Laker Beacons:
An Interactive Learning Context

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Context 3

Learning Goals 4

Assessment Plan 5

Description of Tools, Resources, and Scaffolds Used 6

Appendix 8

Structure of iBeacons usage and application “Laker Beacons” – Beacon Diagram 8

Persona Examples 8

References **Error! Bookmark not defined.**

Topic

In this seminar class for Learning, Design, and Technology (HCI 530), we discussed and explored the various aspects of the learning process. While there may not be supporting evidence for different types of learners (i.e. kinesthetic, visual, or auditory), there is a wide range of research and evidence of learning through experience, age-related learning, distributed intelligence, and more. One of the current challenges in this class is developing a learning intervention in the context of SUNY Oswego. After observing various elements of the physical environment of the campus and surveying colleagues and employees, we developed the idea to use iBeacon technology to bridge contextual data around campus to students. The intervention allows students to receive notifications on their mobile devices while in proximity to the bluetooth signals broadcasted by the iBeacons. It affords learners the process of learning in the context of their physical environment, and are provided with interactive information all based on their physical location.

The identified problem is that some students do not have full knowledge of the available information and services around them on campus and in the city of Oswego. Using location-based iBeacons (or simply Beacons) and a mobile application (Laker Beacons), our goal is to enable students to learn through experience, identify important sites and services on and off campus, and create a socially engaging environment for collaboration and sharing. Depending on academic needs, students will also have the opportunity to gain community service hours while searching for these points of interest, and professors will also have access to Beacons for curriculum integration. Beacons can also be placed around the city of Oswego, and incoming students can be tasked after orientation to download the app and group up with other new students. Beacon technology can provide a context-rich, socially interactive experience for students and parents.

Beacon technology is commonly used by major retail companies; although, Bradley et. al., presents a similar intervention to ours regarding an interactive tour of a campus library using Beacons to guide new students (2016). These Beacons are small, easily maintainable bluetooth low-energy (BLE) devices that notify nearby users through smartphone notifications (iBeacons, 2014). These Beacons provide the opportunity to send hyper-local information to users, which allows them access to information relative to their current surroundings of about one to three meters. In example, a local grocery store can setup 10 Beacons within their store. Upon entering the store, the first Beacon may notify the consumer of today's deals. After tapping that notification, the consumer would be presented with the details of the sale and which aisle to find the products. A different Beacon in the store may provide the user a request for assistance if the user has been near the same Beacon for a set amount of time, and the notification could concisely read, "Request a Supermarket Associate". Beacons present limitless opportunities for learning and education, an area with opportunity research.

When it comes to a learning environment, such as a museum or a nature walk, Beacons can provide contextual information for users based on their location. Notifications can detail information regarding paintings, monuments, statues, statistics, and more. In the context of a

college campus, most colleges have been around for decades and have an extensive history as to its founders and the construction of its buildings. Beacons can provide contextual information while students are touring campus, which brings learning outside books and into the environment. Any site or object can become a point of interest for students, therefore Beacons can provide the most accurate information when students are nearby. The strategic layout of Beacons can provide users with a scavenger hunt activity that requires them to discover Beacons and complete tasks. This activity will allow for learning assessment through evaluation of what Beacons are discovered.

For the purpose of this intervention, SUNY Oswego and the City of Oswego are used as the sites of interest. Beacon technology can be utilized during Orientation Tours and outside of regular class time to learn more about the campus and the city. Beacons can address the problem of not knowing where to get hyperlocal information when living in a new area. Students can learn about basic necessities during orientation; however, continuing to explore the campus and city can be daunting and nerve-racking. Notifications can appear on a smartphone at the top of a screen while a device is unlocked, or show up on the lock screen when the user is near a Beacon. One of the benefits of using notifications to support learning is the fact that notifications can present differently depending on how the device is used. If a user has their device unlocked, the notification can be present at the top of the screen for several seconds before it dismisses itself. If a user's device is locked and in their pocket, a notification will appear on their lockscreen about the point of interest nearby, at which they can decide how to act without worrying about a timer.

Context

Since iBeacons are being utilized, the learning context or situation in which learning would take place is at the location of where the particular object, subject, or site being visited. Although these three differ, the overall learning context doesn't change much, because regardless, the learner is still in physical contact with the artifact that they are learning about. This context differs from the traditional context where an instructor or tour guide is describing the artifact while presenting verbal information to the learner. The iBeacons facilitate an interactive learning context by keeping the learner engaged in the material being presented, because the learners are forced to interact with the application as opposed to just listen to information being presented. In addition, they are required to visit the onsite location of the learning artifacts which equips the learner with a more accurate memorable representation of the artifact being studied, thus enabling them to better understand and further assess their learning so that they are then also able to fill in any gaps in their understanding.

