LEARNING TO LEARN:

A Look into the Collaborative Learning Space

By

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Abstract:

The Collaborative Learning Space is a recent addition to the University of Arizona that helps students engage in active learning. Prior to the incorporation of the CLS, courses were primarily taught in a lecture based format. After receiving a grant, the University of Arizona decided to use the money to develop new types of leaning spaces and classrooms to increase student engagement and active learning. These classrooms are not only effective for the students, but also they make a huge impact on the faculty. For my honors senior thesis, I worked with Dr. Cohen to get a closer look at how we learn and what learning is like in the CLS. We investigated what types of learning and teaching styles are used in the CLS, and how students and professors view this new space in comparison to a regular lecture based classroom. We also explored the literature on how active learning impacts students learning. Overall the teacher and student satisfaction with the new learning spaces was seen to be very high, and active learning was found to show improvements in different areas including information retention, critical thinking, study habits, student attitude, and problem-solving skills.
The History of Learning:

Learning and teaching are essential components of human life. This is the way we grow and spread our ideas and knowledge about various topics. The Oxford dictionary defines learning as “The acquisition of knowledge or skills through study, experience, or being taught.” Before education was formalized, people would spread their knowledge orally through various stories, rituals and songs. The formal roots of education can be dated back to the Egyptians and Greeks around the years of 3500 BCE. At this time, the Egyptians developed an alphabet (Hieroglyphs) and transcribed them onto papyrus, wood and other surfaces. Because of this, people began to take notes by writing rather than relying on passing down information orally. As time went on the topics of education widened. Chinese philosophers began to teach their ideas by parables, and soon after Greek philosophers opened schools to spread their knowledge. An example of one of these schools is one established by Plato in Athens. The school was private, although there was not cost of membership.
Since early human history, ways of education and teaching have changed significantly. Researchers have studied different ways of learning as well as different types of teaching. Many new types of teaching styles have been researched and are practiced in many different levels of educations, throughout the world.

It is argued that active learning was in existence long before it was given a name. Active learning is acquiring skills and knowledge through actually attempting and practicing. The argument holds that before lecture style teaching was introduced, active learning was being done in our everyday lives, as that is how we learned how to hunt and gather, start a fire, and take care of children. These were taught generation to generation by attempting and practicing those actions.

Active learning is a broad categorization that includes different instructional approaches such as collaborative, cooperative, and problem-based learning. The effectiveness of active learning is still a topic of debate in the academic community, as every student and professor has a different way of learning and teaching. There is typically no “one-size-fits-all” approach.

Another way of learning, much different than active learning, is through lecturing. Lecturing, also known as “The Sage on the Stage,” is used to present various types of information through one person to a wide audience. Many colleges and universities use this form of teaching in lecture halls that can seat hundreds of students that watch the professor teach. Lecturing has been used since the 14th
century, as seen in this painting by Laurentius de Voltolina. Even then, students had a hard time paying attention. Often, the presenters of lectures used to use chalkboards or even solely read and recite their notes to their audience, and the audience would listen or take notes. More recently, people use question and answer techniques, discussions, or PowerPoint presentations to present information. Lecturing is not only used in schools, but it is also a way of relaying information to a wide audience. For example, presidential speeches or even motivational speeches are done in a lecture format.

Although lecturing is still widely used, research has been conducted on whether or not this type of teaching is effective, as it only uses a one-way method of communication. There is no back and forth communication with the audience while the lecturer is teaching. This could allow the students to lose their focus or not understand certain concepts, as they are not actively participating. Lecturing is considered to be a passive form of learning, where the student is not getting much experience in the topic being presented. According to a study done at the University of Washington, it was reported that lecturing increases failure by 55%, since the average failure rates for active learning were 21.8% and 33.8% in traditional classrooms.
The main differences found between active learning and lecturing is that active learning provides student centered, small group settings that allow collaboration through student dialogue. These types of classrooms often provide facilitative learning through teachers and preceptors. The students solely listen to the teacher and the learning style is very structured. Lecturing is the traditional form of learning, while active learning has been introduced in classrooms and has been said to be more transformational. The two are especially differ in the structure of the classrooms. Lecture halls tend to be bigger and have all of the students facing one direction towards the professor, while active learning spaces have round tables that allow students to be seated in groups of 3-6, while the professor freely moves throughout the classroom, such as we have adapted here at the University of Arizona.

Other than the type of classroom the students learn in, the use of electronic devices also have an impact on the way a student learns. Since, the 2000s, computers and the use of the Internet have been heavily incorporated into curriculums. Students can now search for information about anything online, and write reports on topics they had physical experience with just searching a key word.

There has been much debate on whether or not the use of electronics is effective in classrooms.
Types of Learning:

As discussed earlier, teaching and learning have been key ways we, as humans, have passed down information, knowledge, and traditions. Every person has a different way of learning that works best for him or her. Not everyone can approach learning the same way, as every person has a different background and different struggles. Researchers have found that there are seven main types of learning. A few more have been written about, but the major types of learning styles include: Visual, Aural, Verbal, Solitary, Social, Logical, and Physical. Each way of learning is unique on its own, as it is associated with the activation of different regions of the brain. A student can always use more than one type of learning to help them better understand a topic presented. We will use the topic of the twelve cranial nerves as our example of each type of learning.
Visual learning, also known as spatial learning, involves the use of images, pictures, and other visual aids to help the student remember or understand a topic. Colors, images, spatial organization, and different types of layouts can aid a special learner. A spatial learner also uses mind maps, replaces words with pictures, and uses different colors to highlight major concepts.

