ARTICLE
Student Evaluation of a Learning Community Model Adapted to Student and Curriculum Needs.

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The Neuroscience Learning Community (LC) that Stonehill introduced to its curriculum grew out of the Great Recession of 2008 and the need for our students to gain hands-on, high-impact learning experiences, despite limited resources. This learning model was first reported in 2013, and since then it has undergone changes that were necessary due to the number of credits and amount of time required for that model. Curriculum changes are common, and Stonehill College changed its credit requirements for LCs to meet students' needs. As a result, the new Neuroscience LC model that we describe here reduced credit hours while leveraging new faculty expertise, collaborations, and new community partnerships. This paper reports student evaluations of an LC model adapted to demand fewer credits and less time, but to retain the community-based learning aspect and to increase faculty collaboration, while maintaining a high standard of learning fundamental neuroscience topics. Evaluations suggest that students valued the updated Neuroscience LC because it helped them understand neuroscience concepts and the impact of neuroscience in our world.

Key words: learning community (LC); experiential learning; undergraduate neuroscience; educational neuroscience

INTRODUCTION

We have reported previously on the Neuroscience Learning Community (LC) offered at Stonehill College (Yu et al., 2013). In that paper, we showed that this 9-credit multi-course model that included a required 3-credit community-based learning course provided students with an immersive and hands-on learning experience early in their college careers. This led to greater understanding of how neuroscience impacts individuals and society, as well as providing students with a valuable opportunity to reflect on their major choice and career path.

Briefly, Stonehill College is a regional college that offers degrees in the liberal arts, health sciences, business, and the natural sciences. Our proximity to Boston allows unique collaborative opportunities with healthcare and biotechnology institutions (Yu et al., 2013 and McCoy et al., 2018). Until 2020, all students at Stonehill were required to complete a LC experience, typically in their second year. Many LCs also involve some type of travel or off-campus work. Although students were not required to complete a learning community within the topic of their major, many students choose to do so, especially science majors who have rigorous schedules that involve laboratory work. To support our neuroscience students in this endeavor, and to provide neuroscience students with an early immersive experience, we developed the Neuroscience LC.

All Stonehill LCs began with the requirement of taking two 3-credit courses and a separate course that combined aspects of the two in some way (another 3 credits). Therefore, students were required to take 9 credits for their LC. The original Neuroscience LC model fit this 9-credit paradigm and included PSY 415 (Brain and Behavior, a 3-credit core introductory neuroscience course taken by second year neuroscience majors but listed as an upper-level psychology elective; see discussion), NEU 200 (Seminar in Neuroscience - The Neurological Basis of Behavior – 3 credits), and LC 282 (Neuroscience: Mind, Body, Community – 3 credits). Many, but not all Stonehill LCs involved community-based learning; however, the neuroscience LC was strengthened by hands-on community-based learning incorporated into the LC 351 course (Yu et al., 2013).

Over time, the 9-credit LC model proved to be cumbersome for many students and sometimes impacted their ability to graduate. This was true for all students, not just neuroscience students. The original 9-credit Neuroscience LC not only required 9 credits, but also required students to be available most Saturdays for the entire semester to work at the HOPe House from 8:30AM-5PM. This requirement became a barrier for student-athletes and students with other weekend obligations. Consequently, Stonehill adjusted the LC credit requirement to allow fewer credits and more flexibility for all students. As of 2019, LCs ranged from three to nine credits.

In addition to the Saturday time commitment, the original LC relied on a combination of uncompensated Stonehill neuroscience faculty and paid neurologists hired as adjunct instructors for the NEU 200 course, each of whom would teach to their various expertise (e.g., neurology and autism, neurophysiology, sleep) (Yu et al., 2013). Therefore, the Neuroscience LC was modified to address these issues and include fewer credits (7 credits total) while retaining a community-based learning component and expanding community partnerships. The redesigned LC focused on educational neuroscience, and consisted of a core course, Brain and Behavior, (3 credits, as in Yu et al., 2013), and an

integrative seminar (NEU 200, 3 credits) with updated and purposely coordinated topics reflecting faculty expertise. Off campus experiences were in collaboration with the adjacent Yawkey House of Possibilities (HOPe House is a facility on the Stonehill campus that provides care for children with neurodevelopmental illness, see Yu et al., 2013); and with a local middle and elementary school in the towns of Norton and Easton, MA (LC 351 Mind, Health, and Education; 1 credit).