The use of iBeacons promotes collaborative learning. Learners are able to easily interact with each other, exchange their thoughts and ideas on the information being presented to them, helping each other by answering questions as well as asking questions to their peers. Through this interaction, not only does learning take place, but friendships and bonds are formed which makes it easier for learners to remember information by associating it to real life applications and personal experiences. Furthermore, Beacons allow for the integration of not only future

potential community members of the Oswego, but also provides a platform for online collaboration and publishing which keep the learners further engaged in the community and as a result learners are also exposed to the digital tools and their capabilities, so that they may also be used in their intended field of profession. Additionally, Beacons promote contextual learning communities which offer researchers the opportunity studying contextual learning communities. Also, the researchers can come and observe how learners interact with their environment through the use of beacons and the application. This results in learning communities to be less confined and more open to different perspectives on improving contextual learning (Glover & McDonald, 2018).

For our purposes, the target learners that our application would be directed towards, primarily consists of potential students, incoming freshman or transfer students and their parents, as well as current students faculty and staff of SUNY Oswego. Anyone who would like to learn more about the different artifacts or sites of the city of Oswego, whether it's a place, a subject, or a piece of artwork can benefit from our application. It provides them with a unique interactive learning context which facilitates a passive form of learning in which learners learn without even realizing compared to traditional methods.

However, there are some constraints which can hinder the learners ability to learn. Factors such as inclement weather can hinder the learners ability to fully enjoy all features of our application because it becomes difficult to be outside in such weather conditions. In addition, if the iBeacon batteries aren't maintained, the user or learner may never receive a notification informing them of a nearby artifact, thus they would miss out on the opportunity of learning about that particular artifact. Furthermore, other factors that might hinder the learner is that if the learner is unable to transport themselves to the location where the beacons are place due to lack of transportation or lack of parking, they might be unmotivated to proceed any further in order to search for the Beacons, and thus they may choose to resort to traditional methods of seeking information such as looking up the information, or contacting different departments of either SUNY Oswego, or employees of the site or artifact they wish to learn more about. Lastly, the application itself must be maintained as to ensure that updates take place when appropriate so that it functions efficiently and is supported by various types of smartphones regardless of the operating system running on that particular phone, so that android and apple users alike have access to our application. The application must be accessible and inclusive to people of various abilities, and therefore must be compatible with tools such as screen readers and other accessibility tools, otherwise this can serve as a constraint for learning.

Learning Goals

Thousands of students come and go in State University of New York Oswego (SUNY Oswego). In the Fall Semester 2018, there were about 7,081 students enrolled in SUNY Oswego (2019 State University of New York at Oswego). Some students are from the area, some arrived from another state, and some traveled abroad. The city of Oswego a community next to Lake

Ontario with a lot of history. Close to farmlands and the Appalachian Mountains, Oswego is also an area much different from cities like Los Angeles, Tokyo, London, or New York City. Most of students that arrived do not know the history behind the city. There also plenty of students that have trouble themselves around the area; especially those new to the campus and the city. Also, there are students that take a few classes, watch their favorite programs, or go out for a drink without realizing what is around them.

The learning goal of this study is to help students to create a better understanding of the area. Students can have memories and experiences to bring back home after attending school. Potential students that are visiting the campus can also explore the SUNY Oswego and the city of Oswego with the application. Students that are new to the campus could use assistance locating some key places, such as career centers and clinics. Students and perhaps their friends and family can also find new ways to socialize when they gather together in Oswego, locate areas of interest and find different paths of transportation.

The learning objectives that were set for the learners are: how location beacons work, historical information, how to use on and off campus transportation/a map. When a new student will accomplish these objective they will be aware of the place itself and its meaning.

In an experiment with David Waller and Yvonne Lippa, they describe some *landmarks are commonly regarded as associative cues-stimuli that enable recall of directional responses that lead closer to the navigator's goal.* (2007 Waller & Lippa). Students and other users can find different ways in and outside of the campus with our application. The app could also aid in learning that would helpful to students with academic studies. The application can offer digital "badges" for accomplishments. It would help the students to keep track of activities including hours for community service. Using the app together with friends can also promote social activities.

