**Academic Program Review: Self-Study**

***Instructions:*** *The following pages will guide your submission of your academic program review self-study. Please type your responses directly into the document. The completed self-study instrument and all attachments must be submitted to the Academic Program Review Coordinator and your Academic Dean by September 1.*

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| **Program Under Review** |
| Degree(s): Associate of Science in Geology and Planetary Science |
| Certificate(s): N/A |
| Contact Information for lead on Self-Study: Name: Wayne PryorCampus: SPCPhone: 520-494-5351Email: wayne.pryor@centralaz.edu |

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| **Program Description, Vision and Outcomes** |
| What is the description of the program as stated in the current CAC catalog: The Associate of Science in Geology and Planetary Science Degree prepares students to transfer to a university to earn a baccalaureate degree in Geology or a related field. |
| 1. Does your program have a mission and/or a vision statement. If it does, please write them below and indicate where they appear.

N/A |
| 1. Describe how the program’s description, mission and/or vision aligns with the College’s Mission and Vision:

**CAC Vision and Mission Statements:***OUR VISION*Central Arizona College is the leader of innovative learnersuccess and the center for educational opportunities in ourdiverse communities.*OUR MISSION*Central Arizona College engages our diverse communities inquality learning experiences for lifelong success by providingaccessible educational, economic, cultural, and personalgrowth opportunities.In keeping with our vision and mission, this degree helps interested students stay on track for transfer to their desired four-year programs, which includes not only geology but also planetary science and other earth-science related degrees. Our program also helps students seeking job training for careers in mining and the energy industry.  |

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| **Program Enrollment and Graduation Trends** |
| 1. Summarize the program enrollment data for the past 5 years in the chart below:

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| --- | --- | --- | --- | --- | --- |
| Degree/Certificate | 2016-17 | 2015-16 | 2014-15 | 2013-14 | 2012-13 |
| Geology & Planetary Science AS | 2 | 0 | 0 | 1 | 0 |
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| 1. Discuss and explain the factors influencing the enrollment trends:

Geology remains a popular major nationally and at Arizona Universities. Enrollment in our geology and astronomy courses is much higher than enrollment in the degree program. The full degree program is mathematically and scientifically rigorous, and will attract a few of CAC's best students in coming years. |
| 1. How has the program typically recruited students and marketed the program:

(1) The catalog. (2) Advising. (3) Professors and STEM staff speaking to classes and giving handouts including discussions of related career opportunities in our fields. (4) STEM nights at the College. (5) Course flyers distributed around the college and in local public libraries. (6) Electronic billboard advertising (7) Students completing coursework in completion of lab science electives |
| 1. Summarize the program graduation rate trends for the past 5 years in the chart below:

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| --- | --- | --- | --- | --- | --- |
| Degree/Certificate | 2016-17 | 2015-16 | 2014-15 | 2013-14 | 2012-13 |
| Geology & Planetary Science AS | 0 | 0 | 1 | 0 | 0 |
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| 1. How many program enrollees or graduates studied at an in-state baccalaureate level institution during the past 5 years? Put the data in the table below.

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| --- | --- | --- | --- | --- | --- |
| Degree/Certificate | 2016-17 | 2015-16 | 2014-15 | 2013-14 | 2012-13 |
|  | No Data | 1 |  |  |  |
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| 1. Discuss and explain the graduation trends. What efforts has the program made to help students achieve completion?

The full degree program remains a small program. GLG 101 is regularly offered at SPC; GLG 102 at SPC and Maricopa; AST 101 at SPC, Maricopa, and SMC; and GLG 110 at SPC, Maricopa, SMC, and San Tan. ENV 101 is offered online and face-to-face. A special section of GLG101 was offered in 2015 to help our one graduate finish the program. |
| 1. Provide a summary of this section. Indicate trends observed in the data, identify areas of strengths, and areas for improvement.

This remains a small program steering a few of our best students from our large astronomy and geology classes towards the courses they will need to take to later major in Geology or related fields at a University. Though the numbers of students in the program are few, the core AST/GLG classes serve many non-majors students seeking lab elective credits. Therefore, the core coursework is offered regardless of the program and the program itself brings no additional costs to the institution.  |

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| **Program Curriculum:** *Submit a completed Curriculum Comparison Chart along with the self-study, comparing the CAC program curriculum to three similar programs, for each Degree and Certificate discussed in this self-study. Ideally compare to other Arizona programs, and out of state if necessary. Use the charts to answer the following questions.*  |
| 1. Certificate(s): After reviewing the Curriculum Comparison Chart of the other institutions for the certificate(s), is insight given into courses that could be added, combined or deleted?