While the original design of the LC model was advantageous because it maximized community-based learning, we find that students still place value in their time spent at both the HOPe House and leading the STEAM activities in the newly designed LC model. This indicates that community-based, experiential learning, even when adjusted for time limitations, can still add value to the student learning experience. We argue that adding a 1-credit community-based learning course (or equivalent) may be worth doing, especially if connected to another course. This updated model can be implemented at small institutions with limited resources, like Stonehill College, but can also be accomplished at large institutions with more faculty members.

METHODS

Between 2016 and 2019, students enrolled in the redesigned Neuroscience LC in the fall semester. Enrollment required students to register for PSY 415 (Brain and Behavior, a core introductory neuroscience course), NEU 200 (Seminar in Neuroscience), and LC 351 (Mind, Health, and Education). This trio of courses totaled seven credits. Brain and Behavior covered foundational neuroscience topics. (For PSY 415 syllabus see Supplementary Material 1.) This 3-credit course is required of all neuroscience majors, and typical enrollment was 20 students.

Course Catalog Entry for PSY 415:
Prerequisites: PSY 101 – Introduction to Psychology
Structure and function of nerve cells and the nervous system. Research methods in biopsychology, effects of brain damage, physiological principles underlying sleep, eating, abnormal behavior, drug effects, and memory.

NEU 200 covered specialized neuroscience topics in detail, such as mechanisms and circuits underlying repetitive behaviors and Developmental Neurobiology of Autism Spectrum Disorder. All topics centered on conditions that affect children. (For NEU 200 syllabus see Supplementary Material 2.) This 3-credit course is not required of neuroscience majors, and typical enrollment was 11 students.

Course Catalog Entry for NEU 200:
Prerequisites: BIO 101 - Biological Principles I
This course will focus on historical and current topics in Neuroscience. Examples of topics that may be discussed include: developmental disorders, such as those on the autistic spectrum, neuroimaging and the information that can be gleaned from various techniques, sex differences, neurophysiology, epigenetics, and learning and memory. The focus of the course may vary from year to year. Readings may be from several sources including the primary literature.

The 1-credit experiential component, LC 351, included off-campus experiences with the campus-adjacent HOPe House and local public schools. (For LC 351 syllabus see Supplementary Material 3.)

Course Catalog Entry for LC 351:
This LC will explore the psychology and neuroscience underlying conditions such as Autism spectrum disorders, ADHD, eating disorders, obesity and Type II Diabetes. Students will participate in community-based learning at local elementary/middle schools as well as the Yawkey House of Possibilities, a facility on the Stonehill campus that provides care for children with neurodevelopmental illness.

Updates to the Neuroscience LC from 2013 to 2017.
As Stonehill was adjusting to student LC issues and reducing their LC credit requirements, the Neuroscience LC was also changing to increase flexibility. Neuroscience faculty felt that retaining the community-based learning component was important. The updated Neuroscience LC began in 2016, still comprised of the same three components (PSY 415, NEU 200, and LC 351), but the 3-credit LC course was changed to a 1-credit LC course (rather than eliminating it). Students in the LC continued to work with the HOPe House for the experiential component. Specifically, Stonehill students helped with their Adventure Club weekend programming. Stonehill students were required to arrive early on two Saturdays and receive instruction from HOPe House professionals. Students would then be paired with one or two children and accompany the children on excursions to the zoo, hayrides, and to the arcade, for example. In addition to working at the HOPe House, Stonehill students also designed and implemented “Neuroscience for Kids” STEAM activities for local public-school children as a part of the experiential component. This provided a creative way for students to strengthen their neuroscience knowledge and introduce neuroscience to younger students. Stonehill students designed their own activities which depended on age group and included coloring the lobes of the brain, making different types of neurons out of pipe cleaners or Play Doh followed by arranging them in a circuit, and sensory lab activities (see activities in Supplementary Material 4). A great source for brain games and activities is the “Neuroscience for Kids” website by Eric H. Chudler, Ph.D., which covers many age groups and levels (Chudler, 2022; https://faculty.washington.edu/chudler/whowe.html). At the conclusion of the semester, LC students would write a reflection piece for their HOPe House and STEAM experiences.