Assessment Plan

Upon evaluating our learning intervention, we outline three specific ways of measuring an individual's learning outcomes. Reflective assessments provide individuals the opportunity to type out experiences in a narrative manner, creating an open-ended format to express the outcomes of learning. Achievements are another way of measuring learning as they can mark milestones of an individual's experience. Some achievements can be evaluated and weighed as real-world rewards, such as earning community service hours or promoting expert knowledge.

Reflective assessment is a broad method of assessing what knowledge learners captured during an activity. It allows the learner to use metacognition to think back on what they learned, recapture their experience, and evaluate their knowledge outcomes. This process can be easily described as "an important human activity in which people recapture their experience, think about it, mull it over, and evaluate it" (Boud et. al., 1985). For the purpose of this Beacon intervention, reflective assessments can take place after individuals complete modules, where they type out their thoughts regarding their experience and what new information they learned.

This assessment can be required for fully completing a module at one hundred percent, upon which the individual may receive a digital award or badge for their accomplishments.

Achievements are an effective way of providing positive feedback to users. It creates a gamified experience where users receive digital badges for their accomplishments within the app. For example, users can receive a badge for completing "5 Hours of Discovery" noting that the individual has spent a total of five hours thus far completing Beacon discovery tasks. Tasks may include learning about historic sites, partaking in social activities, and assisting newer students in their own experience of the campus through Beacons. Students who log enough time within the app can even earn the title of Beacon Expert, in which they earn a special digital badge and can use this title as official experience if applying to be a campus tour guide.

Becoming a Tour Guide. As reflective assessments will help users understand their individual progress and experience throughout their interactions with points of interest, achievements will help to create meaning and significance. When individuals complete a certain number of tasks, assessments, and log enough hours using the application, they can receive an achievement that labels them as an "Expert." The benefits of this achievement are motivation and real-world rewards. Experienced individuals can help facilitate learning with newer students by becoming resources for them. We can observe external learning transfer from the experienced Expert students to the newer students. This elevated experience can be legitimized as a real-world benefit to an individual, where, in example, the individual can apply to become a campus tour guide and use their Expert achievement and knowledge of the application as actual resume experience. An assessment-turned reward can inspire and motivate newer students to eventually earn the same experience and facilitate tours towards the later years of their college career.

Description of Tools, Resources, and Scaffolds Used

In this study we will be using a few tools, along with resources and scaffolds. In order to achieve set goal such as: help new students and their parents get a better idea of SUNY Oswego and the city of Oswego. Following elements will be used, to help with creating a good learning environment for exploring the university and the city of Oswego with objects that is surrounded by in chosen area.

As tools we will be using iBeacons, mobile phones, and extra batteries for mobile phones. The process of how the following tools such as: iBeacons and the app "Laker Beacons" works together are shown in Figure 1 (See Appendix).

iBeacons, Beacons send out an ID number through BLE (Bluetooth Low Energy) channels. A mobile phone will recognize the beacon and picks up its ID number. When the app, "Laker Beacons", recognizes the ID number, it will display a notification on the mobile phone (Adarsh, 2018).

Mobile phones, in order to collect community hours or complete tasks given for students by teachers, learners will have to download the app "Laker Beacons" and use it on their phone. Also, during a guided tour for new students and their family it will be not just a tour guide

talking about the university, but at the same time explaining how the app and Beacons works with mobile phones in this particular situation.

Extra battery for mobile phones, during orientation day at the university, the tour guides will provide the new students with optional portable batteries that have SUNY Oswego's logo on it. This will aid students in exploring the city of Oswego and the university itself as it will ensure that their mobile phone is charged throughout the day. At the end of the day students will have a choice to return the battery or purchase it.

For the resources of the study we chose a *map application, orientation guides, and availability* to access the Internet. In order to for the students and their parents to follow the orientational guides while using the app have to have the access to the Internet. Also, the map application will provide better understanding where the learners at and what is happening.

Hard scaffolds (already designed) and soft scaffolds (could be changeable) (Brush & Saye, 2002). Within the paper we provide learners with different hard scaffolds for them to be able to complete a task, solve problem, and navigate throughout an app and maps of SUNY Oswego and city of Oswego. A few hard scaffolds that support and helps learners pursue their learning are described below.

Orientation guides, when new students arrive to the university they usually take a tour around the campus to get better idea what is college look like. The tour guides provide the students with an information about building and everything around the campus. To provide a better understanding and interaction between students and college we provide them with app that will be connected to iBeacons, this way of telling the new information that is taught by tour guide and supported with the mobile app will increase the interest of the college and its history.

