressed.*	*The experimental approach is clearly defined and logical. The expected outcomes have been discussed and are plausible. Alternative outcomes have been sufficiently addressed.*	
Research Progress	*Limited progress has been made.*	*Some progress has been made.*	*Sufficient progress has been made.*	*Significant progress has been made.*	

	1 (Poor)	2 (Fair)	3 (Good)	4 (Excellent)	Score
Written Communication	*Fails to clearly communicate results and conclusions.*	*Adequately communicates results and conclusions, however supporting information and explanations are missing.*	*Successfully communicates results and conclusions, supporting information and explanations are provided.*	*Results and conclusions are not only successfully summarized and supported, but are also analyzed in the context of the field.*	
Oral Communication	*Fails to clearly communicate results and conclusions.*	*Adequately communicates results and conclusions, however supporting information and explanations are missing.*	*Successfully communicates results and conclusions, supporting information and explanations are provided.*	*Results and conclusions are not only successfully summarized and supported, but are also analyzed in the context of the field.*	

Appendix A2
SLU IAS Program – PhD Dissertation Assessment Rubric

	1 (Poor)	2 (Fair)	3 (Good)	4 (Excellent)	Score
Dissertation Format	*The organization of the dissertation is confusing and/or the length is not appropriate. The references may not be appropriately formatted.*	*The organization of the dissertation is, in places, confusing and/or the length is not appropriate. References may not be appropriately formatted. More emphasis should be placed on several of the sections.*	*The dissertation is well-organized and is of appropriate length. References are appropriately formatted. More emphasis should be placed on a few of the sections.*	*The dissertation is well-organized and is of appropriate length. Chapters are balanced appropriately. References are appropriately formatted.*	
Background Knowledge	*Demonstrates limited knowledge of concentration principles and the current literature.*	*Demonstrates adequate knowledge of concentration principles and an awareness of the current literature, but does not identify unanswered questions in the field.*	*Demonstrates sufficient knowledge of the current literature and concentration principles. Correctly identifies and understands the importance of unanswered questions in the field.*	*Demonstrates the ability to apply fundamental concepts to advanced topics and in-depth knowledge of the current literature. Correctly identifies and illustrates the importance of unanswered questions in the field and presents his/her work within the context of these questions.*	
Presentation of Independent Research	*The aims/objectives and/or the rationale for the project are not adequately described. The experimental approach is neither clearly defined nor logical. Results and discussion are limited.*	*Aims/objectives are described, however, the rationale for the aims/objectives is unclear. The experimental approach is clearly defined and logical, however the results and discussion lack clarity.*	*Aims/objectives are described. A rationale for the aims/objectives is included. The experimental approach is clearly defined and logical. Results are presented and interpreted, but additional discussion should be provided.*	*The aims/objectives are clearly described and provide a logical framework to address a problem. A compelling rationale for the aims/objectives is included. The experimental approach is clearly defined and logical. Results and discussion are complete.*	
Written Communication	*Fails to clearly communicate results and conclusions.*	*Adequately communicates results and conclusions, however supporting information and explanations are missing.*	*Successfully communicates results and conclusions, supporting information and explanations are provided.*	*Results and conclusions are not only successfully summarized and supported, but are also analyzed in the context of the field.*	

Appendix A3
SLU IAS – Final Defense Assessment Rubric for PhD students

	1 (Poor)	2 (Fair)	3 (Good)	4 (Excellent)	Score
Demonstrate advanced level knowledge in concentration discipline with a higher level of knowledge expected in the student's area of focus	*Student lacks basic knowledge in concentration topics.*	*Student displays knowledge, but is weak in several key concepts.*	*Student displays knowledge, with minor weaknesses.*	*Student displays great knowledge of topics.*	
Acquire the basic tools, including practices and theories, needed to conduct advanced research. Students will become proficient in their specialized area and complete an advanced, independent research project resulting in peer-reviewed publications.	*Student has make limited progress on one or more aims of an advanced, independent research project.*	*Some progress has been made on one or more aims of an advanced, independent research project.*	*Sufficient progress has been made on one or more aims of an advanced, independent research project, resulting in a peer-reviewed publication.*	*Significant progress has been made on one or more aims of an advanced, independent research project, resulting in at least 1 peer-reviewed publication.*	
Communicate scientific findings from literature and original findings from the student's own independent research.	*Student unable to clearly communicate concentration topics.*	*Student can sometimes communicate concentration topics effectively.*	*Student can effectively communicate concentration topics.*	*Student can communicate concentration topics effectively and compellingly.*	