Another challenge to the original Neuroscience LC was the ability to schedule the neuroscience seminar around the availability of the two neurologists hired to teach the course. To supplement the neurologists’ availability, other Stonehill Neuroscience faculty volunteered to co-teach the seminar. Our redesigned LC became more efficient because a new faculty member was hired to teach the entirety of the

seminar course. Before the redesign, topics covered in the seminar course were varied and depended on who was teaching. However, the updated seminar was designed to coordinate with work involved at the HOPe House and STEAM activities. To that end, all topics centered around concepts and conditions that affect children such as ASD and ADHD (see NEU 200 syllabus in Supplementary Material 2). Mechanisms underlying these conditions were discussed to reinforce concepts that students were learning in PSY 415 (Brain and Behavior) and to give students some background into mechanisms that underlie the spectrum of neurodiversity, which helped provide an inclusive perspective for the students who worked closely with the children at the HOPe House. The students would also read and discuss a neuroscience paper which described something relevant to children. For example, one of these papers was titled, "Neural evidence for enhanced attention to mistakes among school-aged children with a growth mindset" (Schroder et al., 2017).

Student Evaluation Data

Student evaluations were obtained for all redesigned LC and seminar courses. Although the current paper focuses on the student evaluations for the redesigned LC, we were able to obtain some of the evaluations from the previous LC. Specifically, electronic LC course and seminar course evaluations were obtained for 2014 and 2015. Evaluations were done on paper prior to 2014. Some of these paper evaluations were retrieved from storage, but others were not found. Data are reported on all available evaluations. Responses for evaluations for all redesigned LC courses were above 90% and responses for evaluations for previous LC courses were between 50% and 83.3% (see Tables 1 and 2 for details).

Redesigned LC Survey

In addition to course evaluation data, a retrospective Qualtrics survey was conducted of students who completed the redesigned LC. This anonymous survey was reviewed and approved by the Stonehill College Institutional Review Board (IRB 2018-19-15). The survey was sent to all students who took the LC from 2016-2019. We had a total of 19 students complete the survey. Due to the retrospective nature of the survey, the survey was available for two years: from January 2019 to January 2021. (A copy of the survey can be found in Supplementary Materials 5.)

Of the 19 students who completed our survey, most respondents took the LC in years 2017 and 2018 (15 students). It is possible that most students who took the LC in Fall 2019 did not take the survey in the Spring of 2020 due to the onset of the COVID-19 pandemic. We had three respondents from Fall 2019. We sent the survey to students who took the LC in Fall 2016 and received one response. We did not include the single 2016 data point in this study, thus we report results from 18 respondents which represents 50% of the students enrolled in the LC between 2017 and 2019.

Furthermore, to quantitatively assess the students' value of the LC we coded open response Qualtrics survey questions asking about integration or disintegration. Eighteen students provided open responses to these questions. We did not, however, include the single respondent from 2016 in this analysis, so we report on the coded seventeen responses here. We coded these open responses according to the following criteria: 1 = positive sentiment suggesting integration/strength; 0 = negative sentiment suggesting disintegration/weakness.

RESULTS

LC and Choice of Major

Stonehill is a small college that aims for small class sizes and our LC reflects that. The average enrollment, mean number of students registered for the LC, across all years was 12.8 students (Original LC (2010-2015): mean = 14, redesigned LC (2016-2019): mean = 11). Throughout all years of the LC 65.4% of students who enrolled were neuroscience majors at the time of registration in the LC (Original LC: 63.5%; redesigned LC: 68.9%). There was very little movement among major choices. For example, over the entire history of the course only 13.1% of students switched out of the major and only 1.5% switched into the major. Of the students who were neuroscience majors when they enrolled in the original LC, 72.2% remained and graduated in the major. Of the students who were neuroscience majors when they enrolled in the redesigned LC, 90.3% remained and graduated in the major, reflecting greater stability of major choice among students (see discussion).