Splash screen (app), when students arrive to the college and will be interesting in taking the tour they will be asked to download the app to learn more about the area. Also, specific maps are included in the app that will show to learners how to et to certain spots using a car, bus, or walking.

Map key, for each object located on the map special labels are developed that allow the student to find the place where iBeacon will be located. Also, the map keys will be shown in the corners of the map with information that will help learner to understand the map itself and the meaning of the map. For example: buildings that are located within the SUNY Oswego college the map key will be house-looking symbol; different way of getting to a place will be shown by color: walking - green, bus - blue, and driving - purple.

Signage for nearby Beacons, for the student to find the Beacons will be provided a following information of the location of the iBeacon. Two ways of supporting the location will be available for the learners. First - visual, meaning that a poster or sign will be placed near the iBeacon. Second - digital notification for nearby Beacons on a mobile phone that will pop up when the learner is near the Beacon location.

Appendix

Structure of iBeacons usage and application “Laker Beacons” – Beacon Diagram

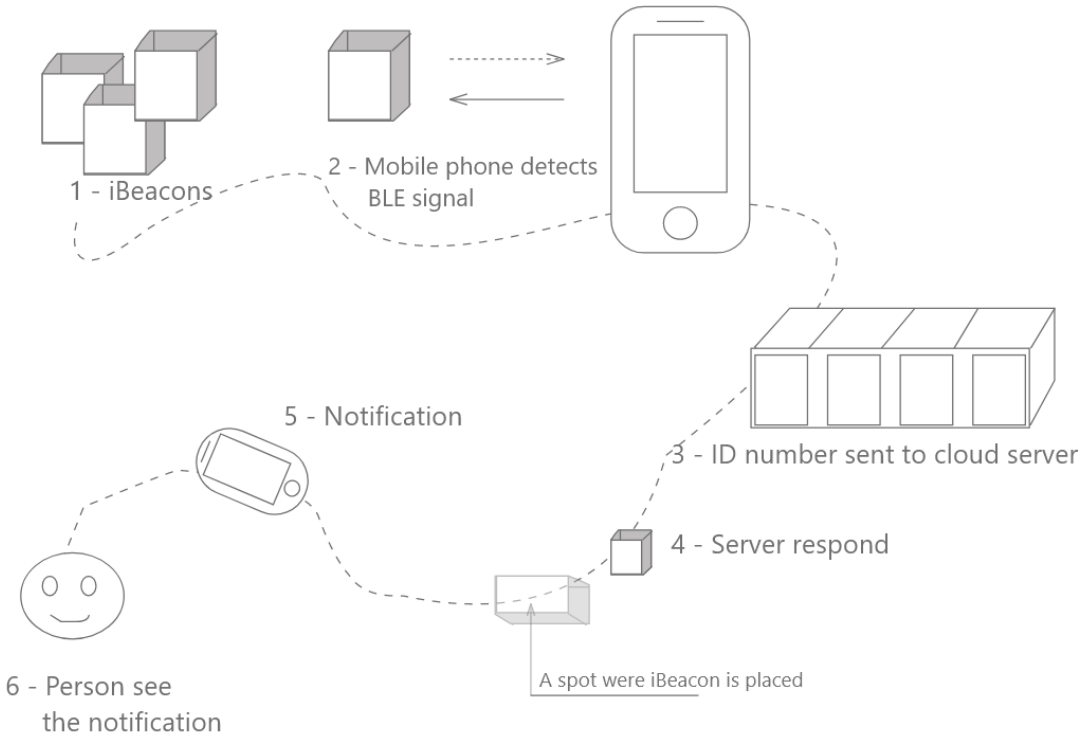


Figure 1 - Process of iBeacons and the app “Laker Beacons”

