Biology B.S. (BBS) and B.A. (BBA)
Program Learning Outcomes, F2021-S2022

Learning Outcome: PLO#1
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:

	2022, n=44	2021, n=50	2018, n=27	2017, n=34	2016, n=30
Overall group mean	52nd %ile	82nd %ile	61st %ile	83rd %ile	92nd %ile
% above 60th %ile	34%	64%	44%	68%	80%
Cell Biology mean	50th %ile	82nd %ile	55th %ile	76th %ile	85th %ile
% above 60th %ile	32%	52%	41%	50%	60%
Genetics/Molecular mean	49th %ile	68th %ile	53rd %ile	83rd %ile	83rd %ile
% above 60th %ile	39%	42%	33%	59%	53%
Organismal mean	41st %ile	88th %ile	59th %ile	86th %ile	90th %ile
% above 60th %ile	32%	56%	44%	65%	70%
Pop/Eco/Evol. Biol. mean	69th %ile	79th %ile	70th %ile	87th %ile	93rd %ile
% above 60th %ile	41%	56%	44%	62%	77%

Conclusions Drawn from Data:
In 2022, none of the criteria were met. In 2021, all criteria were met except in the category of Genetics & Molecular Biology. (Gray numbers indicate criteria not met.) Since 2018, the data have been so variable that it is difficult to predict whether this is a concerning trend or whether there is another effect, e.g. COVID.

In 2019, this exam was not given due to a mishap with the new computer lab, and in 2020, it was not administered due to the complications of COVID-19.

From 2015-2017, all criteria were met, 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 the program.

Rubric Used: ETS Comparative Data Guides – MFT for Biology

Learning Outcome: PLO#2
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:

	Number of students responding of total	% participated in life of dept	Criteria met?	Notes
Sp 2022	39 of 41	85%	Yes	For those who reported no participation, some factors mentioned were outside jobs, sports, and commuting.
Sp 2021	51 of 51	84%	Yes	
Sp 2020	44 of 49	77%	Almost	For those who reported no participation, some factors mentioned were outside jobs and involvement in sports.
Sp 2019	31 of 41	80%	Yes	
Sp 2018	NA	NA	NA	Survey not given
Sp 2017	30 of 32	93%	Yes	
Sp 2016	25 of 30	83%	Yes	
Sp 2015	18 of 24	76%	Almost	

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: PLO#3
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:

	Number of students	% scoring 3 or above	Criteria met?
Sp 2022	41	83%	Yes
Sp 2021	45	93%	Yes
Sp 2020	32	94%	Yes
Sp 2019	41	96%	Yes
Sp 2018	25	96%	Yes
Sp 2017	33	85%	Yes

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 4097 Grading Rubric for *Integration of Science & Faith* annotated bibliography (Info Literacy Assign #2) (25 points)

Grading aspect	Capstone 4	Milestones 3	Milestones 2	Benchmark 1
Number of references 0 – 10 points	☐ At least 5 references ☐ At least 3 references are journal articles or books.	☐ 3-4 references ☐ 2 or fewer references are journal articles or books.	☐ 2 or fewer references, ☐ No references are journal articles or books	☐ No references
Choice of references 0 – 15 points	☐ Annotated bibliography includes 1 – 2 sentences describing choice, use, and purpose of each reference (including bias) ☐ Particular aspects (chapter, pages, figures) of each source are indicated for which the student anticipates using. ☐ Sources are of more than one type such as websites, books, and journal articles. ☐ Credibility of the author is verified ☐ References are properly formatted ☐ Includes at least one source from an alternate viewpoint, written by an author that holds that viewpoint.	☐ Missing 2 of the details	☐ Missing 3 of the details	☐ Little evidence of thought and consideration towards the use, purpose, and ideas derived from each source.

BIO 4097 Grading Rubric for *Integration of Science & Faith* outline (25 points)

Grading aspect	Capstone 4	Milestones 3	Milestones 2	Benchmark 1
Thesis and direction of the paper 0 – 15 points	☐ Thesis is clear ☐ The outline reflects a clear organization of the paragraphs with supporting ideas, as well as reference to how each source will be used.	☐ Thesis is somewhat clear ☐ Overall organization of outline is somewhat clear	☐ Thesis is unclear ☐ No real indication of any thought towards organization of the ideas and supporting evidence within the paper.	☐ No outline
Ideas and organization of the individual supporting paragraphs 0 – 10 points	☐ Thoughtful and organized flow of ideas ☐ Sub-bullets for each main paragraph / supporting idea show evidence of deep thought about the paper ☐ Mention of multiple concepts from PLNU courses that have influenced position	☐ Evidence of overall structure, but student has not yet thought deeply about how to put the main ideas together ☐ Outline has main ideas, but has few sub-bullets ☐ Mention of 1-2 concepts from PLNU courses that have influenced position.	☐ Very little evidence of thought towards organization, main ideas, and structure for the paper. ☐ Outline is highly incomplete. ☐ No mention of how PLNU courses have influenced position.	☐ No outline

BIO 4097 Grading Rubric for *Integration of Science & Faith* Essay (100 points)

Grading aspect	Capstone 4	Milestone 3	Milestone 2	Benchmark 1
Integration of science and faith (evolution or creation care) **0 -20 points**	☐ Deep personal reflection is evident ☐ Question for this assignment was clearly answered ☐ Clear statement of position. ☐ 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)	Meets 3 of the criteria for a Capstone 4. Comments:	Meets 2 of the criteria for a Capstone 4. Comments:	Meets 1 or none of the criteria for Capstone 4 Comments:
Critical Thinking **0 – 20 points**	☐ Issue is stated clearly & position is well-supported with evidence & sources. ☐ Alternate position(s) is/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 position(s) demonstrate(s) grace and understanding	Meets 3 of the criteria for a Capstone 4. Comments:	Meets 2 of the criteria for a Capstone 4. Comments:	Meets 1 or none of the criteria for Capstone 4 Comments:
Incorporation of concepts discussed in PLNU classes **0 – 20 points**	☐ Specific concepts from specific PLNU classes, including science and/or religion classes, are included as part of reflection and defense of 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.	Meets 1 of the criteria for a Capstone 4. Comments:		Meets none of the criteria for a Capstone 4. Comments:
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 coll. sci. audience. ☐ Sufficient length to make a good, complete defense (1200 – 1600 words)	Meets 3 of the criteria for a Capstone 4. Comments:	Meets 2 of the criteria for a Capstone 4. Comments:	Meets 1 or none of the criteria for Capstone 4 Comments:
Information Literacy **0 – 20 points**	☐ Sources are current, authoritative, and relevant to the topic ☐ Communicates, organizes and synthesizes information from sources to achieve a specific purpose, with clarity and depth ☐ Use of in-text citations as well as the annotated bibliography ☐ Excellent choice of paraphrasing, summarizing, or quoting to enhance the essay and support the author's argument ☐ Distinguishes between common knowledge and ideas requiring attribution ☐ Source for the alternate view actually holds that viewpoint	Meets 3 of the criteria for a Capstone 4. Comments:	Meets 2 of the criteria for a Capstone 4. Comments:	Meets 1 or none of the criteria for Capstone 4 Comments:

Learning Outcome: PLO#4
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 typically collected every 5 years. Due to the complications of COVID, we have not yet collected these data again.) The success rate for alumni who apply to graduate or professional schools has been well over 90% for at least 20 years.

1) 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.
2) 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.