During the Fall 2017, students enrolled in AGRI 1050/51 – Introduction to Soil Science were introduced to using mobile devices as a method to collect field data. Initially, this effort titled “Beyond the Walls: Making Mobile Learning Mobile” had four objectives:

1. Use mobile device to collect field boundary data.
2. Use mobile devices to identify soil types.
3. Utilize collected data to create a Best Management Practice Plan (BMP).
4. Utilize mobile devices to be able to navigate to each Soil Science lab.

44 students participated in this mobile learning experience over a 14 week period. During this time, students visited seven local farms as a group to practice using the mobile tools. Students also demonstrated independent abilities to use mobile tools by collecting geographical data and soil type data for a unique soil of their choice. Students used the data collected independently to create specialized BMPs for their respective locations.

1. **Use mobile devices to collect field boundary data.**

   Students visited an area farm to practice using mobile technologies for land measurement. Students were first required to use a measuring wheel to walk the boundaries of a field. Using the measurements they collected, students utilized the traditional pen and paper method to calculate the area of the field being studied.

   Students then used Mapit GIS to determine field size using GIS technologies. Students determined that the type of device played a big role in the accuracy of the field measurements. While some measurements were almost exact, others were not accurate. Although the discrepancies were not planned, they did provide a thoughtful discussion on the limitations of technology in the field. Additionally, students were given the opportunity to demonstrated flexibility as those students with devices that did not give an accurate measurement negotiated with their peers to borrow devices that were more accurate.

One unexpected dynamic of the lab experience was the addition of a drone for field scouting. Initially, inclusion of a drone was not part of the project, but during the summer of 2017 the Technical Education division acquired a DJI Mavic Pro. This device is able to link to a mobile device and allow for field scouting without having to be physically present. This type of technology is beginning to be implemented on farms across America as farmers can use drone technology to check on livestock or crops in the case of extreme temperatures. During the same lab time, students were given the opportunity to use an iPod connected to the drone to collect imagery of the soybean field being surveyed.
2. Use mobile devices to identify soil types.
Students also used SoilWeb, an app made available through the Natural Resource Conservation Service (NRCS) to determine the type of soil at a given location. Historically, in order to determine the soil type of an area, students had to collect a sample or utilize a paper copy of the county-wide soil survey. As one might imagine, either of the processes can be quite laborious. Utilizing the app, students were able to determine in a matter of seconds the soil series name, drainage, depth, and soil layers. Students collected an actual soil sample to test the accuracy of the app and found that across devices, this app could be successfully used to determine the soil type of an area.

3. Utilize collected data to create a Best Management Practice Plan (BMP).

After practicing as a group, the students were asked to choose a location of their own and collect a soil sample from the particular location. Students were to use the Collector App to place a “pin” on a group map from the field. Students were also asked to use the SoilWeb app to find the information needed to properly identify their respective soil samples and include this information in the collector app. Once students returned to campus, they were able to use the collected data to create map layers with the various properties of their soil. Students also combined this field collected data with the results of soil testing done on their individual samples to determine the appropriate fertilizer levels needed to best manage the area.

Students were required to import field boundaries from their work at the actual site, import a map layer from NRCS, create a mapnote to identify the appropriate soil type, and create a presentation with recommended BMPs.

A. Data Collection
Figure 5 Map containing imported layer from NRCS. Using the provided soil survey data, students were able to compare their observations to the data provided through national soil surveys.

Figure 6 Map with mapnote added. Students were able to compare the physical properties they viewed in the field with the imported layer in Figure 5 to determine the accuracy of the National Soil Survey. The box in this photo shows the information added by the student in mapnote form.

B. Presentation

Using the collected information, students prepared an interactive map presentation that included recommended BPMs in regards to fertilizer analysis and recommendations. The slides for one students have been included below.

Figure 7 Intended Use of the highlighted area is corn production.
Figure 8 The student tested the field pH and found it to be 6.0

Figure 9 It is difficult to get an accurate Nitrogen reading because it varies quickly. This student used related literature to recommend 150 lbs/acre of Nitrogen

Figure 10 Soil Tests conducted by the student found the Phosphorus level to be in the medium range

Figure 11 Based on the findings of the soil test, this student recommended 60 lbs/acre of Phosphorus
4. **Utilize mobile devices to be able to navigate to each Soil Science lab.**

Initially, I intended to use ArcGIS to distribute the location of each off-campus lab to the students. Ideally, each week students would open the Collector app, view the appropriate location for the week, and use this tool to navigate to the lab site. I quickly realized that the students did not have enough experience using ArcGIS to utilize it as a navigation tool in the beginning. Therefore, I quickly changed to allow students use the navigation tool of their choice. Most students opted to use Google Maps on their cellular devices as a navigation tool.

**Student Responses to using Mobile technologies in the course.**

At the conclusion of the course, students were asked to take a voluntary survey expressing their views of the use of mobile technologies in soil science. 31 Students participated in the survey.

**MapIt App**

83.3% of students found the MapIT measurement tool to be of use for class work and 81.0% indicated that the app cold be useful outside of coursework. The chart below indicates how students were able to use the MapIT app during the course.
Collector App

80% of students indicated that the Collector App could be useful outside the classroom: 53.3% indicated this could be useful in their personal lives while 26.7% indicated usefulness in professional settings. The chart below indicates how students were able to use the Collector app during the course.

App usage in class

After using apps during the soil science course, a majority of students either agreed or strongly agreed with the inclusion of apps in class.
Conclusions

In using mobile technologies off campus, there were a few observations that need to be noted. First, it would be advisable to test the technology on campus prior to the actual lab experience. Having this exposure before being at the laboratory location would allow students to better utilize their time on task, as opposed to having to spend time learning the app in the field. I would also be wise to discuss with students who will be able to utilize mobile data for the use of apps. After leaving campus, Wi-Fi is not available and not all students have a data plan that allows for the use of these apps in the field.

I do believe the students saw benefit to using apps as tools in the field. Moving forward, I plan to allocate more time to the incorporation of these tools in the course. By introducing the ArcGIS platform earlier in the semester, I strongly believe the presentation of BMPs presentation will be improved. I also believe that exposing students to these tools early in the semester will help add relevance to their usefulness as students build on their knowledge.