 *N/A* |
| 1. Degree (s): After reviewing the Curriculum Comparison Chart of the other institutions for the degree(s), is insight given into courses that could be added, combined or deleted? *Our program is quite similar to the other programs listed, with the exception of our program emphasizing astronomy and environmental science as well as geology.*
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| 1. When the Curriculum Review for each degree and certificate comes due, are there any course descriptions, articulation, additions, revisions or deletions anticipated? *None planned.*
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| **Program Outcomes and Assessment** |
| What are the student learning outcomes for the degree or certificate as currently indicated in ACRES: 1. (Comprehension Level) Explain the basic natural laws and principles upon which the science of geology is based, including demonstrating the application of mathematical techniques, physical and chemical principles, and computer techniques related to geology. 2. (Evaluation Level) After physically examining common igneous, sedimentary and metamorphic rocks, determine their mineral composition and texture. Using this information, identify the samples and explain how these rocks formed. 3. (Evaluation Level) After physically examining various mineral samples, determine a variety of physical properties of minerals, including hardness, cleavage, luster and streak. Using this information, identify the minerals. Demonstrate knowledge of the most important minerals and energy sources used by humans 4. (Analysis Level) Identify a select group of common fossils and describe their methods of preservation. 5. (Evaluation Level) Using geologic maps, determine rock types and ages. Also determine the strike and dips of the beds, and identify different geologic structures. Demonstrate skill with maps, including topographic maps, geologic maps, and geologic cross-sections. 6. (Comprehension Level) Describe the historical development of modern geologic thought. Demonstrate knowledge of the history of the Earth and the evolution of life. 7. (Synthesis Level) Demonstrate knowledge of the major physical features of the Earth, including the Earth's internal structure, features of continents, ocean basins, and those produced by the tectonic and hydrologic systems. Also, describe the sources of energy that drive these systems and the Earth features produced by their operation over long periods of geologic time. Demonstrate understanding of the Earth's key geologic processes, including plate tectonics, the rock cycle, and the water cycle. 8. (Evaluation Level) Summarize the basic components of the hydrologic and tectonic systems. Describe the sources of energy that drive these systems and the Earth features produced by their operation over long periods of geologic time. Compare these systems to those operating on other planets. 9. (Evaluation Level) Summarize the basic components of the hydrologic and tectonic systems. Describe the sources of energy that drive these systems and the Earth features produced by their operation over long periods of geologic time. Compare these systems to those operating on other planets. 10. (Synthesis Level) Summarize the major geologic hazards faced by humans and how they can avoid them. List the major mineral and energy resources used by humans and describe their geologic occurrence. Describe some of the basic relationships that exist between humans and the Earth upon which they live. Show how the choices they will make are related. Demonstrate awareness of human effects on the Earth and its climate. 11. (Analysis Level) Explain the differences between relative and absolute geologic dates and be able to determine relative dates from a block diagram. Identify the major portions of the geologic time scale and explain how this great expanse of time was divided into smaller periods. 12. (Synthesis Level) Explain the differences between relative and absolute geologic dates and be able to determine relative dates from a block diagram. Identify the major portions of the geologic time scale and explain how this great expanse of time was divided into smaller periods and how absolute dates were determined for these periods. 13. (Synthesis Level) Describe some of the current scientific theories regarding the origin of the Earth, list the major advances in the chronological development of life upon the Earth and relate these to the major periods of the Geologic Time Scale and the theory of organic evolution. |
| 1. Are the outcomes from your program determined or influenced by any external organization, agency, or accreditor? If so, please explain. Are there any available accreditations which the program does not have, but maybenefit from seeking?

