High Impact Experiential Learning – STEM Living Learning Communities for Women

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ABSTRACT

Research indicates that an impactful first-year experience is critical in the college experience and has been linked to increased persistence in STEM. The Douglass Women in Science and Engineering program at Rutgers University prioritizes high impact practices (HIP) and high impact experiential learning (HIEL) in various forms, including living-learning communities for first year women in STEM. The Women in Science and Engineering program currently has four living-learning communities in the areas of engineering, computer science, sciences, and pharmacy/nursing, serving up to 180 first year students annually. As the name suggests, each encompasses three components: Living, Learning, and Community. Together, these components foster the development of the students' STEM identity, provide a holistic network of support, and contribute to retention in STEM.

The administration of a living-learning community is a collaborative effort across curricular and co-curricular units that is supported by university leadership. The students live together in a residence hall in cooperation with Residence Life, share a discipline-based course led by an academic unit, and engage in a STEM community led by Douglass Women in Science and Engineering. The STEM community programming includes live-in STEM near-peer mentors, engaging in STEM focused events and activities, and connection to university and STEM resources.

This practice paper reviews the history and evolution of STEM LLCs for women at Rutgers University and catalogs LLC practices, with a particular focus on community engagement. A longitudinal graduation review of living-learning community participants is also provided, showing that an average of 80% of LLC students graduate in STEM.

INTRODUCTION AND BACKGROUND

In the early 1900's, the New Jersey State Federation of Women's Clubs convinced Mabel Smith Douglass to lead the effort of establishing a women's college as part of Rutgers University. In 1918, the New Jersey College for Women, later named Douglass College, opened its doors to 54 students. The College was committed to science education since its inception. Laboratory facilities were continually expanded through the 1920s. See Figure 1.


Figure 1: Douglass Chemistry Lab, Rutgers University, 1920

Since 1986, the Douglass Women in Science and Engineering program (WiSE, originally named the Douglass Project for Women in STEM) has formally supported the advancement of undergraduate STEM students at Rutgers University. Today By co-enrolling at Douglass and a Rutgers academic school, students experience a small college atmosphere and programs that empower their academic excellence and leadership development while engaging with all the rich educational resources of Rutgers University. Over half of Douglass' enrollment consists of STEM students. Today, about 1000 Rutgers STEM students choose to add Douglass WiSE to their Rutgers experience. This is a testament to WiSE's programming, mentoring, and impact on the journey of women who have been an historically underrepresented population in STEM.

'STEM Community' has been the foundation of Douglass WiSE's mission since its inception. Douglass STEM students experience college supported by a network of staff, professionals, and near-peer mentors that provide guidance and opportunity at every turn and bump in the journey towards a degree and career in STEM. The mission also includes providing high impact experiences through living-learning communities (LLCs) for women in STEM majors. Exposure to these experiences is not only useful, but transformative on the students' undergraduate journey.

High impact experiences like first-year LLCs are linked to increased retention and graduation, especially for women in STEM, an historically underrepresented group in engineering, computer science, and other STEM fields [1, 2]. Studies show that women in STEM respond positively to high impact practices (HIP) and high impact experiential learning (HIEL) that are collaborative in nature and have opportunities to share science [3-6]]. All learners, and especially those at risk for attrition in STEM, benefit from high impact experiences and active learning strategies [7, 8]. As the name suggests, each LLC is comprised of three components: living, learning, and community, which together, foster the development of students' STEM identity and provide a holistic network of support, contributing to persistence in STEM.

While Douglass College has supported women in STEM since its inception in 1918, Douglass has formally offered STEM LLCs since 1989. Today, the women's college offers four STEM LLCs in the areas of the sciences (1989), engineering (2012), computer science (2016), and pharmacy/nursing (2023). This practice paper outlines the historical perspectives of STEM LLCs

at Rutgers University, the evolution of the LLCs, and a review of the key program components. While student success is a complex concept with several contributing factors, research shows that cornerstone first-year STEM experiences, including STEM LLCs, have an impact on student success and contributes to graduation rates in STEM. To this end, a longitudinal graduation study of the STEM LLCs has been completed, and the results are included in this paper. Many of the students in the study have graduated or otherwise separated from the university, as a result, other qualitative and anecdotal assessments were not attempted.

LIVING LEARNING COMMUNITY STRUCTURE

Living-Learning Communities: Recruiting, Enrollment, *Partnerships*

Living-learning communities begin each year by recruiting pre-college students. During the spring semester, in partnership with the Office of Admissions and academic schools, the Women in Science and Engineering program participates in university wide as well as school and department specific recruiting events. Through this process, prospective first-year women are informed about and invited to participate in a STEM LLC. Each school year, up to 180 first year women participate in a STEM LLC based on the students' self-identified intended major on the application for admission, see Table 1. Enrollment varies from year to year, with a noted increase in the past few years. However, there is an enrollment cap based on the number of allocated number of beds in the residence halls and based on the number of students that can be served in the associated LLC courses. Waitlists have been utilized in recent years.

