SAINT LOUIS UNIVERSITY

Program Assessment: *Annual Report*

Program(s): Neuroscience

Department: Interdisciplinary: Biology & Psychology

College/School: Arts & Sciences

Date: 7/1/2020

Primary Assessment Contact: Drs. Tony Buchanan and Judith Ogilvie

1. Which program student learning outcomes were assessed in this annual assessment cycle?

   Program Learning Outcome 1: *Students will be able to identify core concepts of neuroscience.*

2. What data/artifacts of student learning were collected for each assessed outcome? Were Madrid student artifacts included?

   Our assessment plan called for collecting information from three sources to assess Learning Outcome 1, two courses, *NEUR 3400: Introduction to Neuroscience I: Molecular, Cellular, & Systemic* and *NEUR 3500: Introduction to Neuroscience II: Behavioral & Cognitive*, and indirect self-assessment on a senior survey.

   Instructors of NEUR 3400: *Introduction to Neuroscience I: Molecular, Cellular, & Systemic* and NEUR 3500: *Neuroscience II: Behavioral & Cognitive* included specific exam and quiz questions addressing core concepts of neuroscience. Core concepts came from the *Society for Neuroscience*, the preeminent organization of neuroscience research and education (see http://www.brainfacts.org/about-neuroscience/core-concepts/). Student responses on these questions were assessed to determine level of mastery of these concepts.

   For the Senior survey, students were asked a series of self-assessment questions about how much they gained in their knowledge of neuroscience core concepts.

   Madrid courses are not applicable to this assessment report.

3. How did you analyze the assessment data? What was the process? Who was involved?
   NOTE: If you used rubrics as part of your analysis, please include them in an appendix.

   Instructors of NEUR 3400 and NEUR 3500 aligned multiple choice exam and quiz questions with core concepts. For NEUR 3400 in 2019 and 2020, Dr. Fenglian Xu collected and analyzed the data. For NEUR 3500 in 2016-2017, Drs. Jill Waring and Tony Buchanan collected and analyzed the data; Dr. Waring continued to collect and analyze data in 2018 and 2019.

   A link to a Senior Survey was sent to all graduating students. Reminders were sent to students who did not comply. Twenty-two of the 53 graduating students completed the survey. Drs. Buchanan and Ogilvie were involved in writing the survey questions, collecting the data, and analysis.

4. What did you learn from the data? Summarize the major findings of your analysis for each assessed outcome.
   NOTE: If necessary, include any tables, charts, or graphs in an appendix.

For NEUR 3400: *Introduction to Neuroscience I: Molecular, Cellular, & Systemic*, 14 core concepts were selected by Dr. Xu. This class is taken primarily by sophomores and included 71 students in Spring 2019 and 75 students in Spring 2020. Results from this assessment demonstrate that the questions were answered correctly by 89.42% of the students in 2019 and 91.44% in 2020.

For NEUR 3500: *Neuroscience II: Behavioral & Cognitive,* data was collected from 53 students, primarily to sophomores, in 2016-17; and from 18 and 53 students, primarily juniors, in Fall 2018 and 2019 respectively. Results from this assessment demonstrate that the questions were answered correctly by 83.5% of the students in 2016-17; 84.7% in 2018 and 93.9% in 2019.

We consider these results to be well above the 'proficient' level of competency (defined as 75% correct performance). See attached table for questions, core concepts, and student performance summary.

Self-assessment questions from the senior survey asked how much students gained in knowledge about the core concepts of neuroscience.

Core concepts: 100% of graduating Neuroscience majors reported some gain in their ability to identify the core concepts of neuroscience. Specifically, 23% reported a *large gain* and 77% reported a *very large gain* in their ability to identify the core concepts of neuroscience and 0% reporting a *moderate, small, or no gain* in this ability.

The largest percentage of students (22%) indicated that Introduction to Neuroscience: Cellular, Molecular, & Systemic (NEUR 3400) was beneficial in regard to their ability to identify the core concepts of neuroscience and 21% indicated that Introduction to Neuroscience: Behavioral & Cognitive (NEUR 3500) was beneficial in this regard. Other courses that students reported as beneficial were Neuroscience Laboratory (NEUR 3550), Brain, Mind, & Society (PSY 3100), Cell Structure & Function (BIOL 3040), and Foundations of Research Methods & Statistics (PSY 2050).

We consider these results to be well above the 'proficient' level of competency (defined as 75% reporting gains in abilities).

5. How did your analysis inform meaningful change? How did you *use the analyzed data to make or implement recommendations for change* in pedagogy, curriculum design, or your assessment plan?

Assessment data will be shared with all Neuroscience faculty at our next faculty meeting. Overall, both indirect (self-reported) and the direct data indicate that we are successfully achieving Learning Outcome 1 at critical points in the curriculum.

