Annual Assessment Report

Chemistry Minor

Dr. Joseph Ross Kyger

Program Mission: The Chemistry Minor at William Woods University exists both to supplement the Biology major and to create in the students a full understanding of the sciences, emphasizing the discipline of Chemistry, as they relate to the world at large.

Annual Assessment Report

Program Profile

	2012-2013	2013-2014
Majors (total, majors 1,2,3)	NA	NA
Minors	26	29
Concentrations (Add Rows if needed)	NA	NA
Full Time Faculty	1	1
Part Time Faculty	0	1

Program Delivery (HLC 3A3)

Traditional on-campus _____29_____
Online Program _____0_____
Evening Cohort _____0_____

Program Retention Numbers:

Year	**2009-2014**
Persistence % Freshman to Soph (2009-2010)	**see Biology report**
Persistence % Soph to Junior (2010-2011)	**see Biology report**

Persistence % Junior to Senior (2011-2012)	**see Biology report**
Graduation Rate from 6 year cohort. (2009-2014)	**see Biology report**

Retention: IPEDS definition. (The percentage of students entering fall freshman year who are retained through the fall of the sophomore year) This does not include transfers.
Persistence: the number of students who continue to make progress towards the degree from year to year within the program.
Graduation Rate: from the incoming fall cohort of students how many graduated within 4 and 6 year national average

Analysis:

After reviewing the results of the Biology Assessment with the appropriate faculty, I will be happy to work in conjunction with them in any and all ways to improve persistence and retention numbers. Currently, I provide many opportunities both in and outside of the classroom to enhance student learning and retention numbers. The best example of this is hundreds of tutoring hours each year with any students that desire additional assistance with program material. The Chemistry Minor is designed to support the Biology major, and the Science department works hard to combine forces to foster student persistence and retention. It is important to note that the number of Biology majors and Chemistry minors has grown significantly in recent years, and the graduation rate has also increased proportionally.

Outside Accreditation:

Is your program accredited by outside accreditor? If "yes", name the accrediting agency and include the cycle for accreditation review. **No**

Is accreditation available for your program? **No**

Are you making strides to attain accreditation? If no, why not? **Not available.**

Program Objectives:

Objective 1. Demonstrate a fundamental understanding of chemical concepts relating to all branches of chemistry, including analytical, organic, physical, inorganic, and biochemistry.
Objective 2. Explain how each individual branch of chemistry is needed to determine the chemical nature of the universe.
Objective 3. Demonstrate a thorough understanding of the periodic table of elements and how it can be used to determine trends in chemical reactivity and stability.

Objective 4. Logically apply the scientific method to everyday situations in order to facilitate an understanding of the world around us.
Objective 5. Relate chemical principles to other areas of science, especially biology and physics.
Objective 6. Integrate empirical evidence with experimental data, such that solid conclusions can be formulated.

Program Objectives Matrix (from most recent Assessment Plan)

	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6
CHM114	I	I, A	I,R	I, A	I	
CHM115	R		R	R		I
CHM124	R, A	R	A	A	R, A	
CHM125	R	R				A
CHM314	R					
CHM315	M, A					M, A
CHM324						
CHM325						

I=Introduced R= Reinforced M=Mastered A=Assessed

Assessment of Program Objectives

Objective 1	Demonstrate a fundamental understanding of chemical concepts relating to all branches of chemistry, including analytical, organic, physical, inorganic, and biochemistry.
Methods	Course unit examinations with specific questions related to the objective Homework assignments with questions related to the objective Extra Credit assignments designed to promote understanding of the objective Quizzes with questions related to the objective Course final examinations have questions related to the objective Lab instructor works with each lab group to visually or orally determine understanding of the objective Lab reports that require understanding of the objective to complete
Benchmark	Students will score above 70% on coursework related to the objective; homework and extra credit should be above 80%. Objective will be measured in lab through lab instructor/student interaction. Students are required to be 100% proficient.
Data Collected (course specific)	Lab TECH 722 Isolating Clove Oil (CHM315): The lab is designed to incorporate a common substance used in most homes, namely cloves, and asks students to go through a series of laboratory manipulations to extract clove oil, which is analyzed for both inorganic and biochemical characteristics. Students were required to do a lab report in which they had to relate the lab directly to Objective 1 in their introduction. 14 students are included in the assessment. Cosmos Essay Bonus: (CHM124): The Cosmos television series article was utilized as an opportunity for students to realize the integrated nature of the universe. Due to the nature of the show, topics are