Table 1: Living-Learning Community - Enrollment

LLC	First-Year Enrollment
Sciences LLC	50-70
Engineering LLC	30-50
Computer Science LLC	25-40
Pharmacy/Nursing LLC	20-40

In addition to Douglass' partnership with the Office of Admissions, each LLC is structured with strong partnerships with academic schools and co-curricular units. Our partners include the School of Environmental and Biological Sciences, the School of Engineering, the School of Arts and Sciences, the School of Pharmacy, the School of Nursing, Residence Life, and the Learning Center. Having these strong partnerships across university units contributes to the success and sustainability of these communities. The partnering academic unit runs the required major related course; Residence Life provides residential spaces where the LLC students live together; the Learning Center provides in-residence STEM tutoring; Douglass WiSE runs the community components.

Living-Learning Communities: Living Component

Informal spaces like residence halls are often where students foster first friendships, study together, and engage in formative STEM and college experiences. At this university, there are five campuses spanning two neighboring towns across five miles. In 1989, a traditional residence hall on the Douglass Campus (also named after Mabel Smith Douglass), which serves as the home of Douglass Residential College, was dedicated as the first women in STEM residential

space. This residence hall has 110 beds and was named after two former women's college deans who were also scientists and pioneers for the advancement of women in STEM, see Figure 2.

Dr. Mary Bunting-Smith began as the dean of Douglass College in 1955. She began her college education at Vassar, studying physics, and going on to earn her Ph.D. in bacteriology from the University of Wisconsin. As Dean of Douglass, Dr. Bunting-Smith secured a grant to establish a mathematics program for women and paved the way for married women/mothers to have flexibility while finishing college. After Douglass, she became the president of Radcliffe College.

Dr. Jewel Plummer Cobb was the first African American to be appointed Dean of Douglass College in 1976. She earned a bachelor's degree in biology from Talladega College, then went on to earn a Ph.D. in cell physiology from New York University. During her tenure as Dean of Douglass, she empowered women to begin careers in science. Part of her research focused on the treatment of skin cancer for melanated skin. After Douglass, she became the president of California State University.

Figure 2: Bunting-Cobb Hall for Women in STEM - Namesakes

From 1989-2011, this residence hall hosted students of all STEM majors including engineering, computer science, pharmacy, sciences, nursing, and STEM adjacent majors. However, it is five miles and a bus ride away from the Busch Campus where many STEM departments are based. Over the years, Douglass Campus's geographic location was a deterrent for some STEM students, particularly in engineering, computer science, and pharmacy. For this reason, the decision was made that any new STEM LLCs would be located on the Busch Campus. Between 2012-2023, Douglass College created three more STEM LLCs on the Busch Campus in the areas of engineering (2012), computer science (2016), pharmacy (2023), and nursing (2023), with three different residential spaces for first year and continuing students.

In 2023, with the creation of these three LLCs, the decision was made that the original STEM LLC on the Douglass Campus would be focused on the sciences only, with a mix of 80% first-year students and 20% continuing students. Additionally, the School of Environmental and Biological Sciences became the academic partner for the re-coined Sciences LLC.

The three newer LLCs on the Busch Campus have a different issue. While they are all on the same campus nearer to academic units, they are housed in different residence halls with a limited number of beds.

- Engineering: In a traditional four-story residence hall designated for first-year School of Engineering students (over 200 beds), the top floor (60 beds) was designated as an all-women floor to host the Engineering LLC, which fills about 40 of the 60 spaces. The remaining spaces on the floor were filled with other first-year women in engineering. The building does not have an elevator, creating an access issue for students with physical disabilities.
- CS and Pharmacy/Nursing: Similarly, in an identical and neighboring residence hall, the top floor (60 beds) was designated as an all-women floor, housing the Computer Science

and Pharmacy/Nursing LLCs. In the 2024-2025 year, the enrollment for these two LLCs was capped due to limited bed space. There were modest waitlists for both LLCs. In the end, we were not able to accept all students on the waitlist. The building does not have an elevator, creating an access issue for students with physical disabilities.

- Continuing LLC students: After the first year, LLC students have the option to live together in a different residential suite-style space on Busch Campus, totaling 44 beds.