The visual learner uses the occipital lobe in the brain, as that is the region that manages the visual senses. An example of visual learning would be looking at a picture that contains all of the cranial nerves and memorizing the placement of each. The image above shows all of the cranial nerves, and they are all labeled. A visual learner would view the image and memorize it.

Aural learning, also known as auditory-musical learning, involves using sound or music to help learn a new concept. These types of learners use sounds, rhymes, and songs while learning or making mnemonics. An aural learner uses the temporal lobe, which handles hearing. A way to memorize the 12 cranial nerves this way is to turn all of them into a song. The following video shows a student who created a song to learn the names and functions of all the cranial nerves:

https://www.youtube.com/watch?v=I BuPzn_8UTc.

An example of the lyrics include:

Oh, Oh, Oh, To Touch And Feel Very Good Velvet. Such Heaven,
Oh, Oh, Oh, To Touch And Feel Very Good Velvet. Such Heaven!

Somewhere over the cranial fossa,
Way up high,
Lies 12 cranial nerves that are extremely vital,
But really why/ Why or why?
The olfactory, Optic, oculomotor,
Trochlear and Trigeminal,
Abducens and Facial,
Vestibulocochlear, glossopharyngeal,
Vagus, Accessory and Hypoglossal nerves,
Let's see what each serves.

Another type of learning is verbal learning, or linguistic learning, which focuses on using words such as in writing or speech. These types of learners tend to use word-based techniques, or record scripts to listen to them later. They also read content aloud or to others by being dramatic or role-playing. For verbal learners, they use specialized regions in the temporal and frontal lobes of the brain called the Broca’s and Wernicke’s area. An example of this would be learning the cranial nerves by repeating them and speaking about them with another person.

The fourth type of learning is solitary, or intrapersonal learning, where a student prefers to study alone. These types of learners use an internal drive to motivate themselves to get work done without the influence of others. They have a set of goals and objectives and find it easier to work alone. The solitary learning style uses the frontal and parietal lobe, along with the limbic system. In this type of learning, the student could use any of
the above techniques but rather than talking to other people about the cranial nerves, they could talk to themselves or quiz themselves.

Social, interpersonal learning is the opposite, as the student prefers to work with other people or in larger groups. This type of learning involves team building and using more of a variety, as there are many people that can contribute to an idea. The social learning style uses the frontal and temporal regions of the brain, along with the limbic system, as it is responsible for various moods and emotions. In this type of learning, the student could quiz each other on the cranial nerves and see where each student is at in terms of their learning.

The 6th type of learning is logical, or mathematical learning where logic, systems and reasoning aid the student. These learners focus on the reasoning behind a concept, which helps them create a bigger picture, create lists from the main points of a lecture, and analyze a topic through the use of logic. This learning style uses the parietal lobes of the brain, particularly the left side, as it is responsible for logical thinking. The student could memorize and learn the cranial nerves by reasoning through where each nerve is placed in the brain. For example, the optical nerve is near the eye, so it transfers visual information to the brain.

The last type of learning is physical, or kinesthetic learning, involves the use of the body. These students use their hands, body, and the sense of touch to associate physical feelings with the topic presented. The use of tangible objects and drawing things out will also help the learner remember what he or she was learning. For physical learning, the parts of the brain used are cerebellum and motor cortex, as they are responsible for our physical movement. In this type of learning, the
student could use a model or dissect an actual sheep brain to see where each cranial nerve lies.

Types of Teaching:

Authoritative or lecture style is what is typically used in university settings. This type of teaching is very professor centered. The professor has a lecture and the students solely listen, take notes, and absorb the information. This type of teaching is very common especially in courses where there are hundreds of students.

Traditional lecture halls contain seats that are all facing the front of the classroom toward the lecturer. The type of teaching is one sided; there is no feedback from the student during class.

Demonstrator or coach style is used by teachers that stay in their authoritative style but instead of lecturing the entire time, the professor
Saeed demonstrates a concept to the class and shows the students how the concept is applied. An example of this would be a chemistry professor performing an experiment in front of the entire classroom.

Facilitator or activity style is used by professors that encourage students to think critically and ask them to apply the concepts. This allows the student to retain more information, as they have to apply it to the questions asked by the professor. This type of teaching is mostly used in the collaborative learning spaces.

Delegator or group style is mostly used in lab or settings where there is peer feedback. An example of this would be in smaller classrooms where students work together to perform an activity or task.

Hybrid or blended style is used by professors that relate their interests and personality into the curriculum. An example of this would be when Dr. Cohen incorporates biking into her cardiovascular physiology class. She uses examples of exercise and how that relates to heart rate or cardiac output.
Learning at the UA:

History of Collaborative Learning Space (CLS)