	presented in such a way that all the sciences, including astronomy, chemistry, physics, and biology are intertwined. The students were to reflect on their appreciation of the series as well as the subject matter presented. 21 students are included in the assessment; only these students completed the assignment.
Data Collected (Assessment Day, external tests, Senior Achievement)	NA
Results/Outcomes	Lab TECH 722 Isolating Clove Oil: All students scored above the benchmark of 70% on their lab report, with a class average score of 97.8%. Cosmos Essay Bonus: All students that completed this assignment scored above the benchmark of 70%. The average score was 100%.
Proposed changes to the assessment process	Satisfied with process, no changes necessary.
Budget needs related to the objective?	None.

Objective 2	Explain how each individual branch of chemistry is needed to determine the chemical nature of the universe.
Methods	Course unit examinations with specific questions related to the objective Homework assignments with questions related to objective Quizzes with questions related to the objective

	Extra Credit Assignments designed to promote understanding of objective Course final examinations have questions related to objective.
Benchmark	Students will score above 70% on coursework related to the objective; homework and extra credit should be above 80%. Objective will be measured in lab through lab instructor/student interaction. Students are required to be 100% proficient.
Data Collected (course specific)	Chapter 2 Homework, Question (CHM114) #1, 3, 5, 6, 8, 36, 44, 92: These questions draw from nuclear, analytical, and physical sciences and are utilized in forming a better understanding of the chemical nature of matter. 52 students were assessed. Chapter 12 Homework (CHM124), Questions # 1, 3, 6, 11, 21, 56: Involves an introduction to Organic Chemistry and fuels. Therefore, students are exposed to the wide-ranging applications of chemistry to our society in general. Components of crude oil are separated for use in the petrochemical industry, plastics are made from these processes, as well as medicines. The applications of the chemical industry are boundless, which students explore in the homework for this chapter. 33 students were assessed.
Data Collected (Assessment Day, external tests, Senior Achievement)	NA
Results/Outcomes	Chapter 2 Homework, Questions # 1, 3, 5, 6, 8, 36, 44, 92: All students that handed in the assignment answered these questions in a proficient manner; they all scored above 80%, with an average score of 96.7%. Chapter 12 Homework, Questions # 1, 3, 6, 11, 21, 56: All students that handed in this assignment scored above the benchmark score of 80%. The average score on this selection of questions from the homework was 100%.

Proposed changes to the assessment process	Satisfied with process, no changes necessary.
Budget needs related to the objective?	None.

Objective 3	Demonstrate a thorough understanding of the periodic table of elements and how it can be used to determine trends in chemical reactivity and stability.
Methods	Course unit examinations with specific questions related to the objective Homework assignments with questions related to objective Quizzes with questions related to the objective Course final examinations have questions related to objective.
Benchmark	Students will score above 70% on coursework related to the objective; homework should be above 80%.
Data Collected (course specific)	Chapter 7 Test (CHM124), Selected Test Questions— Form A: 7, 8, 17, 20, 21, 32, 33. Form B: 8, 11, 15, 16, 28, 36, 39. These questions are all related directly to trends in the periodic table. 42 students were assessed. Course Final (CHM124): Selected Test Questions—Form A: 28, 31, Form B: 40, 50. These questions are all related directly to trends in the periodic table. 39 students were assessed.
Data Collected (Assessment Day, external tests, Senior	NA

Achievement)	
Results/Outcomes	Chapter 7 Test (CHM124), Selected Test Questions— Form A: 7, 8, 20, 21, 32, 33. Form B: 8, 11, 15, 16, 36, 39. Students answered 65.5% of these questions correctly, a little below the benchmark score of 70%. Course Final (CHM124): Selected Test Questions—Form A: 28, 31, Form B: 40, 50. Students answered 71.8% of these questions correctly, just above the benchmark score of 70%.
Proposed changes to the assessment process	Satisfied with process, no changes necessary.
Budget needs related to the objective?	None.