Student Course Evaluation Results

The Neuroscience LC was altered as described above. To understand student evaluations of the original and redesigned experiential learning LC course and seminar course, we examined questions on available evaluations that were consistent over time. These are typical 5-point Likert scale questions. One concern with the redesigned LC was that there was less time spent at the HOPe House, which may impact student evaluations. However, results

LC351 Question	2011 83.3%	2012 71.4%	2014 66.7%	2015 50%	AVE	2016 100%	2017 100%	2018 100%	2019 100%
Integrating ideas in the LC led to new insights or understanding.	4.64	3.70	4.40	4.83	4.39	4.63	4.75	4.91	4.44
This LC required that I work collaboratively and with classmates to solve a problem, examine complex issues, or complete projects.	4.45	3.60	4.70	3.83	4.15	4.75	4.69	4.36	4.44
Overall I rate this course as...			3.80	4.67	4.24	4.88	4.69	4.91	4.78
The overall quality and effectiveness of teaching (classroom instruction) in this course was excellent.	4.27	3.00			3.56				

Table 1. Student evaluations of the learning community (LC), specifically the community-based learning part of the LC in its original 3-credit format (lighter gray) and its redesigned 1-credit format (darker gray). Percentage of students enrolled in the course who responded to evaluations is listed below each year.

Seminar Question	2011 83.3%	2014 66.7%	2015 66.7%	AVE	2016 100%	2017 100%	2018 90.9%	2019 100%	AVE
This course required me to think at a deep level or use critical thinking.	4.10	4.50	4.63	4.41	4.63	4.44	4.60	4.56	4.56
This course enabled me to improve skills examining questions that matter beyond the classroom.		4.60	4.63	4.62	4.75	4.60	4.60	4.67	4.66
Overall I rate this course as...		4.30	3.50	3.90	4.88	4.63	4.70	5.00	4.80
The overall quality and effectiveness of teaching (classroom instruction) in this course was excellent.	4.40			4.40					

Table 2. Student evaluations of the learning community (LC), specifically the seminar part of the LC in its original format (lighter gray) and its redesigned format (darker gray). Percentage of students enrolled in the course who responded to evaluations is listed below each year.

show that student evaluations are similar, if not better, for the redesigned LC (see Table 1 for details). In fact, the score for the overall rating of the experiential learning LC course averaged 4.24 for the original LC and 4.82 for the redesigned LC (departmental mean was 3.95). In earlier years this question was worded differently "The overall quality and effectiveness of teaching (classroom instruction) in this course was excellent." Rather than simply the Overall rating of the course, and the average score for this in the early years of the original LC was 3.56. One of the goals of the redesigned LC was to better integrate the courses involved. Student evaluations suggest that this was successful as the average response to the question "Integrating ideas in the LC led to new insights or understanding" was 4.39 for the original LC and 4.68 for the redesigned LC. The student evaluations of the new seminar course were not lower than the original seminar but were similar or better. Overall student evaluations for the new seminar also exceeded the departmental mean of 4.29.

For example, the score for the overall rating of the redesigned seminar each year taught was higher than the overall course ratings from each year of the original seminar for which evaluations were available.

Students were also asked about how they perceived the components of the LC to be integrated or not integrated. Examples of open responses indicating the LC was well-integrated include the following:

"All the material coincided with each other, and I was able to apply that knowledge through all the classes the LC incorporated. Loved this LC."

"Learning in class plus volunteering at the HOPe House helped give an outlook on the topics that you sometimes cannot get just by learning in a textbook."

"We learned one thing in one class which helped us with the other."

"One strength that demonstrated the integration is that the material was cohesive and built upon each other."

"One strength was being able to learn about something in class and then apply the learning at the HOPe House."

"They fully integrated together to the point where you could treat the two courses as one course and the volunteering as field work."

"Material was all connected and concepts from one course would build on ideas in another without being repetitive."

"The information in all of the classes supported the other classes, without overlapping or becoming redundant."

Examples of comments indicating the LC was not well integrated were the following:

"One weakness would be when we revisited some of the material a few times in all the classes."