The Collaborative Learning Space was created in the Science-Engineering Library at the University of Arizona in the Fall 2014 semester. It began as a pilot in order to improve the undergraduate STEM courses. According to Jane Hunter Ph.D, "what a CLS is, it's basically tables and chairs, furniture that groups students together in small groups so that they can work collaboratively during class. These rooms are really designed for collaboration and that's why we like to call them that." The key component of the CLS is the collaboration. The room contains furniture that is designed to include all students in discussions. The professor is also able to interact with students by walking around the room during times of discussion. A unique component to the CLS is the use of preceptors. Preceptors facilitate the learning of students. Often times preceptors push the students to think on their own; they ask questions to each table such as “What do you think about the question? Do you understand what the question is asking? Why do you think this is relevant?” They also clarify and re-explain concepts. Overall, the CLS has allowed many different professors in various departments to use an unconventional, and more engaging approach to learning.
Jane Hunter Ph.D is the director of Academic Resources and Special Projects at the University of Arizona. She is very involved in the implementation of the CLS at UA. After speaking with her I learned a lot more about the CLS and what it has to offer. The University of Arizona has a collaborative learning space that seats about 266 students, and it is one of the largest in the nation. Along with this there are about ten more spaces around the campus, each varying in size from seating 24 students to the largest room seating 266 students. Each room also has a variety of courses being taught there. The collaborative learning spaces are equipped with round tables and rolling chairs, there are projectors and TV monitors around the rooms, and occasionally a microphone may be passed to students who may have questions or comments. The students are also provided with small whiteboards and dry erase markers to do the problems presented to them by the professor. Once they have completed a problem, the
professor, TA, or preceptors can come and check the student’s work.

The collaborative learning space also has a very unique component to it. Many professors who teach courses in the collaborative learning space have preceptors and teaching assistants. Preceptors are students who have previously taken the course and have earned a grade that reflects that they have mastered the content taught in the course. Courses vary in the number of preceptors that walk around the room to facilitate the learning of the students. Preceptoring is a fairly new concept that is highly used around the UA campus in all different departments.

Teaching and facilitating are very different. Teaching is what the professor does. Students attend the course to often learn a topic for the first time. The professor lectures, and the students take notes and learn about the topics that will be assessed later. Facilitating however, is different in that students are given a topic, and rather than seeing it for their first time, they have already learned it and are just applying a concept. Often times preceptors push the students to think on their own; they ask questions to each table such as “What do you think about the question? Do you understand what the question is asking? Why do you think this is relevant?” They also clarify and re-explain concepts, they do not teach a completely new topic to a student. Facilitating is leading a student to the correct answer or the central goal of an assignment. The answer is not given; rather the student is led to the correct answer through a series of tasks or questions given by the facilitator.
Immunology & Cardio-physiology in the CLS

The University of Arizona has started to implement the use of the collaborative learning space in a variety of classes. Classes such as general chemistry and biology are often taught in the CLS. In these classes professors are able to ask the students to apply concepts learned in class to answer problems that often have a solid answer. These questions typically include the use of an equation or formula to solve. In contrast, physiology and anatomy are typically taught in lecture halls in which the professor lectures information to the student and the students use the notes and lectures to solely memorize the information. However, Dr. Zoe Cohen, despite being in the Physiology department, decided to take a different approach.

Dr. Cohen has decided to move both of her classes from the traditional lecture halls into the CLS. You might be wondering how critical analysis and thinking is useful in classes where students typically study using route memorization. Dr. Cohen believes that students should discuss the content learned and apply it to issues or problems that could arise in real life situations. She asks a variety of questions in which she goes a step further to really get the student thinking about what they have just learned. Since so many students in our physiology major are thinking about medical school or other pre-health professional schools, it is crucial that they are able to apply what they learn to real life scenarios or even be able to relate one concept to another. Being a doctor, it is crucial to relate the information that you’ve learned in your schooling to aid a patient who may be suffering from an illness. Memorization is not going to save the patients life, rather,
looking at everything with a holistic view will allow the patient to be treated fully. This is why Dr. Cohen thinks the students should be challenged and discuss what the answers to the questions she asks may be. From the change of moving into the CLS, Dr. Cohen has noticed an improvement in her exam scores. After the end of the first exam, Dr. Cohen surveys students to ask them how they feel about the CLS in comparison to other classes/learning styles. Students always have a mixed response. Some students prefer to absorb the information and take some time to digest what they just learned; these students don't feel as though just listening to the material once has allowed them to grasp and apply the material to the question. Other students, however, thrive by discussing with other students.

The courses taught by Dr. Cohen in the CLS include Cardiovascular physiology (PSIO 485) and Physiology of the Immune System (PSIO 431). Dr. Cohen has taught these courses in the traditional settings as well, but after the CLS was introduced at the UA, she has transformed her courses to better suit the curriculum in the collaborative learning space.

Does it work?

Many students and teachers agree that the CLS has had a huge impact in their teaching and leaning. The preceptors, TAs, and professors find it much easier to navigate around the classroom. Interacting with students is made not only easier but more personal as well. Dr. Cohen mentioned that it really makes her love her job even more. We tend to neglect the well being of professors, but the professors are
the ones who work at the university. If we ever feel tired during our four year undergraduate education, imagine how the professors feel, who essentially work here for their entire careers. Overall, it helps with the well being of the professors since they are able to really get a scope on how the students feel about the material and they are also able to hear new ideas that students have even if they may be incorrect.

In terms of learning, the research shows that active learning can be much more effective then regular lecturing. Most students love the room and the activities and discussions that come with it. However, not everyone thrives in this setting. It is important to know how to use this room. Almost every professor recommends reading about the material prior to class so they are not being blind sided by completely new information, rather they have a basis of the information. It is also important to pay attention during the entirety of the class. The discussions are not helpful or impactful if the group focuses on what they did Saturday night rather than talking about how the Frank-Starling concept impacts the cardiac muscle.

According to many students who have taken PSIO 431 (Physiology of the Immune System, the use of the CLS really helps them engage in class and master the concepts. Below are some of the comments student’s have written in the online Teacher Course Evaluation.