Objective 4	Logically apply the scientific method to everyday situations in order to facilitate an understanding of the world around us.
Methods	Course unit examinations with specific questions related to the objective Homework assignments with questions related to objective Quizzes in Lecture and Lab with questions related to the objective Lab Reports that require understanding of objective to complete Extra Credit Assignments designed to promote understanding of objective Course final examinations have questions related to objective.
Benchmark	Students will score above 70% on coursework related to the objective; homework and extra credit should be above 80%. Objective will be measured in lab through lab instructor/student interaction. Students are required to be 100% proficient.
Data Collected	TK20 Assignment: Essay on Global Warming/Carbon Dioxide Connection (CHM124)— This article required the students to assess the

(course specific)	scientific validity of an article they found in the press relating man's contribution to this global phenomenon. They were required, not to assess the causative nature of anthropogenic carbon dioxide, but simply whether good scientific methodology was employed in the article they found. 40 students were assessed. Essay—Critiquing an Article of Dietary Fats (CHM114): For this assignment, students were required to critique an article about dietary fats which they found in the media. They were to assess the health cost/benefit relationship for the various dietary fats available for consumption. 52 students were assessed
Data Collected (Assessment Day, external tests, Senior Achievement)	NA
Results/Outcomes	TK20 Assignment: Essay on Global Warming/Carbon Dioxide Connection— All students that handed in this assignment scored over the benchmark score of 70%, with an average score of 93.5%. Essay—Critiquing an Article of Dietary Fats (CHM114): All except for two of the 52 students completing this assignment scored over the benchmark score of 70%, with an average score of 86%.
Proposed changes to the assessment process	Satisfied with process, no changes necessary.
Budget needs related to the objective?	None.

Objective 5	Relate chemical principles to other areas of science, especially biology and physics.
Methods	Course unit examinations with specific questions related to the objective Homework assignments with questions related to objective

	Quizzes with questions related to the objective Extra Credit Assignments designed to promote understanding of objective Course final examinations have questions related to objective.
Benchmark	Students will score above 70% on coursework related to the objective; homework and extra credit should be above 80%.
Data Collected (course specific)	Chapter 20 Homework, Questions # 1, 3, 4, 5, 7, 8, 29 (CHM124): This chapter's homework focuses on nuclear chemistry, and it involves the history of radioactivity, it's nuclear nature, applications such as power and medicinal usages, and exposure levels. Due to the atomic origin of radioactivity, there are clear relationships with physics in particular, which this homework explores. Additionally, the medicinal uses of radioactivity, as well as a knowledge of exposure limits clearly associates it in the biological realm. 37 students were assessed. Exam 2 (CHM124), Questions— Form A: 47, Form B: 44. This test question involved Le Chatelier's Principle, which states that a system at equilibrium, if disturbed, will readjust to reestablish equilibrium. This principle has broad-reaching applications in all areas of the sciences. 41 students were assessed.
Data Collected (Assessment Day, external tests, Senior Achievement)	NA
Results/Outcomes	Chapter 20 Homework, Questions # 1, 3, 4, 5, 7, 8, 29 (CHM124): Of the students that turned in the assignment, all scored above the benchmark score of 70%. The average score was 100%. Exam 2 (CHM124), Questions— Form A: 47, Form B: 44. 75.6% of students answered this question correctly, above the benchmark score of 70%.
Proposed changes to the assessment	Satisfied with process, no changes necessary.

process	
Budget needs related to the objective?	None.

Objective 6	Integrate empirical evidence with experimental data, such that solid conclusions can be formulated.
Methods	Lab reports, pre-lab/post-lab assignments that require understanding of the objective to complete Lab Instructor works with each lab group to visually or orally determine understanding of the objective Lab quizzes with questions related to objective
Benchmark	Students will score above 70% on coursework related to the objective. Objective will be measured in lab through lab instructor/student interaction. Students are required to be 100% proficient.
Data Collected (course specific)	Lab TECH 701 Melting Points (CHM315): Students were required to complete this lab successfully, explain it to the lab instructor, and turn in results that indicated that they were able to successfully integrate acquired lab data with basic theoretical concepts to form conclusions requested by the lab. 15 students were assessed. Lab EQUL 0616 Introducing Chemical Equilibrium (CHM125): Chemical Equilibrium was investigated. Students collected a series of data points, created a Beer's Law plot, found a best fit line and equation, and from that were able to evaluate the equilibrium constant for this particular reaction. With the equilibrium constant, they were able to assess whether the reaction favored products or reactants, and furthermore, were able to estimate quantities of reactants and products at equilibrium. 32 students were assessed.