Due to the limitations in the residential spaces on the Busch Campus that are split across three residence halls, in fall 2024, Residence Life agreed to designate an entire residence hall on the Busch Campus to Douglass WiSE which will house all three LLCs, first-year and continuing students. This suite-style residence hall has 162 student beds (120 first-year, 42 continuing), each suite featuring 3 double bedrooms, a living room, and a bathroom. The building has study spaces on all four floors, a recreation room and kitchen on the first floor, and an elevator. It is anticipated that the suite-style space will be attractive to both prospective and continuing students. This new space is an amazing opportunity to elevate our women in STEM community experience, which will debut in the fall 2025 semester.

Living-Learning Communities: Learning Component

The major related and required LLC courses are designed to engage and inspire the LLC students in topics related to their majors. The courses are safe and brave spaces where the students have the unique experience of an all-women STEM course, unlike most or all other STEM courses they will experience at Rutgers. In these courses, LLC students engage with their field of study, STEM faculty, STEM student organizations, and STEM community, while interacting with each other, developing their voices, building their self-confidence, and cultivating their overall STEM identity. The current course titles and a short description can be seen in Table 2.

Table 2: Living-Learning Community - Courses

LLC Name	Course Information
Computer Science LLC	Great Ideas in CS: Utilizing a breadth-first approach, this course engages students in computing related application areas and societal contributions. Elements include active learning, computing curiosity, gamification, and current technologies that are appropriately leveled for first-year students.
Engineering LLC	Introduction to Data-Driven Design for Engineering Applications (ID3EA): Engineering design, experiential learning, teamwork, data literacy, computing, programming, communications, problem solving, success strategies, transition to college and SOE, and women in engineering.
Pharmacy/Nursing LLC	Scientific and Technical Writing: Practice in research and writing in scientific and technical settings. Focus on an independent project related to the student's field of specialization.
Sciences LLC	Plants for Human Wellness: Learn the history and applications of plants in various areas related to human health

	and wellness such as food, modern & traditional medicine, cosmetics, flavors, fragrances and more.

While the academic unit is the official lead of the course, Douglass WiSE is often consulted for curricular input. Additionally, the academic unit has agreed that the residential LLC mentors and Director can attend the course a few times each semester. The presence of the LLC mentors in the classroom where all the students are required to be in one place strengthens the relationship between the students and the mentors. Students are often more comfortable talking with the mentors out of class when they interact with them in the classroom.

Living-Learning Communities: Community Component
Community has been at the core of Douglass College since its inception. The Women in Science and Engineering program has been practicing living and learning communities for decades. For LLCs, community happens in many forms including multi-tiered mentoring, STEM tutoring, activities, and events. Research indicates that students often drop out of STEM after the first year. Community-based initiatives are meant to support first to second year retention in STEM. WiSE has additional offerings and support to engage STEM students beyond the first year.

One notable element that can affect retention is the ease and ability for students to transfer to different majors early in education. While all Rutgers students have transferring opportunities, it could affect students in the School of Arts and Sciences (SAS) more than students in a professional school. Students in SAS (ex. computer science and many science majors) are admitted without a major and can adjust their class selection at any time during their education without changing schools. This low hassle switching ability can provide students with an easy off-ramp from STEM, which could in turn negatively affect STEM retention. Conversely, students in professional schools (ex. engineering, environmental studies, pharmacy, and nursing majors) would have to submit a formal transfer application to pursue majors outside of their school of matriculation. There are also GPA requirements for transferring between schools. This extra step and academic requirement may influence a student's decision on staying in their current school and major or transferring.

Maintaining a robust community structure is critical in supporting the overall student experience, promoting enthusiasm towards STEM, academic capabilities in their studies, and retention. Below is a description of community building initiatives in the LLCs:

i. Staff Director: The directors attend LLC events, is available for one-on-one mentoring, provides university connections for the students, and leads the LLCs.
ii. Near Peer Mentoring: Leveraging the power of students, WiSE hires upper-class women in STEM to serve as live-in near-peer mentors. These mentors are role models who are succeeding in their major, and who have an interest in giving back to the next cohort. The mentors' majors are aligned with the LLC that they serve, where an engineering student serves as a mentor for the Engineering LLC. The Sciences LLC has three STEM LLC Mentors. The Busch Campus LLCs (Engineering, Computer Science, and Pharmacy/Nursing) each have two student mentors. Starting in Fall 2025 when the Busch Campus LLCs will be together in one building, they will have four mentors in total, instead of six: one per LLC and one lead mentor.

iii. Residence Life also provides standard resident assistants (RA) in the residence halls, who focus mostly on roommate issues, extenuating circumstances, and the general college experience. RAs can be any major. While there are some similarities between RAs and STEM LLC Mentors, STEM LLC Mentors differ from RAs in that they focus on the STEM experience. They provide insight into the STEM specific college experiences, act as liaisons to faculty, LLC Directors, academic advising staff, and lead engaging STEM focused activities. LLC Mentors are compensated with a free bed in the residence hall. The role requires 15hrs/week see Table 3.

