Program: Biology B.S. (BBS) and B.A. (BBA)

Learning Outcome: PLO1: Demonstrate an understanding of the process of science and of the concepts and theories of biology across a broad range of organizational levels: cellular, molecular, organismal, and ecological (population, community, ecosystem).

Outcome Measure: ETS Major Field Test in Biology.

Criteria for Success: The overall group mean on the ETS exam will be ≥ 75th percentile and at least 50% of our students will have an overall score ≥ 60th percentile. Additionally, the same criteria established for the overall ETS score will be applied to each of the 4 sub-disciplines, which are 1) Cell, 2) Genetic & Molecular, 3) Organismal, and 4) Population, Ecological, & Evolutionary Biology.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	2018, n=27	**2017, n=34**	**2016, n=30**	**2015, n=24**
Overall group mean	61st %ile	83rd %ile	92nd %ile	93rd %ile
% above 60th %ile	44%	68%	80%	75%
Cell Biology mean	55th %ile	76th %ile	85th %ile	96th %ile
% above 60th %ile	41%	50%	60%	63%
Genetics/Molecular mean	53rd %ile	83rd %ile	83rd %ile	93rd %ile
% above 60th %ile	33%	59%	53%	71%
Organismal mean	59th %ile	86th %ile	90th %ile	88th %ile
% above 60th %ile	44%	65%	70%	75%
Pop/Eco/Evol. Biol. mean	70th %ile	87th %ile	93rd %ile	95th %ile
% above 60th %ile	44%	62%	77%	75%

Conclusions Drawn from Data:

All criteria were met from 2015-2017, but interestingly, none were met in 2018. We analyzed the data further to understand why this might be. If the GPAs of students graduating in 2018 were compared against those graduating in 2017, we found that a higher percentage of students had a GPA below 2.5, specifically 18.5% of BBA/BBS majors in 2018 vs. only 3% in 2017. Correspondingly, this group of seniors also scored lower on the ETS major field tests in critical thinking, writing, and quantitative literacy. If we pulled these students' scores out of the

analysis, we found that at least 50% of the remaining students scored above the 60th percentile for the overall score, the cell biology score, the organismal biology score, and the ecology/evolution score. For the molecular biology score, 44% of the students scored above the 60th percentile.

Changes to be Made Based on Data: No changes to program.
Rubric Used: ETS 2017 Comparative Data Guides – MFT for Biology

Learning Outcome: PLO2: Participate in the life of the department in Biology/Chemistry clubs or in various positions of responsibility such as graders, tutors, and teaching assistants.

Outcome Measure: Self-reported data of participation.

Criteria for Success: At least 80% of our students will participate in one of these positions during their time at PLNU.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning
5. Civic and Global Learning

Longitudinal Data:
Data for participation in clubs or positions of responsibility was not collected in 2018.

30 of the 32 BBS majors (93%) reported participation in clubs or positions of responsibility in 2017 (**criteria met**).

25 of the 30 BBS majors (83%) reported participation in clubs or positions of responsibility in 2016 (**criteria met**).

18 of the 24 BBS majors (76%) reported participation in clubs or positions of responsibility in 2015 (**criteria almost met**).

In 2014, of the 21 BBS students who took the survey, 95% reported participation in clubs or positions of responsibility (**criteria met**).

Conclusions Drawn from Data:
The BBS/BBA majors are generally participating in the life of the department.

Changes to be Made Based on Data:
No changes to the program.

Rubric Used: Not applicable to self-reported data.

Learning Outcome: PLO3: Develop a rationally defensible integration of science and faith.

Outcome Measure: During their senior year, students will defend the integration of their faith with various scientific topics via a written essay.

Criteria for Success: At least 80% of our students will achieve a level of 3 or higher on each area of the science/faith integration essay rubric, which considers both science/faith integration and critical thinking.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning
5. Civic and Global Learning

Longitudinal Data:
Of the 25 BBA/BBS majors who were assessed in 2018, 96% scored 3 or above on the science faith integration essay (**criteria met**).

Of the 33 BBS majors who were assessed in 2017, 85% scored 3 or above on the science faith integration essay (**criteria met**).

A random sample of students was selected in 2016 and 13 BBS majors were in this sample. 100% of the students scored 3 or above on science faith integration essay (**criteria met**).

Conclusions Drawn from Data:
The BBS/BBA majors are able to develop a rationally defensible integration of science and faith.