Data Collected (Assessment Day, external tests, Senior Achievement)	NA
Results/Outcomes	Lab TECH 701 Melting Points: Students performed at 100% proficiency on this lab, which is the benchmark required for success. Lab EQUL 0616 Introducing Chemical Equilibrium: All but one student performed this lab at 100% proficiency, shown through their Beer's Law plots and conclusions, as well as discussion with the instructor.
Proposed changes to the assessment process	Satisfied with process, no changes necessary.
Budget needs related to the objective?	None.

Attach Rubrics and or other explanatory documents pertaining to program assessment discussed in the chart to the report (portfolio guidelines, assignment sheet)

Analysis of Assessment:

Overall, the results of the assessments were very promising. However, performance on test questions, especially the Chapter 7 test, were lower than scores on other coursework. This suggests that the instructor will need to put greater emphasis on this portion of Chapter 7 and provide a quiz to pretest the students before the regular exam. The process in general is quite effective in determining student assimilation of the objective, and the instructor sees no need to modify or change the assessment process in a significant way. In general, students are achieving in Chemistry courses at a satisfactory level.

Analysis of the Assessment Process (Empirical & Non-Empirical) (HLC4B3)

I collected two examples of student work for each objective in order to assess each, as well as talking to students during lab. By looking at the results and answers the students gave to questions on the given

assignments, I am able to gain a substantial understanding of how students are comprehending information relating to the objectives. The only significant change to the assessment process this year was the absence of a Project-Based Learning Unit from the curriculum. I am planning on doing a Service-Learning or Project-Based Learning activity in the upcoming school year, as that was very helpful in assessing how students were assimilating their knowledge to the objectives. Also, student feedback was very positive on the experience. Program objectives for the upcoming year could use a facelift, and these will be proposed at the appropriate time. Due to the integrated nature of the assessment process, all components were equally valuable at determining student understanding. Because of the larger number of students, the process is time-consuming and arduous, albeit necessary.

Program Changes Based on Assessment:

I offered review sessions for all finals as well as extra office hours for tutoring, and I solicited more student feedback during lecture to ascertain understanding. I also attempted to better integrate lecture and lab components of all courses, specifically reinforcing lecture topics in lab to facilitate better understanding in kinesthetic learners.

General Education Assessment:

For General Chemistry, communication and mathematics allow students to compute mathematical problems as well as to communicate answers/ideas in an articulate manner. Meaning and Historical Perspective allows students to understand the historical perspective and social importance of the sciences. Critical thinking allows students to better understand and utilize the scientific method. Value and Diversity allows students to gain a perspective crucial for working in a diverse society in a cooperative and effective manner, an ability which is necessary in a scientific environment. As to Creative and Aesthetic Sensibility, there is no purer art form than Organic Chemistry to a student of the sciences. Social Sciences allow students to understand that science extends from the "hard" sciences to social sciences, which are equally valuable.

Program Activities:

Student Performance Day Activities (Assessment Day):

NA

Senior Achievement Day Presentations:

NA

Service Learning Activities:

None in the current school year.

Program Sponsored LEAD Events:

NA

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Student Accomplishments:

Samantha Berry, a 2014 Chemistry minor, was accepted into chiropractic school. Additional Chemistry minors with Biology majors were also accepted into prestigious graduate programs such as veterinary or medical school.

Faculty Accomplishments:

Professor Kyger was honored with an official Resolution from the Missouri House of Representatives, unanimously voted on by the House, which recognized him as one of Missouri's "exemplary citizens" due to the "excellence of their contributions to higher education." The Resolution further stated that Kyger "empowers students to believe in themselves, enables students to succeed at high levels, and inspires students to achieve their vision for the future."

Alumni (Recent Graduates) Accomplishments (past year graduating class):

No data collected at the present time.