Table 3: STEM LLC Mentor Responsibilities

15 hours/week	Responsibilities
2 hrs/wk	Attend the LLC House Course weekly (course schedule permitting).
5 hrs/wk	Hold weekly mentoring hours.
2 hrs/wk	Plan, advertise, and implement one STEM-related activity per month.
1 hr/wk	Communicate regularly with the LLC student community through platforms such as the LLC Canvas page, GetInvolved, GroupMe, bulletin boards, email, flyers
5 hrs/wk	Complete other LLC-related tasks, including: • Create 1 new STEM activity each semester. • Attend recruiting events. • Participate in one virtual Welcome Session during the summer.

iv. *STEM Tutoring*: Persistence in STEM, a primary goal of our LLCs, is often correlated with succeeding in STEM courses. To make tutoring easier and more likely to happen, WiSE brings tutoring into the residential LLC spaces. While our student LLC mentors are successful STEM students who have taken STEM courses themselves, they are neither hired nor trained to provide academic tutoring. Instead, WiSE works with the Learning Center to provide in-residence tutoring services for STEM courses. Courses vary by LLC and include math, chemistry, biology, computer programming, see Table 4.

Table 4: LLC Tutoring Subjects

LLC Name	Courses
Sciences LLC	precalculus, calculus 1, biology 1/2, chemistry1/2
Engineering LLC	calculus 1, calculus 2, physics 1
Computer Science LLC	precalculus, calculus 1, discrete structures, computer architecture
Pharmacy/Nursing LLC	precalculus, calculus 1, biology

v. *LLC Events and STEM Activities*: In the LLCs, STEM is used as a socialization tool, STEM activities are carefully crafted to engage the students in a STEM topic, provide fun and socialization with one another, and include an element of representation by highlighting a woman who has contributed to the field related to the activity. Table 5 provides examples of STEM activities for each LLC, a short description, and sample highlighting woman in STEM.

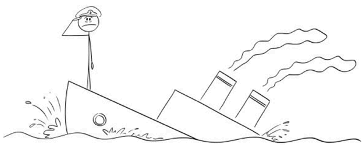
Table 5: STEM LLC Activity Examples

STEM Discipline	**Activity**
Computer Science	Binary Coded Bracelets: Students learn to convert letters into binary code. Students make a binary coded bracelet for the first letter of their name. Woman in STEM Highlight: Lubna of Córdoba
Engineering	Sinking Ships: Students design and test a small boat to hold as much weight as possible using principles of buoyancy, density, volume, and area. Woman in STEM highlight: Monica Nancy Candny
Pharmacy	Compounded Mocktails: Students practice the pharmaceutical process of compounding (grinding, combining, and mixing) to create a desired outcome and tasty beverage. Woman in STEM highlight: Mary the Prophetess
Nursing	Blood Pressure Basics: Students learn about blood pressure and practice on their peers. Woman in STEM highlight: Mary Eliza Mahoney
Science	Perfume Making: Students learn the fundamentals of making perfume using essential oils and design their own unique blend. Woman in STEM highlight: Tapputi-Belatekallim

STEM LLC Mentors are required to create one new STEM activity per semester, tapping into their academic excellence and the interests of students in their age group. The LLC Directors also create STEM activities and provide advice in STEM content accuracy and presentation to the student mentors. These informal learning experiences contribute to belonging and provide context to their major and first-year academic experience. Figure 3 is an example of one of the STEM activity sheets (See the Appendix for additional activity sheets).

Sinking Ships

Introduction: Have you ever wondered how a ship made of steel can float? Or better yet, how can a steel ship carry a heavy load without sinking?



A Career in Engineering: The maritime industry was a no-go area for women until 1988, meet Monica Nancy Candny, marine engineer: Marine engineers are responsible for the internal systems of a ship, such as the propulsion, electrical, refrigeration, and steering systems. Marine engineers typically need a bachelor's degree in marine, mechanical, or electrical engineering.

A few questions before you begin:

1. What determines whether an object floats or sinks?
2. Are you familiar with these terms: Buoyancy, Density
3. What is the density of water?
4. What is the density of aluminum foil?

Materials

- Aluminum foil
- Ruler
- Tape
- Paper towels
- Pennies
- Calculator
- Bucket or tub
- Water

Instructions:

1. Using your squares of aluminum foil, build a boat. For example, you could make it with two pointed ends (like a canoe), square, or rectangular. Note: Hollow, wide and long shapes are more buoyant.
2. Make finishing touches to your boat. Make sure it doesn't have any leaks. If needed, use a little tape to make them stronger. Flatten the bottom of the boat.
3. Determine the volume of your boat.
4. Add your boat to the container of water. Gently add one penny at a time and keep adding pennies until the boat finally sinks.
5. Determine the mass of the pennies needed to sink your boat (the penny that sank the boat does not count).
6. For your boat, divide the number of grams it could support by its volume in cubic centimeters. This roughly gives you the boat's density.
7. What was the density of your boat right before sinking? How do you think this relates to the density of water?