"One weakness was that sometimes we would learn something in one class and then the next week we were taught the same thing again in the other class."

"Some things were taught slightly differently in each class."

"Exams were scheduled with conflicts once."

"Assuming that we learned things in one class as opposed to the other."

Survey Responses to Redesigned LC.

To solicit more feedback, we surveyed students who were enrolled in the redesigned Neuroscience LC. At Stonehill College students have many choices of what LC to take, especially since the credit requirement was changed to

Figure 1. Respondents asked if they would recommend this LC to other students. Blue: Definitely yes (13, 68%); Grey: Might or might not (3, 16%); Orange: Probably yes (2, 11%).

Figure 2. Respondents' opinion if second year is ideal for taking the Neuroscience LC. Blue: Definitely yes (7, 39%); Orange: Probably yes (3, 17%); Grey: Might or might not (4, 22%); Yellow: Probably not (4, 22%).

include LCs with as few as 3 credits. Given that students have many choices, we wanted to ask if they would recommend the Neuroscience LC to other students. Our responses overwhelmingly indicated "yes" (Figure 1). No survey respondents chose "Probably not" or "Definitely not".

The survey questions we asked about integration versus disintegration were coded as either strengths or weaknesses, respectively. In this analysis, we found that all seventeen respondents had something positive to say about their experience (data not shown), indicating that students attribute strong value to their LC experience.

In addition to asking about integration or disintegration, we also wanted to know which specific assignments or assessments students felt helped them synthesize information or ideas from the different courses or perspectives within the LC. The following are some of the responses we received:

"Teaching neuroscience to middle schoolers."

"When we went to the HOPe House, I was really able to utilize all the information we had been learning."

"Volunteering at the HOPe House gave me real life perspective and understanding of disorders we discussed in class."

"Volunteering at the HOPe House and reflecting on it."

"Volunteering at the HOPe House was a fantastic way to summarize all of the information I was learning because it allowed me to have hands-on experience."

We also asked if this LC allowed students to reflect on the importance of neuroscience as it relates to the world around them, and if so how. Every respondent said yes and had something positive to say for this question. Examples of responses included the following:

"Yes, I would say it caused me to reflect on my personal experience with the children of the HOPe House."

"Yes, for sure. It allowed me to have an actual understanding and application for the material."

"Yes! Interacting with real people with developmental disorders made me reflect and consider more carefully the concepts I read in the book or learned about in class."

"Yes, it reaffirmed how interesting neuro is and how relevant it is."

"Yes, it definitely made me think of the social aspects on what people think of in regard to neurodevelopmental disorders."

"Absolutely. I began seeing neuroscience in everything, and it ignited my passion for neuropsychology."

"Yes, I learned more about disorders and have a greater understanding of why people are the way they are."

Finally, we asked if the second year is the best year for students to take this LC. Of the 18 respondents, most said, "Definitely yes," when asked if the second year is the ideal year to take the LC. The remaining responses were split evenly between, "Probably yes," "Might or might not," and "Probably not" (Figure 2). No respondents chose, "Definitely not".

We wanted to know more about students' opinions of taking this LC in their second year, so we asked this question in an open response format. Examples citing that the second year is *not* ideal for taking this LC, indicated the workload and the difficulty of balancing this course with other science courses:

"Brain & Behavior is a very hard, upper level class"

"Taking organic chemistry II, cell biology AND brain and Behavior is way too much. I took it in my junior year and it was the best decision I ever made. Taking Brain and behavior with anatomy I and the seminar was a great decision and a lot of the material helped me in my other courses."

"It's dense material, it really depends on the other classes a person takes as well"

"It felt like an upper class requirement with the 400 level course"

Examples citing that the second year *is* ideal for taking this LC include the following:

"It should be taken sophomore year because the classes provide usually the first opportunity to have

exposure to neuroscience material, which allows growth in the field at an earlier time."

"I think that it should especially for neuroscience majors because it will tell you if this is really what you want to study."

"It provided a great amount of foundational information that I relied on in my upper level [sic] courses and helped me feel confident in deciding my career path."