*N/A* |
| 1. Describe the department/program strategies for determining how learning outcomes are assessed using direct and indirect methods and for collecting, analyzing and discussing findings*. Assessments are currently in the form of labs, homeworks, quizzes, and tests prepared by the instructor. Also, Pryor has for many years used the "Introductory Astronomy Survey" of 29 questions prepared by The Collaboration for Astronomy Education Research (CAER) as a pre-test to help students understand the type of reasoning required in a college astronomy course.*
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| 1. Is a common assessment being conducted to assess the Measurable Student Learning Outcomes (MSLOs) for a common course? Is there data which indicates the degree to which students in the program are achieving the program’s MSLOs?

*There is not currently a standard assessment used across the district. We plan to use the "Introductory Astronomy Survey" as a post-test as well as a pre-test starting Fall 2018 to assess student progress.* |
| 1. Is there data which indicates the degree to which students in the program are achieving the program’s Common Student Learning Outcomes (CSLOs)? Please share and explain the data.

**The four Common Student Learning Outcomes are:**1. Cultural and Civic EngagementParticipate in diverse environments while demonstrating global citizenship and social consciousness2. Integrative KnowledgeIdentify, comprehend, apply and synthesize facts, concepts, theories and practices across broad and specialized knowledge areas3. Personal and Professional SkillsDemonstrate skills which enhance personal and professional development4. Reasoning SkillsInquire and analyze to solve problems, draw logical conclusions, or create innovative ideas*Standard labs, tests, and homeworks assess CSLOs 2, 3, and 4. Our GLG 110 classes also have a required student project and presentation which is particularly good at assessing 2 (Integrating Knowledge). Geology and Environmental Science classes have a significant section on environmental issues related to CSLO 1.* |
| 1. Discuss how the program has used MSLO and CSLO assessment results to improve instruction and/or student learning over the past 5 years. Summarize actions taken based on assessment of student learning findings. *Instructors continue to rework lectures, labs, quizzes, tests, and class projects based on student needs and performance.*
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| 1. Discuss how the program supports current or future needs for the job market in Pinal County, the state of Arizona, and/or the United States. *The energy and mining industries continue to need trained geologists. Many geologists also work for the government.*
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| 1. For degree programs, identify any specific in-state baccalaureate programs into which this program is particularly suited for transfer*. ASU offers related degrees in Earth and Environmental Studies; and Earth and Space Exploration in their School of Earth and Space Exploration.* *University of Arizona offers related degrees in Astronomy, Environmental Science, and Geosciences. Northern Arizona University offers related degrees in Astronomy, Environmental Science, and Geology.*
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| 1. Indicate if there are any articulation agreements in place for degree graduates. *N/A.*
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| 1. Discuss how the program gets feedback on its program and curriculum from external sources, suchas advisory boards, employers, articulation task forces, accreditors, etc. *Pryor attends the Geology ATF meetings. Vangilder attends the Physic and Astronomy ATF meetings.*
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| **Program Specific Resources:***In this section please focus on program specific resource. You may, but do not have to, discuss resources available to the college at large such as Blackboard, the Learning Centers, Library, etc. However, if these resources are impacting your program in a positive or negative way which you would like to discuss, please do so.* |
| 1. Discuss the adequacy of the budgetary resources, human resources, technological resources, classrooms, labs and space, academic support for students (ie: learning center, library) and student support (ie: advising) available to the program over the past 5 years: *Budgetary resources: In Summer 2018 a significant grant was used to update the college's large 24-inch telescope control system. A new safer ladder was also purchased this year. Ongoing budgetary needs include significant funds for travel and equipment updates. One way we have been trimming costs is having students drive themselves to some geology field trip, although this is not ideal for longer trips.* *Human resources: Geology and astronomy instruction has been provided by 1 full-time and 2 adjunct instructors. This is sufficient, however under new HLC requirements it is more difficult to identify adjunct instructors who meet minimum qualifications.*