Terms and Useful Information:

- Buoyancy: ability or tendency to float in water, air, or some other fluid
- Density: mass per unit of volume
- **1.0 mL = 1.0 cm^3**
- Density of water: 1.0 g/cm^3
- Density of aluminum foil: 2.71 g/cm^3
- Mass of a penny: 2.5 g
- Volume of rectangle: L x W x H
- Volume of triangle: ½ x base x height

Figure 3: Sample STEM Activity

The frequency of LLC events has varied over the years. In the years prior to 2021, LLCs often held 10-15 events per year, including some purely social events. In recent years, event attendance was analyzed and there was some indication that too many events led to lower attendance. Also, STEM students are typically taking multiple STEM courses each semester, lending to a rigorous and demanding schedule. Since 2021, the LLC events have been held monthly, and all include a STEM-based activity, totaling 8 events per year. Purely social events are now held solely by the RAs. This also helps with the distinction between the roles of RAs vs. STEM LLC Mentors. The new and intentional monthly cadence of STEM based events has yielded higher event turnout, better planning, and an ability to elevate the quality of the events.

Living-Learning Communities: Graduation Statistics

All the elements of STEM living-learning communities, working in tandem, are important and critical to the desired results of increased engagement, community building, and graduation in STEM. While there are many factors that contribute to why students stay in STEM or choose to leave, LLCs are considered high impact experiences in the academic journey. While the goals of this practice paper are to review the history and evolution of STEM LLCs at this institution and to catalog the LLC practices, since WiSE has been running LLCs for many years, it is possible to also see how the LLC students fared at graduation time. Many of the students who participated in an LLC have already graduated, making qualitative data collection of these students extremely difficult, and not possible in many cases. Providing graduation rates is not a complete assessment of the LLCs, rather just one element and a bird's eye view into their impact. A graduation assessment has been completed for each LLC, except for the Pharmacy/Nursing LLC, as it was newly created. The other three LLCs were reviewed for graduation rates for up to 10 years, see Table 6.

Table 6: STEM LLC Graduation Review

LLC Name	Number years reviewed	Number Students	Graduated in Major	Graduated in other STEM	Graduated nonSTEM	Did not graduate
Sciences	10	513	62%	15%	8%	15%
Engineering	9	255	89%	5%	2%	4%
Computer Science	4	86	67%	23%	6%	4%

These results show that most LLC students graduate in-major, and even more within a broader STEM definition. The Sciences and Computer Sciences LLCs fared similarly. The Engineering LLC performed the best, markedly higher than the other two. There are a couple of reasons that can be proposed as to why the Engineering LLC fared better:

- Stricter admissions standards for a professional school like the School of Engineering may dictate a better prepared pool of students.
- Engineering students share a common first-year curriculum which may create more interaction among the students who are taking the same courses. Conversely, students interested in computing may be starting at a variety of levels. Students interested in science have a vast array of majors and requirements, also starting at a variety of levels.
- Students in the School of Arts and Sciences, which includes all of the Computer Science LLC and about half of the Sciences LLC, can pursue different majors without any formal applications. Conversely, School of Engineering students would have to apply to transfer into a different school to pursue a non-engineering major and must qualify for school-specific entrance requirements.
- The Sciences LLC used to accept students from a broader set majors, including STEM adjacent majors, including psychology, public health, health administration, cognitive science, business, and more. This graduation review used a narrower and more traditional definition of science for the 'in major' category.

If graduating in any STEM major is considered a success, it can be said that the LLCs have 77%-94% STEM graduation rates. In all, the statistics paint a picture that LLCs do, as research

suggests, contribute to persistence in STEM. It is acknowledged that more research is needed to support this claim.

DISCUSSION

Living-learning communities are considered high impact learning experiences and can have lasting effects on the student's college experience. Providing an effective and impactful living-learning community is a complex task that requires carefully crafted investment from multiple university entities. The women's college has decades of experience practicing and running living-learning communities. During this time, challenges presented themselves, solutions were implemented, and successes were forged. Looking ahead, there are enhancements proposed to elevate the experiences and impact. It is our hope that more practitioners and faculty adopt HIELs and HIPs into their work.

Challenges and Solutions

Initially the singular campus location for an innovative women in STEM LLC, the first of its kind, located on the home campus of Douglass College served the community well. As time went on, the location became a deterrent to certain majors that were based miles away. This was resolved by creating new LLCs that were situated on the Busch Campus where many STEM schools and departments are based. Having strong partnerships across the university is critical to the success and longevity of the LLCs. These partnerships were not without work and adjustments along the way. As new LLC and related initiatives are formed, it is suggested that leadership in the relevant units have in depth discussions about the partnership before work on the ground happens.