"It offers a quick first-hand experience for students who are new to science."

STEAM Activities

Due to student privacy concerns, we were not permitted to survey public school students, nor take photos of them engaging in the various STEAM activities designed for them. Although photos were taken by the school adhering to each school's privacy policy and used in take-home fliers. Here we offer an assessment from the lead, highly experienced middle school teacher whose class participated in the STEAM activities each year of the redesigned LC.

"Hands-on activities are an essential component to learning science in middle school. My 6th grade students were fortunate enough to be paired with Dr. Cyr's college students to learn about neuroscience. My students were eager to learn the inner workings of the brain and the effect on human activity. Both college and middle school students were engaged in activities about brain structure and function using diagrams and 3D models. During one class, neurons were made from pipe cleaners and Play-Doh. This was a definite favorite activity for my students and allowed them to take ownership of their learning. A coloring packet of the lobes of the brain led to a wonderful question and answer session. The Ratio of 2:1 (students to mentors) allowed my students to freely ask questions increasing their understanding of the topic. It was a wonderful experience for students of all ages."

DISCUSSION

The Redesigned Neuroscience LC Still Achieves Curricular Goals

Our program's mission is to "prepare students to actively engage in and contribute to the process, understanding and application of neuroscience..." And our learning outcomes strive for students to be able to "demonstrate foundational knowledge in neuroscience, demonstrate technical training in neuroscience at the molecular, cellular, systems and behavioral/cognitive levels, understand and practice the ethical principles that guide the professional behavior of neuroscientists and related careers, and to develop competency in written and oral communication skills. Our LC was designed to teach the fundamentals of neuroscience in an interdisciplinary manner while providing experiential learning opportunities. Even though we needed to cut credit requirements and adjust the course, we did so in a way that kept all components.

In NEU 200, students learned about the cellular and molecular mechanisms underlying the behavior and cognitive neuroscience they were learning in PSY 415. For example, one student wrote "All the material coincided with each other, and I was able to apply that knowledge through all the classes the LC incorporated…." Students learned ethical practices in neuroscience through their training and in working with the professionals at the HOPe House. In addition, LC students were able to actively engage with the community and apply their knowledge when working with the children at the HOPe House and when running the STEAM events. Most students commented that these experiences strengthened their learning. Furthermore, in NEU 200, students were taught how to read scientific literature and were asked to present a paper to the class and write a synopsis of the paper, which provided practice in written and oral communication. Altogether, the LC fulfills many of the curricular goals stated in our mission and in our program's learning outcomes.

O'Keefe and colleagues conducted a survey of undergraduate neuroscience students in which they were asked about the traditional lecture-format of their courses, given that a large amount of web-based learning is available today. Surprisingly, students responded overwhelmingly that traditional lectures were beneficial to their learning, but that other factors such as engagement, time, and a varied format were also important (O'Keefe et al., 2017). We feel that our LC model aligns with these findings because LC students are offered a variety of learning formats: formal lecture (e.g., PSY 415), discussion-based integrative seminar (NEU 200) and informal community-based learning opportunities (e.g., LC 351). We believe the trio of courses keep students motivated and engaged.

Students Still Find that the Redesigned Neuroscience LC is a Valuable Learning Experience

Student evaluations of the activities involved in the LC as well as the evaluations of the course itself provide evidence that this was an important course. For example, on all reflection pieces students wrote that they enjoyed their experiences at the HOPe House and STEAM events. Although they suggested changes, they all expressed that they learned from the activities. One of the most popular suggestions was more time in the classroom for STEAM events. Activities often took longer than expected and felt rushed at the end.

In student evaluations across all years of the redesigned LC 351 component from 2016-2019, the response to the question "Integrating ideas in the LC led to new insights or understanding" all students either agreed or strongly agreed. The average score was higher than the average from the previous neuroscience LC as well as the departmental average. Similarly, 100% of respondents rated the redesigned NEU 200 seminar as excellent or good and the mean score was higher than the previous neuroscience LC mean, and the department mean. These responses strongly suggest that the students valued the experience and the updated LC.