*Technological resources: The observatory has recently benefited from new desktop computers and a new laptop computer. Classroom technologies are gradually improving, however classroom computers require updating.*  *Observatory and classrooms: The observatory was preserved when the old science building was taken down. It needs some ongoing attention as that building removal project is finished- internet and phone connections are currently down; and the smaller of the two observatory buildings has no power. The walkway lighting is still not on.* *Classroom instruction at SPC has been switched from the old science building to T-209 because it is close to the observatory. Unlike the old room, the new room has fume hoods and working sinks, enabling some new labs. Classroom instruction at SMC, Maricopa, and San Tan also benefit from modern classrooms. A lingering concern is high levels of air-conditioning noise in Maricopa room C-106 which at times makes instruction difficult.*  *Student support: both the learning center and advising have been very helpful. The old STEM grant provided textbooks and lab manuals for many of our students.*  |
| 1. What future goals does the program have? Will extra resources and funding be required to achieve it? *Goal: Moving towards free online texts for most of our classes as these become more available and higher quality. AST 101 has been using OpenStax for several terms; the GLG 101 class is also trying a free online text Fall 2018. We have not found good free texts yet for GLG 102 and GLG 110, although we will continue to look. A set of physical geology lab manuals was purchased by the STEM grant which also helps our students save money. Purchasing a few more lab manuals would be a good goal so instructors don't have to carry them back and forth between campuses.* *Goal:* *Complete the upgrades to the observatory. We want those facilities to be clean, functional, and attractive for future college public events. Some painting, wiring, and cleaning is needed before those events can take place. Training on the new telescope control system needs to be completed.*
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| **Program Effectiveness for Graduates** |
| 1. Describe how you measure the success of degree and certificate program graduates. For example, are graduate surveys conducted? Are surveys given to employers to determine satisfaction with program graduate employees?

 *We have been relying on conversations with our students and graduates. For example, one of the Science Dept. lab techs, a recent CAC graduate, just informed us that she will be majoring in geology at a 4-year University this year.* |
| 1. If a degree or certificate is designed to lead directly into the workforce, describe the success of students in obtaining a job in the field of study upon graduation. Please provide any qualitative or quantitative data you have: *No data yet.*
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| 1. If your program serves to prepare a student for external certification or licensure of any kind identify the certification or license and the percentage of program graduates who earn/achieve it. Put data in the table below. *\*This table is not applicable (N/A) for this program*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Licensure/Certification | 2016-17 | 2015-16 | 2014-15 | 2013-14 | 2012-13 |
| \* | N/A | N/A | N/A | N/A | N/A |
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| **Program Continuous Quality Improvement** |
| 1. Discuss how the program has used operational planning goals to achieve quality improvement over the past 5 years:

*We have been modifying our geology and astronomy lab procedures to include more critical thinking projects than previously existed.* |
| 1. Describe other ways the program has engaged in continuous quality improvement:

 *We have recently increased the online component of our astronomy classes, making use of improvements in video-streaming technologies to eliminate some passive laboratories. Students can watch certain materials at home, and attend class fewer hours. They will still attend class for lectures, and for our more active laboratories, involving telescopes, spectrometers, computers, binoculars, and cameras.* |

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| **Program Alignment with Institutional Strategic Goals:** |
| 1.Describe how the program has directly or indirectly is helping the College achieve its current strategic goals.***CAC Strategic Goals:*** 1. Ensure broad access to high-quality innovative educational programs, services and training opportunities for Pinal County resident. *We would like to offer these courses at more campuses to provide broad access to our residents.*
2. Improve student retention, persistence, completion and job placement
3. Ensure a safe, sustainable environment that promotes learning, communication, diversity and satisfaction among students, faculty and staff
4. Enhance our physical and technological infrastructure to support changes in the learning and work environment *Recent observatory upgrades and our "new" geology and astronomy classroom (T-209) fall into this category.*
5. Expand partnerships with Universities to provide advanced degrees to Pinal County residents
6. Obtain approval from the state and regional accreditation body to offer baccalaureate degrees at CAC
7. Optimize fiscal resources that support the needs and expectations of students and the community,

contribute to the economic vitality, workforce development, and job training needs of Pinal County and surrounding region *Finding free books and cutting travel costs help our students and the district save money.* |

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| **Evaluation of Program Strengths, Viability and Areas for Improvement:** |
| 1. After completing the APR Self Study, identify areas of strength and areas for improvement in the program. Is the program still a viable program? Discuss the next steps for the program and possible Action Plan Ideas. *This degree program is aimed at a few of our best astronomy and geology students, and helps them identify and complete courses needed for future transfer or job opportunities. The astronomy and geology classes serve a significant fraction of CAC's students, as we run several sections of these courses each semester. Providing continuing upgrades in the observatory and classrooms helps many of our students. Observatory programs can potentially reach a large segment of the community when the upgrades are completed.* ***This self-study has identified the need for better standardized assessment across the district, and tracking of our program graduates after they leave.***
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