Learning outcome 1 was last assessed in 2017. The primary concern from that year's assessment was in the variability of performance among different students across core concepts in NEUR 3500: performance varied from a low of 58.5% correct responses to a high of 98.1% correct responses. To address the variability of this particular Learning Outcome (*Students will be able to identify the core concepts of neuroscience*), the instructors of each of our Introduction courses worked together before the beginning of the course to review the core concepts that should be emphasized and to ensure consistent and appropriate pedagogy for each of these concepts. The success of this approach can be seen in the 2019 results for NEUR 3500: performance ranged from 83% to 100%, with all concepts above the 'proficient' level of competency.

Due to the fire in Macelwane Hall, this was the first year for assessment of core concepts in NEUR 3400. In both Spring 2019 and 2020, performance was above the proficient level of 75% for all questions.

Finally, we have been relying on the Society for Neuroscience list of Core Concepts but have been concerned that these are not appropriately targeted at our students, since they include K-12. Two of us (Judy Ogilvie and Fenglian Xu) participated in a virtual workshop this summer of to develop Neuroscience Core Concepts for undergraduate and graduate neuroscience students. We expect

this set of more appropriate core concepts to be fully developed within the next year and available for future assessment.

6. Did you follow up ("close the loop") on past assessment work? If so, what did you learn? *(For example, has that curriculum change you made two years ago manifested in improved student learning today, as evidenced in your recent assessment data and analysis?)*

Last year, our assessment focused on Program Learning Outcome 3: *Students will be able to communicate neuroscientific information in a clear, reasoned manner, both verbally and in writing.* As a result of our assessment last year, we have modified our Assessment Plan to streamline the assessment of LO3.

Previously, the data for LO3 was collected from a range of courses, taught by different faculty members using different rubrics, yet the results were notably consistent. Thus, we determined that fewer courses could suffice for future assessment. Data from the capstone experience was the least reliable since any students that did not have a neuroscience faculty member as a mentor on their project were not included. In addition, some presentations or written work were done individually where others were done in a group. Thus, data from the capstone experience has now been removed from the assessment plan. Data from PSY 3100 was also deleted since this course includes a significant mix of psychology and neuroscience majors making it very time consuming to extract meaningful data. Finally, we were unable to obtain data from PHIL 4280 since the instructor is not directly affiliated with the Neuroscience Program, so this course has also been deleted from our Assessment Plan.

We have added NEUR 4900: Neuroscience Seminar, which is required for all neuroscience majors and is limited to only neuroscience majors. We determined that data from this course and NEUR 3550: Neuroscience Laboratory would be most reliable and consistent and have modified the Assessment Plan accordingly.

Last year, student outcomes for LO3 far exceeded the proficient level. We have shared this information with all instructors and encouraged them to reinforce efforts that are currently successful.

IMPORTANT: Please submit any revised/updated assessment plans to the University Assessment Coordinator along with this report.

Core Concepts were selected from the Society for Neuroscience list of	
SfN Core Concepts assessed in NEUR 3400	
Question	SfN Core Concept
	1. The brain is the body's most complex organ.
Q1: Determine how the different signals (excitatory/inhibitory) that affect Neuron#1 can change the release of the transmitter dopanine from Neuron	1B: Each neuron communicates with many other neurons to form circuits and share information.
Q2: Sensory information on its way from you hand to the cerebral cortex would involve neurons in these regions in a order of (Quiz 2, Q#16)	1C: Proper nervous system function involves coordinated action of neurons in many brain regions.
	2. Neurons communicate using both electrical and chemical signals.
Q3: The process of how a stimulus produces a change in the membrane potential of a sensory cell is called (quiz 2, Q#15)	2A: Sensory stimuli are converted to electrical signals.
Q4: Action potentials propagate *unidirectionally* down the axon due to: (quiz 1, Q#18)	2B: Action potentials are electrical signals carried along neurons
Q5: Which of the following statements about electrical and chdcial synapses is FALSE? (Mid-term; Q#5)	2C: Synapses are chemical or electrical junctions that allow electrical signals to pass from neurons to other cells.
Q6: This is the CORRECT statement of the somatic motor pathway and the transmitter/receptor for neuromuscular junction (Final, Q#31)	2D: Electrical signals in muscles cause contraction and movement.
Q7: If a CA1 neuron is highly depolarized, active synapses within its dendritic abor are likely to undergo (Assignment 2, Q#53)	2E: Changes in the amount of activity at a synapse can enhance or reduce its function.
Q8: After receiving drugs that block the synthesis of new proteins shortly after training, rats in a learning paradigm exhibit the following (Assingment 2, #56)	2F: Communication between neurons is strengthened or weakened by an individual's activities, such as exercise, stress, and drug use.
	3. Genetically determined circuits are the foundation of the nervous system.
Q9: This pathway conveys nerve impulses that originate in the cerebral cortex and are destined to cause precise, voluntary movements of skeletal muscles. (Final, Q#18)	3B: Sensory circuits (sight, touch, hearing, smell, taste) bring information to the nervous system, whereas motor circuits send information to muscles and glands.
Q10: Question about reflex arc and strech reflex (Final)	3C: The simplest circuit is a reflex, in which sensory stimulus directly triggers an immediate motor response.
Q11: If your finger was poked by accident, which is the correct sequence of body response, (1) sensory neuron relays impulse through ....(2)... till (5) (Final, Q#25)	3D: Complex responses occur when the brain integrates information from many brain circuits to generate a response.
	4. Life experiences change the nervous system.
Q12: What are the possile events or mechansims that are invovled in the synaptic potentiation (learning and memory) (Final, #39)	4D: Continuously challenging the brain with physical and mental activity helps maintain its structure and function - "use it or lose it."
	8. Fundamental discoveries promote healthy living and treatment of disease.
Q13: The development of optogenetics marks an advancement for electrophysiology because: (quiz 1, Q#9)	8A: Experiments on animals play a central role in providing insights about the human brain and in helping to make healthy lifestyle choices, prevent disease, and find cures for disorders.
Q14: How is the patch-clamp method used to understand ion channels on neurons ? (quiz 1, #14)	8E. Neuroscience research has formed the basis for significant progress in treating a large number of disorders.
SfN Core Concepts assessed in NEUR 3500	
Question	