Teaching others and community outreach can be a high-impact learning experience for all. Other studies have

shown that outreach experiences for undergraduate neuroscience students are an important aspect of neuroscience mastery. For example, Kouh (2020) ran a capstone course for neuroscience students in which the final project involved presenting neuroscience research to a high school audience. In this study, students found it beneficial to their learning because the course required them to simplify difficult concepts in way that was accessible to a wider audience. In support of this, when students are allowed to "become the teacher" they report greater perceived learning and greater satisfaction with their learning experience (see Kurczek and Johnson, 2014).

Despite the Reduction in The Experiential Component, the Neuroscience LC Still Provides an Important Hands-On Experience for Students Early in Their College Careers

PSY 415 (Brain and Behavior) serves as the introductory course for neuroscience majors, thus it introduces students to basic neuroscience concepts not previously learned. Designing NEU 200 to reinforce those concepts and apply them to real-life situations enhanced student learning. Having LC students brainstorm ideas and design activities to teach younger students basic neuroscience concepts further reinforced learning and provided both a creative outlet for our neuroscience students and a fun introduction to neuroscience for younger students who may not have the opportunity to learn about neuroscience in school. Furthermore, working at the HOPe House provided a unique experience to learn about neurodiversity in real life and learn from the children at the HOPe House. As evidenced from student comments, LC students enjoyed working with the children at the HOPe House and connecting the relevance of the neuroscience that they were studying in their courses. For example, they were able to see how the children at the HOPe House used different forms of augmentative and alternative communication to convey their ideas and emotions, which is an experience not easily achieved in a typical classroom. In addition, two former students were hired by the HOPe House as full-time professionals after graduation. Overall, this was a unique experience from which our students benefitted.

Our findings on the benefit of immersive experiences to students are consistent with other undergraduate neuroscience programs that employ experiential learning and community outreach (e.g., Bazzett et al., 2018; Deal., et al., 2014; Kouh, 2020; Simonds et al., 2018; Vollbrecht et al., 2019). Generally, these high-impact experiences seem to promote deeper understanding of neuroscience concepts in undergraduate students, while imparting a sense that neuroscience (and science in general) is important for the greater community. One of our concerns with changing the LC and reducing the time spent at the HOPe House was that the experience would not have a large enough impact which could affect retention in the major. This, however, did not appear to be the case as student retention in the major was not reduced, but improved in our redesigned LC. This improvement may be due to a couple of factors: the redesigned LC was more cohesive instructionally, as well as from a content perspective; and the reduction in LC credits may have allowed students with busy schedules to stay in a science major, like neuroscience. Furthermore, allowing students the time to reflect on their experience may enhance the overall impact of the experience. For example, all students who responded to our survey said they appreciated having the opportunity to reflect on their LC experience and to contemplate the impact of that experience on others and on their choice of major.

The Neuroscience LC May be a Valuable Learning Experience for Public School Students

While we were unable to assess the learning outcomes and experiences of the younger students directly, an indirect assessment by the classroom teacher pointed to a rewarding and exciting opportunity for the middle schoolers. Personal conversations with other teachers as well as some of the public-school students also indicate that the children enjoyed the activities. Several studies have shown the benefit of early immersive science experiences for children in K-12 schools. For example, Toledo et al. (2020) found that a neuroscience-student-led supplemental science intervention for sixth graders led to improvement in understanding science, confidence in themselves, and their attitudes toward attending college. Furthermore, Vollbrecht and colleagues (2019) demonstrated that collaborative outreach programs for middle school students were indeed effective in delivering new content to younger students.

The Neuroscience LC is a Good Model for Small Colleges but Can be Adapted for Larger Institutions

As previously reported in Yu et al., 2013, having the opportunity to collaborate to support student learning was an advantage of this model. As a small school with few faculty to teach neuroscience courses, it is imperative that we design high-impact courses. Faculty collaborations allowed us to optimize what we teach and how well students learned and retained the material. To this end we built on foundational material while providing hands-on experiences. This allowed us to optimize student learning in a way that did not require expensive materials or equipment. Moreover, we were able to incorporate the expertise of the professionals at the HOPe House and learn teaching techniques from local public-school teachers.