Persona Examples

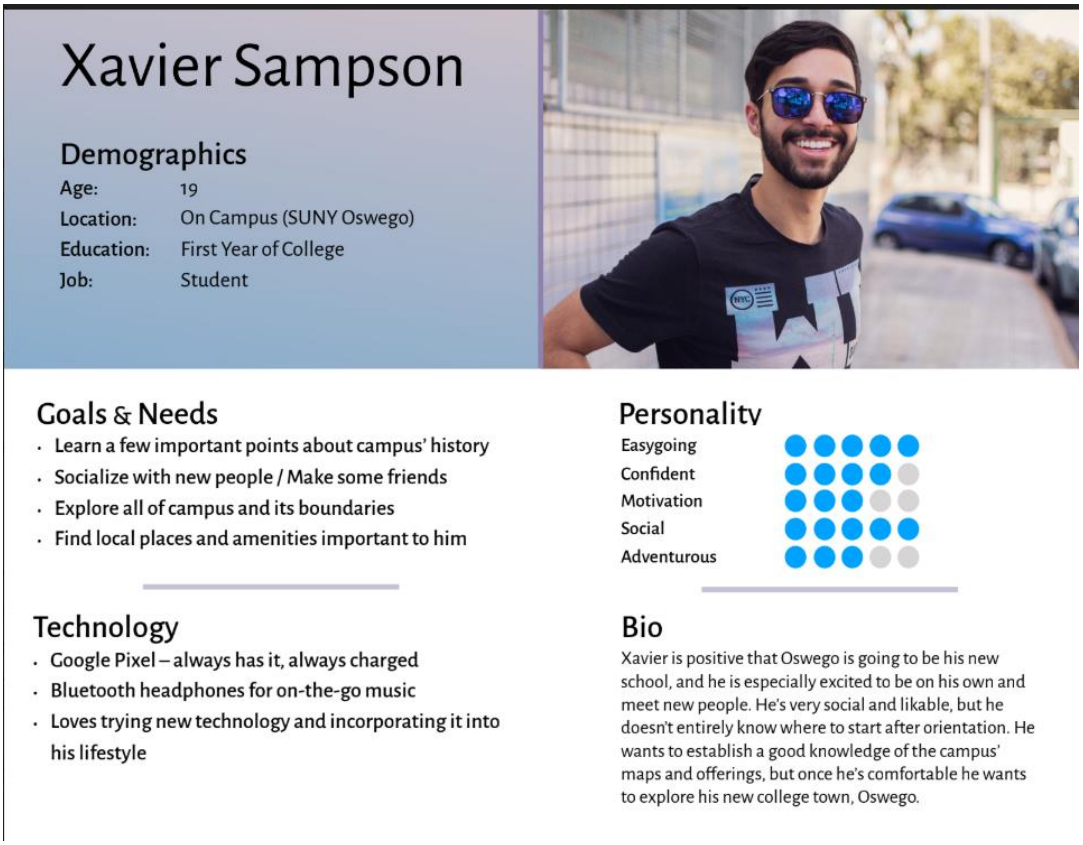
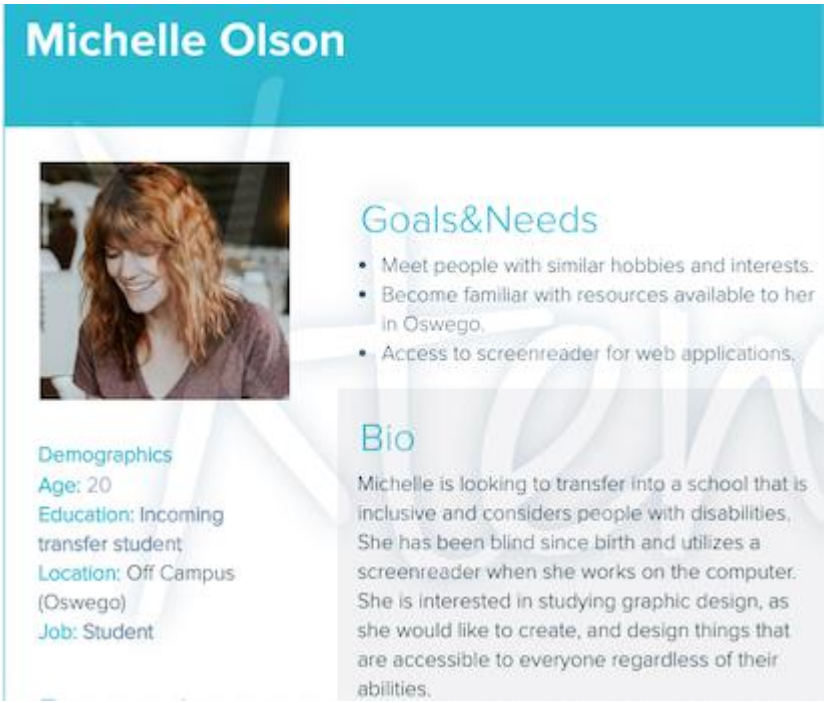


Figure 2 – Persona that were used in order to create the app 'Laker Beacons'



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