• “I like the discussion based classroom because it gives the students a break from the long lecture to absorb the material and bounce info off one another.”
• “I was pretty surprised when I was studying for the exam that I actually remembered a lot of discussions we had in class, and it was easier for me to retain information compared to in a primarily lecture-based class.”
• “Loved the interactive learning style used in this course, I felt that it made discussion much less ‘scary’ and instead was positively encouraged. The most class participation I’ve ever seen in a college class.”

• “I enjoyed talking about real world issues in class so that I could connect what I learned from the readings to it and think critically. I believed it really helped solidify the information”

**Conclusion:**

After both working with Dr. Cohen as a preceptor for PSIO 485 and taking PSIO 431 in the CLS, I learned that the it has a huge impact on the students and professor. The professors feel that they are getting to know the students better. By hearing the students answers, the professors are able to clarify misconceptions or miscommunications about the topic presented. Through their student interactions, they feel much more rewarded, and their days are less repetitive.

The students also feel very engaged in these classrooms. If they use the classroom the way it is intended, they see an positive impact in their exam scores, as they feel their retention is much higher through the class discussions. They are also able to get to know the professor and ask questions during designated class discussion times. The students also love being surrounded by a support system of their table mates. They are able to make new friends, communicate, and discuss issues they might be having in the course. Of course, this can be done in a regular
classroom, but the round tables and collaborative environment makes the student feel more comfortable when doing so.

As for active learning: The effectiveness of any single approach to teaching is difficult to quantify, but there is evidence supporting the superiority of student engagement in the academic setting. In contrast with the conventional emphasis on individuality and competition, evidence demonstrates that collaborative and cooperative environments are more conducive to learning. Additionally, Problem-based learning, which is a highly variable approach in its own right, has contrasting levels of improvements depending on what factors are emphasized. Improvements can be seen in different areas including information retention, critical thinking, study habits, student attitude, and problem-solving skills. Active learning has shown to be both impactful for students and the professors teaching in these rooms.

**Personal Experience in the CLS:**

Since I was a child, I always loved teaching others. I would take my dolls and set them all up to learn the alphabets and colors. I would even force my little cousins to learn about multiplication and division, despite their strong desires to go play outside and run around. I had heard a lot about preceptoring even before I came to the U of A. My aunt, who called me “ustani,” a word in Urdu that means little teacher, had told me that is was an amazing experience and many medical schools would love to see it on my resume. During my first semester my freshman year, a professor in my Mexican American Studies general education course offered
all the students in the class a preceptorship for extra credit. Being a typical pre-med student, I was the first one to raise my hand, as I couldn't let the opportunity slip. As a preceptor, I would lead the class discussions and help the professor hand back assignments or write examples on the board while she lectured. After preceptoring the course, I decided to do it again. I preceptored the course for four semesters, not because I had to or because I needed to check a box on my resume, but because I really enjoyed helping and making connections with not only the students but also the professor.

After this amazing experience my freshman year, I was inspired to preceptor in some science courses. I would always spend most of my free time in Koffler 202, a room in which all the general chemistry preceptors hold their office
hours. Since I loved the topic of chemistry and was doing fairly well on the tests, I would help out my peers. I always felt like a preceptor. Once I became a preceptor, I always wore the badge during my office hours with honor. My favorite part was that I was not only getting to help the students, but I was also able to make connections with them and mentor them in issues I had when I was in their position.

In my undergraduate experience, I was fortunate enough to preceptor ten different courses, each unique in its own way. These courses include CHEM 151, CHEM 152, MAS 150, PSIO 201, PSIO 202, MCB 170, PSIO 485, CHEM 241A, CHEM 241B, and PSIO 295H.

When I took general chemistry, the CLS had not been created, but there was a lot of research going on in the classrooms. I remember there were video cameras all over the classrooms to record how the students were learning in the lecture rooms. The preceptors would usually stay in one seat the whole time, some would walk around and help other students, but it was extremely difficult for them to squeeze through the rows to students to answer a question of someone seated in the center of the row.

By the time all the general chemistry courses had been moved to the CLS, I was beginning to preceptor. I found it much easier that I didn't have to squeeze through rows and I could easily help anyone rather than only those that sat on the end of the rows. I also found it really rewarding when certain students would ask for my office hours or would always raise their hand to call me over when they had a question. I have also preceptored in a regular classrooms, and it was no where nearly as rewarding because students never get to know who you are. There aren't many
active learning questions and when a question is asked many students sit quietly rather than actually discussing the content. I can’t blame them, as they would really have the turn their whole body to talk to someone, as they are all in secured chairs and facing the front to the classroom.

Additionally I have preceptored in both physiology 201 and 202 labs. The lab most closely represents the CLS because students are allowed to discuss topics and they are able to face each other and engage in discussions about what they are learning.

Besides preceptoring, I have also taken a course in the CLS. I took PSIO 431, Physiology of the Immune System with Dr. Cohen! I found this course extremely different than the rest. I was able to ask questions whenever I wanted to. Since I already knew Dr. Cohen it didn't help me get to know her more, but I feel that if I hadn’t known the professor I would have used that opportunity to be recognized by the professor and get to know them this way as well. In terms of learning, I have a short attention spam and so I easily get lost during discussions or during the lecture portion, however my table groups and preceptors really aided me in getting the information I may have missed during my space out. But I do feel that the class discussions allowed me to get to know other students and form study groups that really helped during exam weeks. I was also reminded of certain discussions when I was taking the exam!