The neuroscience LC can also work for larger institutions with greater resources. For example, one design might include several different experiential sections each with a unique focus based on student interest, that are then tied to a larger uniting foundational course. Yet another possibility for larger institutions in diverse metropolitan areas could be to include outreach programs to underserved communities. Bazzett et al. (2018) detail a framework for how this can be achieved. Their collaboration with an elementary school involves teaching neuroscience to fourth and sixth graders that includes teaching basic neuroscience concepts, encouraging healthy choices, reducing risky behavior, altogether with a peer mentorship component.

FUTURE DIRECTIONS

This LC changed over time to incorporate the expertise of

new faculty which is a distinct advantage of this model. Our relationship with the HOPe House has been and remains a cornerstone of the community-based learning aspect of the LC. New faculty had previous experience in education and in teaching middle school students as well as running STEAM events for children. Thus, our update to the LC was a natural evolution and coordinated well with the HOPe House. It would have been easy, however, to leverage other faculty expertise (e.g., psychology, sociology, philosophy) given that neuroscience is inherently interdisciplinary. This is especially true at Stonehill College where faculty from across departments often interact. For example, we can leverage collaborations with our education department colleagues to create additional age-appropriate outreach opportunities, as demonstrated in Brown et al., 2019.

We have previously reported on the benefits of leveraging off-campus collaborations to enhance student learning (McCoy et al., 2018; Yu et al., 2013). We believe this practice is becoming more popular because of the benefit to undergraduates, faculty, and the wider community. For example, Simonds et al. (2018) developed a collaboration with neurosurgeons at Virginia Tech Medical School to make clinical neuroscience more accessible to neuroscience undergraduates and students who plan to matriculate in health professional programs. As we reported in Yu et al., 2013, students greatly value the expertise of practitioners. A similar connection can be made with physical therapists and other practitioners in our community who treat patients for neuromuscular disorders.

Lastly, as Bazzett and colleagues describe (2018) large metropolitan institutions and small suburban institutions alike can make connections with diverse urban communities. This idea is feasible for a small suburban school like Stonehill College because of its proximity to the diverse neighboring city of Brockton, MA.

Over time, feedback from student evaluations as well as from external reviewers has helped us to improve our LC course and our neuroscience program. As we move forward, we will be changing our introductory course. PSY 415 (Brain and Behavior) was originally designed as an upper-level psychology course to provide psychology majors with an overview of the nervous system, and its relationship and implications for behavioral processes. With the establishment of the neuroscience program, PSY 415 (Brain and Behavior) came to serve two groups of students with different educational needs. For neuroscience majors, PSY 415 is the entry-level neuroscience course, taken in the second year after a year of foundational biology and chemistry. Feedback has indicated that this is not ideal, hence a new course, NEU 101: Introduction to Neuroscience, will replace PSY 415 for neuroscience majors and will be offered in the second semester of their first year. The existing Brain and Behavior course (PSY 415) will change significantly to support psychology majors, becoming more descriptive and applied, with much of the content on physiological mechanisms and neuroanatomy removed. Together, we believe these changes will be in the best interest of both neuroscience majors and psychology majors.

These changes are currently underway and will help us deliver a more comprehensive education for our neuroscience majors. This is consistent with the New Blueprints outlined by Wiertelak and colleagues (2018) that advocates for an introductory experience followed by opportunities to “explore the field” more broadly over several semesters with intermediate and lab-based courses, and then concludes with an advanced/integrative/capstone experience. Credit problems with learning communities as well as complications with COVID-19 caused Stonehill to cancel the LC requirement for all students. Despite these challenges, we continue to explore creative ways of maintaining the experiential aspects of the LC in our curriculum. One possibility is that a 1-credit community-based learning aspect could be an option for first year students taking NEU 101. Consistent with the New Blueprints, we believe this will inspire new neuroscience students in the early stages of their academic careers, help them understand the relevance of neuroscience to the community at an influential stage, and connect them to the rich on-campus and off-campus resources that are available to them. Overall, we argue that experiential, community-based courses are a valued part of a curriculum that can be relevant and impactful at different levels of time commitment and that including these courses can be done despite curricular challenges.

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