Looking Ahead

The newly designated residential building on the Busch Campus is an exciting and promising change. It is hoped that students in these LLCs will experience a greater sense of community, will have in-house resources in their second year, will allow for joint LLC events, and will foster increased event attendance. Currently for Fall 2025, the new space is at capacity with a small waitlist. The change to hold LLC events monthly allows for better planning and marketing, increased quality of STEM activities, and provides a clear distinction between RAs and STEM LLC mentors. Another new feature this year is the addition of STEM-based campus exploration. Each LLC hosts 1-2 campus field trips to STEM spaces to provide another element of STEM community engagement. Some examples of places visited are Asphalt Lab, University Gardens, Hackerspace, Medical Simulation Lab, and Makerspace. A new position is being created for a Lead STEM LLC Mentor. The purpose of this position is to provide a higher level of leadership for an eager and talented student who has served as a STEM LLC Mentor in a prior year. This position will also help the LLC Directors by the Lead Mentor ensuring certain details related to mentoring and event planning are attended to in a timely manner.

It is our hope that these changes will lead to positive impacts all around. STEM LLCs are a cornerstone experience for first-year women in STEM at Rutgers University. In addition to the challenges and successes along the way, the data from the longitudinal graduation review indicates that students who participate in an LLC graduate from STEM and/or from college at a high rate, higher than national averages in STEM. These figures support the anecdotal

observations that the STEM LLCs are a pivotal and foundational element of Douglass WiSE programming.

Adopt HIEL and HIPs into Other Works

Living-Learning Communities are impactful, complex, and replicable initiatives to implement. With the right design, investment, partnerships, and support, other faculty and practitioners can start or elevate their work in this area. However, not every faculty or practitioner is in the position to start a living-learning community. There are elements used in LLCs, other components of HIEL and HIPs that can be adopted into STEM works on a smaller scale or different application. Some examples include active learning pedagogies, authentic applications of STEM, mentoring programs, major specific events and field trips, affinity based living communities, affinity base learning communities, and more. The keys of HIEL and HIPs are to actively engage the learner in as many ways as possible, providing personal, academic, or career skill development and opportunities that improve the student's STEM experience.

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APPENDIX

Compounding Mocktail Activity

(inspired by Tara Sabapathy, 23-24 PNLLC Mentor and Pharmacy Student)

Introduction:

A mocktail is a non-alcoholic drink made to mimic a cocktail. The beverage usually contains juices, and syrups. Many people credit the popularization of mocktails to the Shirley Temple in the 1930's. Compounding in pharmacy is the process of combining, mixing, or altering ingredients to create a medication tailored to the needs of an individual patient. Compounding includes the combining of two or more drugs.

Pharma-She Spotlight: Mary the Prophetess

Mary the Prophetess, an alchemist from the 1st or 2nd century AD, made significant early contributions to drug compounding. She invented the **Bain-Marie**, or double boiler, which allows for precise, gentle heating of substances—a technique still used in modern pharmacy. Her work in distillation and extraction also laid foundational principles for isolating active ingredients. These innovations were crucial in shaping the practices of drug preparation. Mary's pioneering efforts remind us of the deep historical roots of our modern pharmaceutical techniques.

Ingredients:	**Procedure for Shirley "Girly" Temple:**
• Mortar and pestle • Beaker • Straw • Lemon lime soda- 150mL • Pop rocks- ½ packet • Grenadine- 20mL • Simple syrup- 20mL • lemon/lime- ½ of the juice	1. Take a beaker and measure 150mL of lemon-lime soda. 2. Gradually add 20 mL of grenadine to the lemon-lime soda and mix with straw. 3. In a mortar, triturate half-packet of pop rocks. 4. Calibrate the soda mixture with ice until 300mL. 5. Sprinkle the pop rocks slowly over the beaker and watch the drink fizzle. 6. Finally add a maraschino cherry and a straw and enjoy!

Questions:

1. What does triturate mean?
2. What could be the instructions for this mixture?
3. What is the difference between suspension and solution?