Overall the CLS has had a huge impact on my college experience, and I love talking to others about their thoughts and experience on the room.
Poster Presentation:

Learning to Learn – A Look into the Collaborative Learning Space!
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Abstract
Learning and teaching are essential components of the human life. This is the way we grew and spread our ideas and knowledge about various topics. The Oxford dictionary defines learning as “the acquisition of knowledge or skills through study, experience, or being taught.” The Collaborative Learning Space is a recent addition to the University of Arizona that helps students engage in active learning. For my honors senior thesis, I worked with Dr. Cohen to get a closer look at how we learn and what learning is like in the CLS.

How We Learn
Every person has a different way of learning that works best for him or her. Not everyone approaches learning the same way, and every person has a different background and different struggles. Researchers have found that there are about seven different types of learning. A few more have been written about, but the seven main types of learning styles include Visual, Audial, Verbal, Solitary, Social, Logical, and Physical. Each type of learning is unique in its own, as it is associated with the activation of different regions of the brain. A student can always use more than one type of learning to help them better understand a topic presented.

The Lecture
Lecturing, also known as “the sage on the stage,” is used to present various types of information through one person to a wide audience. Many colleges and universities use this form of teaching in lecture halls that can seat hundreds of students who watch the professor teach. Lecturing was also used in the University of Bologna, where the lecture would speak while the students would listen, take notes, or sleep, as depicted in this painting. Typically, the presenters of lectures use cue sheets to outline or read notes to their audience, and the audience would listen or skip notes. More recently, people use question-and-answer techniques, discussions, or even PowerPoint presentations to present information.

Active Learning
It is argued that active learning is as important a concept long before it was given a name. Active learning is acquiring skills and knowledge through actively attempting and practicing them. The argument holds that before lecture-style teaching was introduced, active learning was being done in our everyday lives, as that is how we learned how to hunt and gather, start a fire, and take care of children.

Active learning is a broad categorization that includes different instructional approaches such as collaborative, cooperative, and problem-based learning. The effectiveness of active learning is still a topic of debate in the academic community, as every student and professor has a different way of learning and teaching. There is typically no “one-size-fits-all” approach.

Does it Work?
According to many students who have taken PHSO 431 (Physiology of the Immune System), the use of the CLS really helps them engage in class and master the concepts. Below are some of the comments students have written in the online Teacher Course Evaluation.

- “It is the discussion-based classroom because it gives the students a break from the long lectures in about the material, and because it’s off one another.”
- “I was pretty surprised when I was studying for the exam that I actually remembered a lot of information we had in class, and it was easier for me to remember that information when we were actively engaged in the learning process.”
- “I found the collaborative learning style used in the course, and it made discussions much more engaging and turned what was previously stressful. The most I’ve participated in a class that I’ve really learned from with the techniques in it, and I think actually, I believed it really helped me the most.”

Conclusion
Although the effectiveness of any single approach to teaching is difficult to quantify, there is evidence supporting the benefits of group engagement in the academic setting. In contrast with the conventional emphasis on individual and competition, evidence demonstrates that collaborative and cooperative environments are more conducive to learning. Additionally, Problem-Based Learning, which is a highly variable approach in its own right, has consistently demonstrated levels of improvements depending on what factors are emphasized. Improvements can be seen in different areas including information retention, critical thinking, study habits, student attitude, and problem-solving skills. Active learning has shown to be both impactful for students and the professors teaching in these areas.

References
- TCE Comments regarding the CLS (PISO 431), Physiology of the Immune System, taught by Zoe Cohen, Ph.D.
Interview Transcriptions:

CLS Interview with Dr. Cohen

- How did you learn about the CLS and how long have you been involved?

  I learned about the CLS when Dr. Claudia Stanescu sent me an email that she had received saying that they had built these rooms. This was I think in the Spring of 2015, and she sent a thing that said she was taking applications so I thought what the heck! I’ve been sort of intrigued with the idea of flipping classrooms in the past so I filled out an application, and luckily I got chosen.

- What is your favorite part about the CLS?

  My favorite part about the CLS in terms of how it has changed my teaching, I love the interaction I have with students now. I actually feel like I get to know them in a much better way than I did when I taught in a traditional classroom setting. I really love when they come up with answers to questions that I would have never thought of. So the interaction really makes me excited to go to class everyday.

- You teach immuno and cardio, which one do you like teaching more in the CLS?

  So, now I have taught both courses twice in the CLS. I’ve taught immuno Fall of 2015 and Fall of 2016 and cardio Fall of 2016 and Spring of 2017, and I can’t really pick a favorite because both of them have the student energy which makes it so fun, so I have to say both because in both cases the interactions I have with the students are just mind
boggling. They're just so good that, like I said, I'm excited. It makes me happy and
excited to teach now. I was kind of getting a little burnt out but now I'm not.

- Can you give me an example of an interaction that you remember?

  I’m trying to think. There’s so many good ones but just sort of a basic one is when
I bring up a point and say hey how would you test this? How would you test this
phenomenon that were talking about? and I have maybe some basic ideas in my own
head about how I would personally go about testing it, and the students consistently
surprise me with things that are so outside the box, maybe completely unreasonable and
impossible to do, but they're thinking and its just so cool to me when students come up
with things that I've never even thought of. It just makes me so happy. Those are the days
I leave the classroom and I have to call somebody and tell them how excited I am.

- Going off of that, you enjoy the CLS but do you know any professors who use the CLS
  and disliked it?