What does functional magnetic resonance imaging (fMRI) directly measure?	7A: The nervous system can be studied at many levels, from complex behaviors such as speech or learning, to the interactions among individual molecules.
If damage to region X is found to reliably disrupt performance on tasks involving function F, what could we conclude?	7A: The nervous system can be studied at many levels, from complex behaviors such as speech or learning, to the interactions among individual molecules.
What does the McGurk illusion demonstrate about speech perception?	6B: Communication can create and solve many of the most pressing problems humankind faces.
Memory impairments associated with retrograde amnesia following traumatic brain injury are:	5C: The brain learns from experiences and makes predictions about best actions in response to present and future challenges.
The N400 ERP component is responsive to what kind of cognitive process?	6A: Languages are acquired early in development and facilitate information exchange and creative thought.
The broad ability to implement appropriate behavioral strategies in response to internal and external cues over short and long time frames is known as:	5C: The brain learns from experiences and makes predictions about best actions in response to present and future challenges.
Core affect is represented by which brain regions?	5B: Emotions are based on value judgments made by our brains and are manifested by feelings as basic as love and anger and as complex as empathy and hate.
In which part of the brain does myelination not reach completion until late adolescence?	4G: Some neurons continue to be generated throughout life and their production is regulated by hormones and experience.

LEARNING OUTCOME ASSESMENT DATA from NEUR 3400																
Section	N	Q1_1B	Q2_1C	Q3_2A	Q4_2B	Q5_2C	Q6_2D	Q7_2E	Q8_2F	Q9_3B	Q10_3C	Q11_3D	Q12_4D	Q13_8A	Q14_8E	
2019 Xu																Total
Total misses	71	10	11	0	4	10	0	6	9	5	9	11	16	8	5	
% correct		85.9	84.51	100	94.36	85.92	100	90.14	87.3	93	87.3	84.51	77.46	88.7	92.8	89.42
2020 Xu																
Total misses	75	9	8	0	6	9	0	4	12	6	7	7	12	6	5	
% correct		88	89.33	100	92	88.52	100	94.7	84	92	90.56	90.56	85.12	92	93.3	91.44
Note:																
Data are based on Assignment #1 and #2, Quiz #1 and #2, Mid-term, and Final exams in 2019 and 2020.																
All are multiple choice questions except Assignment #1 which are critical questions.																
Data did not include information from other course assessements such as Assignment #3 (Clinical case studies) and Homework #1 and #2.																
LEARNING OUTCOME ASSESMENT DATA from NEUR 3500																
Section	N	Q1 fmri	Q2 lesion	Q3 mcgur	Q4 amnes	Q5 N400	Q6 exec f	Q7 affect	Q8 myelir	Totals						
2016-2017																
Buchanan	21	2	4	0	11	1	2	8	1							
Waring	32	12	3	4	6	2	0	14	0							
Total misses	53	14	7	4	17	3	2	22	1							
% correct		73.6	86.8	92.5	67.9	94.3	96.2	58.5	98.1	83.5						
		#1	#11	#30	#29	#28	#4	#7	#6							
2018 Waring																
Total misses	18	9	0	4	4	1	3	1	0							
% correct		50.0	100.0	77.8	77.8	94.4	83.3	94.4	100.0	84.7						
		#1	#34	#30	#29	#28	#4	#7	#6							
2019 Waring																
Total misses	53	7	4	1	1	9	4	0	0							
% correct		86.8	92.5	98.1	98.1	83.0	92.5	100.0	100.0	93.9						