Changes to be Made Based on Data:
No changes to the program.

Rubric Used: See attached.

BIO 497 Grading rubric for *Integration of Science & Faith* Essay (2017)

Grading aspect	Capstone 4	Milestones 3	Milestones 2	Benchmark 1
Integration of science and faith (evolution or creation care) 0 -20 points	• Deep personal reflection is evident • Clear and well-defended position that merges faith and scientific reasoning (note: the exact position is not important, but rather the evidence of reflection, understanding, and ability to defend that position)	Obvious evidence of reflection on the integration of science and faith, but the author is only marginally effective at defending his/her position.	Evidence of clear and deep reflection is not very apparent, and the position taken is not well-defended.	There is no indication of personal reflection and thought into the integration of faith and science.
Critical Thinking **0 – 20 points**	• Issue is stated clearly • Position is well-supported with evidence and sources. • Alternate positions are clearly addressed in a manner that flows well with the author's argument • Clear arguments against these alternate positions using personal reflection and scientific information • Evaluation of altering positions demonstrate grace and understanding	Fairly strong support of the argument. Alternate positions are addressed and the author's own position is supported against these positions, but didn't demonstrate adequate understanding of other positions, nor did a strong argument against them emerge.	Position is weakly defended Other, perhaps conflicting, positions on this issue are mentioned, but are poorly addressed	Position is not defended There is no reference to any other position on this issue.
Incorporation of concepts discussed in various classes while at PLNU Critical Thinking **0 – 20 points**	• Concepts from PLNU classes, including science and / or religion classes, are included as part of the author's reflection and defense of his/her position. • Includes a clear reflection of how the position has changed while at PLNU. If his/her position has not changed, essay still includes a clear explanation of why it did not change, that demonstrates personal reflection.	Concepts and discussion from PLNU classes are included and discussed appropriately, but are not clearly interwoven into the author's defense and explanation of his/her own position or how this position has changed while at PLNU	Concepts and discussions from PLNU classes are part of his/her defendable position, but there is no reflection on how/if these have affected the author's position.	No concepts or discussions from PLNU classes are clearly included in the argument
Written Communication **0 – 20 points**	• No, or very few, grammatical and spelling errors. • Essay flow is excellent with a clear introduction, argumentative reasoning, and a strong conclusion. • Writing effectively communicates with a college science audience. • Sufficient length to make a good, complete defense (estimated ~1200 – 1600 words; can be less if essay is sufficiently and concisely supported)	Few grammatical and spelling errors are apparent in the writing. Writing shows evidence of revision, but the argument does not flow very well. Essay is of sufficient length to support the argument	Writing is OK, but grammatical and spelling errors are somewhat frequent. Further revisions are required. Essay length is not sufficient to support the argument.	Writing is very poor with several grammatical and spelling errors. No evidence of revision. (Essay is <800 words)
Information Literacy **0 – 20 points**	• Includes 5 or more appropriate sources. Includes sources from more than one type (websites, books, articles, etc.). Multiple journal and/or book sources. • Includes substantial references in the text that enhance the essay and support the author's argument. • Paraphrasing is done well, and quotes are used correctly, but not overly frequently. • Annotated bibliography includes 1 – 2 sentences appropriately describing why each reference was chosen and how it was used.	Includes 3-4 appropriate sources. Includes some references in the text that are incorporated into the essay well. Some of the references may not be appropriate for the topic or may not be used appropriately.	Includes 1 – 2 appropriate sources. In-text references show little connection to the essay. Quotes are overly used or long. No indication as to how / why the references were used.	Includes no appropriate sources. No in-text references. Or most sources were inappropriate or used for incorrect purposes.

Learning Outcome: PLO4: Be prepared for post-graduate studies or science-related careers.

Outcome Measure: After graduation, alumni will be tracked and data regarding their postgraduate education and profession will be recorded.

Criteria for Success: Success rates for alumni who apply for graduate or professional schools will be > 75% and the percentage of graduates who obtain jobs in science-related occupations will be >70%.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning
5. Civic and Global Learning

Longitudinal Data: (These data are collected every 5 years, and were not collected in 2018.)