  Oh that’s interesting. I know that there have been a few professors that really did
not embrace the fact that when you're teaching in the collaborative learning space, you're
not the center of attention. You can’t be because there are times that people can’t see you,
especially in the Science-Engineering Library. So, I think, as you know, the old term we
used to call ourselves when we lectured in a traditional classroom is “Sage on the Stage.”
All eyes on me, look at me, look at me talking to you. In the CLS, they're not. Most of the
time their eyes are on the screens that are around the room. You're just really helping
guide the situation. I had heard, I don't know what's happening now, but I’ve heard that
the faculty who really, really embraced being the center of attention had a really hard
time in that room because all eyes were not on them. That kind of, I think, bothered them.
I think other people might have a problem, again if you're not willing to share the load with the students. When I first started teaching in the room, actually before I started teaching in the room, I met with Dr. John Pollard, and he asked me how much of what you say is necessary for the students to hear? I had only taught in a lecture format, and I said I think pretty much everything I say is super important; I mean felt like every word that drips from my lips is like a pearl, and Dr. Pollard just looked at me, and I began thinking, I thought oh okay maybe not. Okay, well, alright, I guess, okay, alright, probably not. And that was the kind of thing where you began to say okay, I want to tell them all these things, they're not going to remember all these things, so why don't I really sort of try to limit what I'm talking about to the really interesting or really important things. Everything else is fluff. Figuring how much I could take out, so that we could have these conversations was one of the hardest things, and I think faculty who are unable to give up portions of their material have a really hard time in these rooms.

• What would you change about the collaborative learning space?

I think not a heck of a lot. I mean other than the doceri machine kicking me out all the time. I like it. I think a lot of people would say get rid of the pillars if you could in the Science-Engineering Library, but at the same time I kinda like it because you know I get it. The faculty shouldn't be the center so it's okay when you're not in view. Yeah, so not a heck of a lot other than the technology not always working when you want it to work. Other than that I think not a lot.

• Do you think the CLS suits everyone? You talked about teachers but what about students?
Oh for students. I think once students embrace it, once they sort of give over to the technique, I think it can benefit any student. You will have students that say, well I don't wanna collaborate I am a solo learner by myself. But sort of when they are forced into discussion they seem to really strive. I think there are ways to maybe improve that I probably don't do or don't know about. I think truthfully everyone would benefit, even if you're a very quiet person, and you're not actually participating in the discussion. I think hearing the discussion, hearing how people think. I don't think there is a down side to it. Whether students would tell you something different, but I don't know. But I think it would be interesting for the most part the students seem to, once they realize the benefit, it can't be a hard sell. Where again I say, you know what I'm not doing the heavy lifting, you guys are. I'm just here guiding you a little bit. I think that’s a huge shift, especially truthfully for my students who are for the first time getting this huge shift in their junior and senior years. Whereas many of the other departments are starting this as freshman. So I've been amazed and super happy with the fact that my students, my juniors and seniors, have embraced it the way they have. I haven't had any push back that I know of.

- What type of teaching and learning is used in medical schools, because you teach at the medical schools as well, and do you think the CLS could be established in medical schools?

Very timely question! So right now most of the lectures are held in a basic lecture format, although they do have what they call small group sessions, which is more collaborative. They're in groups of six to eight and they're usually discussing a pathology image or something like that. So they do a little bit of the sort of flipped idea. Most of the basic lectures so far have been just basic lecture format. The University of Arizona’s
Medical School has really bought into the idea that collaborative learning increasing retention, increases understanding. Because of this in the new medical education building, that they're building right now called the health inspiration something something. They're actually not building a single regular lecture room, all the rooms are gonna be collaborative spaces. There’s pushback in the new building. There is pushback from the faculty who are scared to try something new, but the administration has bought in, have seen the literature have seen the research, and is ready to make that kind of shift. So the new building will be 100% collaborative. More and more classes will move in there.

- What future plans do you have in or with the CLS in terms of teaching, improvements, etc…

Every semester I try to improve, every semester I try to find questions that really work with the students to increase learning. I really enjoy in my immunology course having the notes that they read ahead of time. Part of my future plans is to create a set of notes for cardio in the same way, so that they have some pre-reading prior to class. We’re hoping that my excitement my success, I guess, in teaching in these rooms has really sort of brought more people interested, more people in the department interested in trying collaborative learning. I’d love to be helpful in helping them create these types of courses. We’re hoping to develop a new pathophysiology course that would be created from the ground up for a collaborative space. Which would be different than me in the sense retrofitting both of my courses to it. Actually developing it with this type of teaching in mind. I think it’s the wave of the future, and people are excited. It really does make such a difference, not just for student learning and student retention and all of that,
but faculty enjoyment, faculty happiness, which we tend not to worry about so much, but I think is kind of important. So I'm all in, and I'm hoping to be that forefront of recruiters for the next generation.

**CLS Interview with Jane Hunter**

- Tell me about the CLS at the University of Arizona.

  So right now, about three years ago, we worked with Dr. Pollard, who had a real interest in trying to use the strategy he uses in an environment that was more suitable to the types of pedagogy he uses. So we did a pilot in this building in the science engineering library and we transformed it into a CLS that seats 260 students which is very, very large. It is probably one of the largest in the nation. But we had a pretty successful pilot so we made plans to forge ahead and permanently transform that room into a CLS. So for us what a CLS is, it’s basically tables and chairs, furniture that groups students together in small groups so that they can work collaboratively during class. So that’s probably the single most important feature of a CLS. We also have increased network capacity so that if students are expected to be on their devices they will have sufficient bandwidth that they can be online all simultaneously. We also have a lot of projectors and screens or monitors so that every student from every seat has a good view of the materials being presented in class. So it’s really the furniture, it’s viewing what’s being presented, it’s bandwidth, and then we do
use whiteboards, and table top whiteboards. As low tech as that is it really seems to be an effective strategy. And so that is what our collaborative learning spaces are. and we now have ten of them on campus, we went from 0 to 10 in the span of two years.