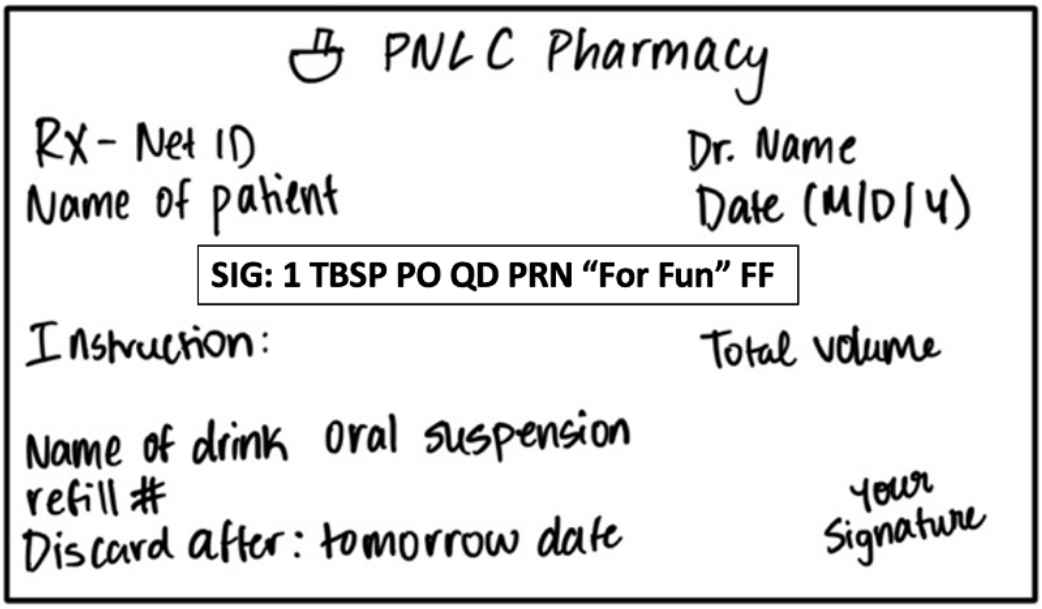
RX Sign Translation

RX SIGs are abbreviated Latin or English phrases still used in modern-day drug labeling to denote certain activities, actions, or specifications on how to take a medication. These Sigs are used to save time, but should NOT be given to the patient. Still, healthcare providers should be familiar with them! Use the provided "Sig-ctionary" to translate the sigs below into usable labels.

Below are a series of practice sigs to get you used to some of the items you might see in pharmaceutical and nursing settings! Don't worry about memorizing them- you'll get them with time, and there's a few that will come up more frequently than others.

1. 1 CAP PO QD PRN RA: _____
2. Take 5 ML PO Q2H: _____
3. SS TAB PO TID FF:_____
4. 1-2 TAB Q4-Q6 PRN PAIN: _____
5. 1 ML BUC PRN HYPOGLYCEMIA: _____
6. Make your own sign: _____

Sample RX Label for your Mocktail



Pulse Precision: Mastering Blood Pressure Basics

Inspired by Nora Abdelfattah and Simar Monga, PNLLC Mentors

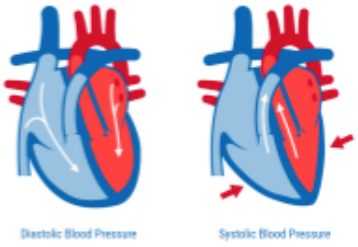
Nurse Nation Entry #1:

Nurse Mary Eliza Mahoney was the first African American to graduate from Nursing school in the country. Although facing racial discrimination from clients and colleagues, she was praised for her diligence by many that met her. She would go on to serve as the director for the Howard Colored Orphan Asylum, which served both Black children and elderly in the state of New York. Additionally, her parents. She would also serve as an original member of the Nurses Associated Alumnae of the United States and Canada (NAAUSC), but after facing racial discrimination, would go on to co-found the National Association of Colored Graduate Nurses (NACGN).

Blood pressure is defined as the force exerted by circulating blood on the walls of blood vessels. It is measured in _____ (mmHg) and is expressed as systolic/diastolic (e.g., 120/80 mmHg). Some factors affecting BP are: 1.) _____, 2.) _____, and 3.) _____.

Blood Pressure Categories

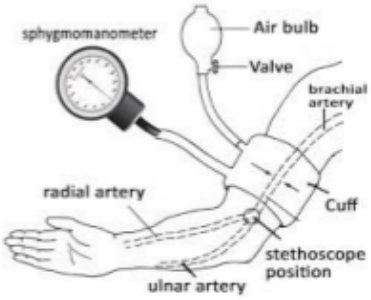
BLOOD PRESSURE CATEGORY	SYSTOLIC mm Hg (upper number)		DIASTOLIC mm Hg (lower number)
NORMAL	LESS THAN 120	and	LESS THAN 80
ELEVATED	120 – 129	and	LESS THAN 80
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1	130 – 139	or	80 – 89
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2	140 OR HIGHER	or	90 OR HIGHER
HYPERTENSIVE CRISIS (consult your doctor immediately)	HIGHER THAN 180	and/or	HIGHER THAN 120



Diastolic Blood Pressure | Systolic Blood Pressure

Hypertension is a condition characterized by consistently elevated blood pressure levels, typically defined as a systolic pressure of 130 mmHg or higher, or a diastolic pressure of 80 mmHg or higher. One of the most common causes of hypertension is ____, which can lead to increased blood volume and vascular resistance. Other factors can include lifestyle, genetic predisposition, or medications such as birth control or diet pills. Systolic pressure, the _____ number in a blood pressure reading, measures the force of blood against artery walls when the heart contracts. Diastolic pressure, the _____ number, indicates the pressure in the arteries when the heart is at rest between beats.