1) The success rate for alumni who apply to graduate or professional schools has been well over 90% for at least 20 years.
2) An alumni survey was conducted by the Biology and Chemistry Depts. in January, 2015, that included graduates from 2004 – 2014. 408 alumni were emailed and 115 responded (28% response rate). The lowest response rate was from the class of 2007 (7%); all other classes had a response rate of 21-42%, which is fairly typical of alumni surveys.
3) 44 BBS majors responded (27% response). Of these alumni, 84% are employed or attending school in a Biology or STEM-related field (**criteria met**). 1 is applying to medical school, 4 are employed outside science, and 2 are unemployed (class of 2014).

Conclusions Drawn from Data:
The BBS/BBA majors are successful at obtaining jobs and entering graduate/professional schools.

Changes to be Made Based on Data:
No changes to program.

Rubric Used: Not applicable to self-reported data. Survey instrument is attached.

Alumni Survey 2015

The Biology and Chemistry Departments are doing an extensive Program Review. We would greatly appreciate your feedback as a PLNU alum on your experience as a Biology or Chemistry major. This 15-question survey should take about 15 minutes to complete. If you provide your email address, we will also enter you into a drawing for one of three $100 Amazon cards as a thank you for your time!

1) What year did you graduate from PLNU?

2) What was your major?
   a) Biology-BA
   b) Biology-BS
   c) Chemistry
   d) Biology-Chemistry
   e) Environmental Science

3) What is your highest degree earned?
   a) BA/BS
   b) MA/MS
   c) PhD
   d) MD/DO
   e) PA
   f) DDS
   g) DVM
   h) OD
   i) PharmD
   j) Other – please specify

4) What is your current professional situation?
   a) Professor
   b) Teacher
   c) Health professional
   d) Biotechnology or pharmaceutical industry
   e) Academic or government lab
   f) Graduate student – please specify field or specialty
   g) Other – please specify

5) Rank how well we prepared you to meet the following goals that were set for your major. (Only PLOs for specified major selected in #2 will appear.)
   a) Unprepared
   b) Somewhat unprepared
   c) Prepared
   d) Well prepared
   e) Extremely well prepared

6) Were you involved in the PLNU biology or chemistry summer research programs?
   a) Yes – describe how this experience is impacting your career.

b) No

7) Which classes or experiences do you appreciate more now as opposed to when you had just graduated?

8) Is there any course, topic, or skill you've repeatedly encountered that you wish you had been taught at PLNU? Please explain.

9) If you are pursuing a career in environmental science, do you wish you had substituted an internship experience for a science elective while you were at PLNU?
   a) I am not pursuing a career in environmental science.
   b) I did an internship.
   c) Yes, I wish I had done an internship while at PLNU.
   d) No, I did not need to do an internship while at PLNU.

   Comments?

10) Do you wish you had taken any of the following options at PLNU?
   a) BIO130/140 (Human Anatomy & Physiology)
   b) Upper-division anatomy class
   c) No, I didn't need an Anatomy class

   Comments?

11) What were one or two aspects of the biology curriculum that might have been improved to better prepare you for your profession or for further studies?

12) What were one or two aspects of the chemistry curriculum that might have been improved to better prepare you for your profession or for further studies?

13) Have you done any of the following? Check all that apply.
   a) Recommended PLNU to a prospective student
   b) Promoted PLNU to another person
   c) Been involved with the alumni association
   d) Donated to Research Associates
   e) Other – please specify.

14) Since you left PLNU, have you ever had a conversation in which you had to integrate Christian faith with scientific knowledge? Did you feel prepared scientifically? Did you feel prepared theologically? Check all that apply. Please describe the situation and your feelings about your preparation.
   a) I've never had such a conversation.
   b) I felt prepared scientifically.
   c) I didn't feel prepared scientifically.
   d) I felt prepared theologically.
   e) I didn't feel prepared theologically.

15) Since you left PLNU, have you made any decisions that were influenced by your knowledge of creation care and sustainability? If so, did you feel prepared to make those decisions from a scientific understanding of sustainability?

a) I do not tend to make decisions based on sustainability considerations.

b) I often feel unprepared to make those decisions as it is rarely clear to me which options would best benefit the planet.

c) I usually feel prepared to make those decisions as I am generally confident in my understanding of how my choices affect, and which options are best for, the planet.

d) I feel very comfortable in my scientific knowledge of how various decisions will affect the earth, either negatively or positively.

16) Please provide your email address to be entered into the drawing for an Amazon gift card. Your email address will not be associated with your responses on this survey.