- Where are they located?

They're all over campus, and I can send you a chart that shows where they are all over campus, but we purposely chose to put them at different locations around campus because we wanted a lot of people, a lot of faculty members, a lot of students to see them and to have the opportunity to experience either teaching or learning in them. So they're scattered all over campus, there a lot of different sizes, they range from. We now have one that is only 24 students up to the very largest is 264, so we have a pretty wide range in a variety of classes as well.

- How is the CLS at UA different than other CLS?

So some institutions have a very prescribed model that they use. A good example is the University of Minnesota, who we have really learned a lot from their experience. What they chose to do, is they chose a very specific model, they had a building that would house all their CLS and they built basically that same room over and over again in different sizes. And they always use tables of nine, basically the intent is to sort of have three groups of three at these tables of nine and that model seems to work for them. We decided nine is too big; in fact downstairs (the science-engineering library) is the only room that has six students, all of the rest of our rooms have just four students. And actually our faculty have determined that they prefer the groups of four over the groups of six. So as much as we keep saying let’s try something different, we always seem to go back to these groups of four because it seems to be a model that works well for us. So the
number of students that other institutions have at a table will vary and some institutions will use a lot of technology in the classrooms, so they might have tables with built in monitors so that that table can project from their devices on to that monitor. Others will have very sophisticated sound systems in them. We didn't feel that that investment was wise for us. We felt better about sticking with pretty low tech and building as many rooms as we could with the funding we had. And so that’s probably the biggest difference is what type of furniture they chose and the amount of technology in the classrooms, otherwise the differences are pretty subtle.

• What inspired you to implement the CLS here at the University of Arizona?

  So, I think probably, the key impetus was we had a grant from AAU, which is the Association of American Universities, to improve our undergraduate stem courses, primarily our foundational courses. And that group brought together some of the leading educators on our campus, including Dr. Pollard. One of the things they really wanted to do was explore other types of classrooms, basically we call them collaborative learning spaces, a lot of schools call them active learning classrooms or active learning centers. We just kinda liked the word collaborative, because that’s just really kinda key. I mean you can do a lot of active learning and it doesn't necessarily mean it involves collaborations. But these rooms are really designed for collaboration and that’s why we like to call them that. Then when we did that pilot I told you about, that’s what really got the ball rolling for us and we realized there was a tremendous interest in rooms that facilitate active learning, and so that’s why we forged ahead.

• So how long did it take you to start the project and continue it?
So the pilot was really an amazing effort, I mean we really only got started during the summer and by October we had the pilot up and running with eight different faculty and eight different classes being taught in the room. And it really took a collaboration from all sorts of different units across campus. It was the library of course was instrumental in the process, we had faculty members who played an important roll, our information technology group called CTS, which stands for classroom technology services, they were involved. The disability resources center were involved. I mean it was just the Provos office, the office of instruction and assessment, there was just a slew of people who just contributed in a big way. It was just an amazing collaboration, which we loved it because it exemplified what we were trying to teach our students to be, which is good collaborators. So it was kinda of a sorta of a nice symmetry there. So that first pilot was very very fast paced. We held the pilot in October time frame and by August of the following fall semester we had five rooms totally built out and we also put out a strategic plan that said lets build a minimum of five new rooms each year. And so far we’ve completed two years, and we have been successful, and we have ten collaborative learning spaces.

- Are you guys going to expand that too?

   Yup, we have submitted requests for funding to continue to do that for five years and hopefully five more after that, but right now we’re looking at a five year horizon, and we have early indications we’ll get the funding approved.

- Based on that question, what were the rooms before they became collaborative learning spaces?
So downstairs, the room here in the science engineering library, was a journal room, which literally had newspapers and articles, magazines and things of that nature. Libraries for the most part don't have journal rooms anymore, and so they were repurposing that space anyways. So that was unique in that it had a different purpose. All the other rooms have been traditional classrooms and we've transformed them from traditional classrooms into the collaborative learning spaces. When we do that, one of the outcomes is that, or impacts is that the number of students that fit in the room is reduced, so the capacity declines and it typically declines as much as a third. So that adds additional challenges for the people at the university who do room and course scheduling because now they have fewer seats available for students. So that’s one of the challenges, one of the costs associated with transforming existing classrooms. We have other ideas about other spaces that we may be able to transform that were not previously classrooms, so that we could have a net positive, but for the most part we are generally taking existing classrooms and transforming them.

- What more do you want to add to the collaborative learning space?

Right now, I think the most important thing we can do is to help educate faculty how to use the spaces. So the spaces themselves, we feel quite confident that they are meeting the needs. But I think what we need to do is continue to help faculty figure out ways to effectively use those spaces without adding too much burden to their workload. We don't want faculty to feel like its a huge burden to take on a course that’s taught in one of these rooms. So the more we can provide services and help to support, the better off they'll be in actually using the rooms as they were designed.

- So not necessarily adding the technology and stuff?
No I don't think so, as we went through this five year plan, we readdress this question, in fact every year we readdress that question: Do we wanna add more technology? Do we wanna try different furniture? We basically start with a clean slate every time and say okay we've learned a lot in the last year, now what do we want to do kinds of things? Once again we just went through a five year plan and there was no strong demand or requirement for more technology in the classrooms. One of the areas that we struggle with and still don't feel like we have a great solution to is in the very large rooms, how to give the opportunity for students to kind of communicate with the whole class. So we use hand held microphones, we tried table top microphones, those didn't work great. The hand held microphones work well for some instructors, not so well for other instructor. So that’s one of those areas we have not found a good solution, but we will continue to investigate what options are available, and we’ll hopefully continue to make progress on that challenge.

