

My personal learning experience for the Super program.

My initial learning goals

The SUPER (Skills for Undergraduate Participation in Ecological Research) Program is designed for Colorado State University (CSU) undergraduates interested in gaining experience in ecological research. This project lasts for two semesters, which for me occurred in my senior year, and the focus of the two semesters is also different. In the first semester, we mainly studied a series of foundational research skills and pairing with my mentor. I also developed an interest in research in the process of accumulating basic knowledge. In the second semester, I followed the schedule with my mentor and team, mainly completing a bulk of research project works and seminars. When I first got involved with the Super program, my idea was to get in touch with the real and concrete research process, because I had no similar learning experience before. And I eagerly hoped to apply the theoretical knowledge learned in the first three years of university to lay the foundation for future graduate studies or work.



Figure 1: Affected by the epidemic, most part of our projects were carried out online , but we can still go to the campus to learn and communicate with the SUPER team

First contact with the citizen science project

To be honest, I never heard the concept of citizen science and CitSci before joining the project that I joined. But in the first semester of the research, my mentor, Dr. Greg Newman, shared with us a lot of basic knowledge about citizen science, especially the significance, research models and specific feasibility of citizen science. An important concept in particular is that not all research and experiments rely on just the participation of scientists and professionals. The participation of citizens, mainly non-scientists, can be very important for some studies. CitSci is an online data platform that meets the needs of citizen science. The goal of CitSci is to make it easy

for all participants from all over the world to join or create citizen science projects. Regardless of whether the participants have relevant research experience, participants can share data and help each other through platforms and networks. Through the use of platforms and network applications as a means of linking a research community, all participants are offered the opportunity to share experimental data and research experience, which are valuable for answering research questions and writing new research proposals. In general, Citizen Science expands the scope of public participation and increases public understanding of science to promote the progress of scientific research.

The research topic of our group is "Civic Science Applications for the Study of Perennial Grains." which involved working with a partner, The Land Institute (TLI), located in Salina, Kansas. TLI is working with civic scientists to study the growth of perennial grains in different climates and environments, and at the same time encourage participants to be connected with TLI and citizen science. The grains being studied are shown below in figures 2 and 3, the silphium plant and the sainfoin plant. TLI hopes to increase the number of participants to expand the scale of the project to more locations, so they hope to simplify the data collection process with a customized platform. This allows more data to be shared and collected in order to attract more participants. At the same time participants connect with TLI and citizen science. .



Figure 2: The silphium plant, a perennial crop that resembles the sunflower.



Figure 3: The sainfoin plant, a perennial legume plant.

Specific research process

Previously, my understanding of agricultural planting was limited to land contracting or mechanical and automated farming. I am pleasantly surprised by the involvement of citizen science, especially the use of platforms and applications designed to help TLI, agricultural growers, and civic science participants exchange and share planting experiences. The collected data can help more people use the knowledge that is grown to find the best approaches to growing perennial plants and bring related benefits to this community and ecosystem sustainability.

However, due to many personal and external reasons, not all participants are interested in relevant technological development. Our research question focuses on how TLI civic scientists value different features that are being developed by CitSci. Especially for participants they do value some features while others do not agree with all of them. I was also interested about why not all participants keep a positive attitude in technological assistance in the civic science agricultural data collection process. The possible reason is that platform and App features contain different advantages and disadvantages in how they affect the agricultural data collection process for participants.

Dr. Stacy Lynn conducted 18 interviews, some which included participation of our student team members. Each interview contained 16 quantitative questions, seven in reference to the platform features to be developed (Figure3) and nine in reference to mobile application features to be developed (Figure 4). Participants rated the value of each of these features on a scale of 1 to 5, with 5 being very important and 1 being undesirable. These answers were collected and graphed to find patterns within the data and analyze which features are most important to perennial grain civic science participants.

PLATFORM	
P1	Access to resources and information
P2	Communicate with TLI directly via a messaging button
P3	Communicate with others in the civic science project via forums
P4	Communicate with individuals in the civic science project via messaging
P5	Submit observations that you have taken in paper form
P6	See data that you have submitted over time in your profile on the CitSci platform
P7	Visualize results to see your data overlaid with data collected by others in visual format (graphs)

Figure 4: The platforms features rated by participants on a scale of 1 to 5, with 5 being very important and 1 being undesirable.

APP	
A1	Access to resources and information
A2	Submit observations directly via the app in a single step
A3	See data you have submitted over time in your profile on the app
A4	Receive notifications and alerts from TLI
A5	Submit photos of things you have questions about directly through a data sheet rather than email
A6	Record audio responses to upload audio file
A7	Record audio responses for voice-to-text
A8	Complete TLI surveys as a data sheet in the app
A9	Automatically save photos directly to your device's photo stream

Figure 5: The mobile application features rated by participants on a scale of 1 to 5, with 5 being very important and 1 being undesirable.

Conclusion and personal inspiration

The scores of the sub-questions obtained through descriptive statistics and qualitative analysis of contextual comments represent the attitudes of participants towards different technological assistance. The final results show that in many ways, participants gave high scores and are willing to put them into practice, but still need to adjust in detail. However, at the same time, in some other potential proposals, such as platforms replacing emails for communication, automatic photo storage systems, and other issues, participants gave lower scores or controversial scores with a wide range of differences. This represents the negative attitudes of agricultural participants towards these aspects. The specific reasons include: the feasibility of the communication process, the efficiency of the estimated return on investment for the Platform and APP, the personal preference of the participants, etc. This also means

that to a large extent, the scientific and technological assistance and platform sharing of citizen science can indeed help participants to increase planting income, and a large number of participants are willing to actively participate in it. However, considering personal habits and expectations of returns, some proposals are controversial and are not widely recognized. This requires citizen science to maintain a high degree of flexibility in the implementation process, allowing more stakeholders to express their views at the same time to reserve the right to choose. Platforms and organizations can also give participants more comprehensive assistance after weighing the pros and cons. This also allowed me to learn how to consider a more thoughtful and comprehensive model in future research studies, especially in citizen science or projects involving the cooperation of many participants.