Blood Pressure Measurement Activity:



1. Ensure patient is sitting still with their feet against the ground, arms in the supine position, and that no talking or exterior distractions are happening while taking pressure
2. Place the cuff on bare upper arm of non-dominant hand, 2-3 CM above inner elbow aligned the brachial artery.
3. Place stethoscope atop brachial artery
4. Rotate valve on blood pressure cuff until completely closed, then pump unit sphygmomanometer reaches ~180 mmHg
5. Gradually release the valve until korotkoff sounds become audible. Note this number down as the systolic pressure.
6. Slowly release pressure until you stop hearing the Korotkoff sounds. Note this number as the diastolic pressure.
    a. In my own words, Korotkoff sounds are: _____

    _____

    _____

Patient Documentation Information (Fill this out with your information)

1. My patient's systolic pressure was _____ and diastolic pressure was _____.
   This means that my patient was in the _____ range on the hypertensive scale.

2. Does my patient have any habits or history that could lead to risk of hypertension?

   _____

   _____

3. The hardest thing I found about taking blood pressure was:

   _____

   _____

4. What uses could knowing how to take blood pressure have in nursing/pharmacy, depending on your major?

   _____

   _____

Bits & Beads: Binary Code Bracelet

by Dr. Hayet Bensetti
Inspired by Madison Chin & Shinbee Kang

Background: Computer coding is the process of writing instructions in English via programming languages, which then gets translated to our computer hardware in a language it understands called **binary**. Once our computer understands our instructions, it can carry out functions on its hardware, allowing us to create functional and complex software, apps, and websites.

Career Connections: Computer programmers use binary code to write instructions that tell computers how to function. Understanding binary code helps us see how computers process information and communicate with humans.

What is binary code?	Why do computers use binary code?
• Binary code is the most basic language of computers • It uses combinations of 0s and 1s to represent numbers, letters, and symbols • Each "1" or "0" in binary code is known as a **bit**	• Simplest way computers can store and process information • Easily represented electronically where there are only 2 states On: 1. Off: 0

Women in STEM Spotlight: Lubna of Córdoba

Lubna of Córdoba (10th century) was a brilliant mathematician, scholar, and scribe in the court of Caliph Al-Hakam II in Al-Andalus (modern-day Spain). She was highly skilled in arithmetic, geometry, and the sciences, contributing significantly to the intellectual advancements of the era. She helped expand Córdoba's vast library and contributed to the preservation and dissemination of mathematical knowledge.

Today's Activity: Create a binary coded bracelet representing the first letter of a name.

Materials Needed: Beads and string -- ASCII table -- Basic arithmetic

Directions

1) Choose a name and identify the first letter. (e.g., G for Ginger, Z for Zoe)

2) Convert **letter to number**: find the letter in the ASCII table (pronounced as-kee)
   a. Find the corresponding number of the letter. E.g., the letter "**Z**" has a numerical value of **90**.

3) Convert the **number to binary code**:
   a. Divide the numerical value by 2 until you get to zero, noting the remainders
   b. See example: **read the 1-0 remainders from bottom to top** to get the binary representation. E.g. Z (90) in binary is **1011010**

4) Now let's **create the bracelet:**
   a. Select color 1 for the 1s
   b. Select color 2 for the 0s
   c. Select color 3 for the rest of the bracelet.
   d. Thread the beads in the correct binary sequence on the string.

ASCII Table & Binary Conversion

ASCII Symbol	Num.		ASCII Symbol	Num.
A	65		N	78
B	66		O	79
C	67		P	80
D	68		Q	81
E	69		R	82
F	70		S	83
G	71		T	84
H	72		U	85
I	73		V	86
J	74		W	87
K	75		X	88
L	76		Y	89
M	77		Z	90

Number to Binary Conversion Example

90 ÷ 2 = 45 Remainder **0**
45 ÷ 2 = 22 Remainder **1**
22 ÷ 2 = 11 Remainder **0**
11 ÷ 2 = 5 Remainder **1**
5 ÷ 2 = 2 Remainder **1**
2 ÷ 2 = 1 Remainder **0**
1 ÷ 2 = **0** Remainder **1**