- Did you have anything like this when you went to college or other education levels?

No, and I'm a great example, because I did my undergraduate here, at the University of Arizona, and I would say there were zero class rooms that were taught, that were designed that way. I would say the vast majority of the courses I took were strictly lecture based. And I was in engineering, I have an engineering degree and I suppose there were some classes maybe that we did some problems in class, but for the most part we mostly went to lecture. So this is a big transformation for the university, and were very proud that we are impacting the culture here at our university because in general it has historically been a typical institution that has primarily lectures and very little active learning in the classroom.
• What improvements do you think the CLS could use?

You know I think again its more about how they’re used than what the rooms actually physically are. I think some faculty members in the large classrooms have not quite figured out how to effectively use their learning assistance. So whatever we can do to help them prepare their learning assistance and help them, and provide them with strategies to help them be more effective I think is probably the best investment on our part.

• Same with how the students interact in the room?

Yeah! Im glad you mentioned that because that is also one of the things we feel a responsibility to do is not only teach faculty how to teach but also teach students how to learn, and so we've recently started a new series called the Learning to Learn series. What that does is it basically asks our faculty members to relay the message to our students about what works and what doesn't work in terms of learning. And so we teach them about the importance of retrieval practice. Trying to test yourself rather than re-reading or highlighting your book and spacing out your practice and doing questions like why does that work making connections between the things. So that’s a really important part.

• Where is that program?

It is, we have a website, we are sending emails out to the faculty members but the website is available to everyone and it is academicaffairs.arizona.edu/uali under the learning to learn tab. SAIL fellows is also a part of the UA learning initiative.

• Have you taught in the CLS and how does it differ from regular lecture rooms?

I have used it. I have not taught a full semester course in there, no. I have certainly done a lot of stuff in there. What I think happens in those collaborative learning
spaces is I students behave differently in there and faculty, everyone behaves differently in that room. It just is a natural environment for collaborating. Students tend to communicate more, they tend to interact more, they tend to engage in conversation more readily, and it’s all in a very, it seems quite natural. When you teach in a space like that its kind of like well this is how we ought to learn isn't it? Rather than someone trying to open a lid and pour it in, I mean let’s talk about it and let’s explore these ideas. it just creates an environment conducive to exploring and developing deeper understanding on the material that’s been covered. On the flip side of that is that you typically don't actually deliver as much information. But, there so many other medium now to deliver that it sort of becomes irrelevant that did you cover everything during class because you have other ways of “covering” material and you know what I say is just because I said something doesn't mean you learned it. There is sort of this naive impression that we had that oh wow, I said it so they learned it. Well that’s not how it works. I’m probably better off having you read and do some questions and practice retrieving that information and then giving you quiz, the chances are probably better that you will learn more that way than if you were i just explained it to you. Even though some of our faculty members are incredibly effective at explaining. They are very eloquent, they are well spoken, they know how to explain things, but even then until a student grapples with the information, until they really dig into it themselves the leaning doesn't really happen. I meant they will kind of get it superficially, but it won’t stick. And that’s sort of the whole “Make It Stick” idea. It just doesn't stick if you don't kind of wrestle with it for a little bit, and that’s sort of the whole point of those spaces. Take the time where you have all the students together with a common goal which is to learn the material and get the grades, but they have a
common goal, why not use that time for them to work together as a group rather than for you to just sit there and talk at them. It just makes a lot of sense.

- What other faculty are involved in this project?

If you go to academicaffairs.arizona.edu/cls that’s collaborative learning spaces, and you'll see a bunch of choices and one of them will be planning for teaching in a CLS. You'll see there is a schedule, if you just click on it, it'll show you the schedule for all ten of the rooms. So we have ten of the rooms and at least a dozen classes in all of those rooms, so that'll give you lots of names of people teaching in those spaces. Some of them are new to them some of them are very experienced. Most of the people who are teaching in this room downstairs and then there is also one room in bio sciences west, those are our two largest rooms. Those are the people that probably have the most experience. Some of the smaller rooms we have people who might be their first time teaching in those spaces.

- I know that UA has been inspired through other universities, but has UA inspired other universities?

Yeah we really have. I have had the opportunity to present at a couple different conferences. A large number of our faculty members, Dr. Pollard has presented at a number of different institutions. Dr. Narter from psychology has. Dr. Boulder from MCB has. Lots of our faculty have. Dr. Hans from physics. So our faculty have presented to all sorts of different places across the country and so I am quite certain we have inspired a lot of institutions. And I can first hand talk about a lot of them that have been influenced by our success. Because we’re kind of one of the schools where we don't have huge endowments like the Ivy league schools have, or the private schools have. We're just a
land grant state institution. We don't have very fat budgets. We made it happen just
because we were determined to make it happen, and so I think in a lot of ways were
inspiring because there are a lot of schools like us. They don't have a lot of money, they
don't have a lot of extra money floating around to do things like this. And when we get up
there and say you know we maybe get five rooms done where some of these schools only
get one room in. They kind of perk up and say well at least maybe we can do one. They
start realizing it’s not as much of a impossibility as much as they might initially think.
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- TCE Comments regarding the CLS (PSIO 431, Physiology of the Immune System, Taught by Zoe Cohen, Ph.D.)

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