Assessment Rubric Annual Assessment Report					
Assessment Component	**Assessment Reflects Best Practices**	**Assessment Meets the Expectations of the University**	**Assessment Needs Development**	**Assessment is Inadequate**	**Comments:**
Learning Outcomes	☐ Posted measurable program learning outcomes (objectives) ☐ All outcomes are developed and include a mix of assessment measures.	☐ Measurable program learning outcomes. ☐ Learning outcomes are clearly articulated.	☐ Program learning outcomes have been identified and are somewhat measurable	☐ Program learning outcomes are not clear or measurable	☐
Assessment Measures	☐ Multiple measures are used to assess a student-learning outcomes. ☐ Rubrics or guides used are provided. ☐ All measurements are clearly described.	☐ Specific measures are clearly identified ☐ Measures relate to program learning outcomes. ☐ Measures can provide useful information about student learning.	☐ Some measurements are described, but need further description.	☐ Assessment measures do not connect to learning outcomes (objectives). ☐ Assessment measures are not clear. ☐ No assessment measures are established.	☐ The number of measures should match the data provided.
Assessment Results	☐ All learning outcomes are assessed annually; or a rotation schedule is provided. ☐ Data are collected and analyzed to evaluate prior actions to improve student learning. ☐ Standards for performance and gaps in	☐ A majority of learning outcomes assessed annually. ☐ Data collected and aggregated are linked to specific learning outcome(s). ☐ Data are aggregated in a meaningful way that the average reader can understand. ☐ Standards for student performance and gaps in student	☐ Data collected and aggregated for at least one learning outcome (objectives). ☐ Data collection is incomplete ☐ Standards for student performance and gaps in student learning are not identified.	☐ Learning outcomes are not routinely assessed. ☐ Routine data is not collected. ☐ N/A Program is too new to have collected assessment data.	☐ Thank you for the specific percentages in your data and including the N of your sample.

	student learning are clearly identified.	learning are recognized.			
Assessment Component	**Assessment Reflects Best Practices**	**Assessment meets the expectations of the University**	**Assessment needs Development**	**Assessment is Inadequate**	**Comments:**
Faculty Analysis and Conclusions	☐ All faculty within the program synthesize the results from various assessment measures to form conclusions about each learning outcome. ☐ Includes input from adjunct faculty. ☐ Includes input from outside consultant.	☐ Program faculty receive annual assessment results and meet to discuss assessment results. ☐ Specific conclusions about student learning are made based on the available assessment results.	☐ Some program faculty receive annual assessment results ☐ Faculty input about results is sought	☐ Faculty input is not sought. ☐ Conclusions about student learning are not identified. ☐ N/A Program recently started or too few graduates to suggest any changes.	☐ Only one faculty member in the program.
Actions to Improve Learning and Assessment	☐ A comprehensive understanding of the program's assessment plan and suggestions for improvement. ☐ Clearly stated	☐ Description of the action to improve learning or assessment is specific and relates directly to faculty conclusions about areas for improvement. ☐ Description of	☐ At least one action to improve learning or improve assessment is identified. ☐ Adjustments to the assessment plan are	☐ No actions are taken to improve student learning. ☐ Actions discussed are not connected to data results or analysis.	☐ Next year adding service learning project. ☐ Review of program objectives

	adjustments in curriculum as a result of assessment data.	action includes a timetable for implementation and identifies who is responsible for action ☐ Actions are realistic, with a good probability of improving learning or assessment.	proposed but not clearly connected to data ☐ Minimal discussion of the effectiveness of the assessment plan; minimal discussion of changes, if needed.	☐ N/A Program recently started or too few graduates to suggest any changes.	

Additional Comments:

If only 2 samples of data are going to be discussed in the collection/results section of the assessment report, why list 7-8 different methods of assessment. Only put down the 2 that are actually going to be assessed. We know faculty are doing on going assessment in each course, but this is specific to the documented assessment of student work.

For assessment method, it is more helpful if you state CHM114: course exam questions like you did when you talked about the data collected. Again, no need for 5 assessment measures if only two are going to be discussed. Leave the two assessment measures and delete the others from the methods section.

Objective 3: the benchmark is only on homework, but the data collected related to chapter 7 exam and the course final. The benchmark needs to focus on the exams instead of homework if you are using exams as your evidence.

This report was much improved from last year and the work you put into it shows. The amount of data you collected is extensive and we might look at what options are available that would make the data easier for you to keep track of. I don't know if you use the exam function on owlnet, but it will let you run statistics on your exams and you can export scores to excel. I know not everyone is interested in on line exams, and they are not my favorite, but it might be something you look at for a few of the exams just to ease the data collection aspect of assessment.

For the program, many of the assessment results were 100% and students scoring 100%. What pedagogy of student learning are you using? Do students work through the labs until they reach mastery? Do you think you need to make any alterations to the courses based upon feedback from students who have gone on to graduate school? Just some thoughts… thanks for the report.