Assessing the Use of Mobile Application Technology to Enhance Self-Regulated Learning Experiences

Michelle Rearick
Environmental Education Programmer
Habitat Environmental Center, Kettering PRCA
Advanced Inquiry Program, Oxford, Ohio

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Introduction

Bonney *et al.* (2009) states, "explain science to the public, and both science and scientists will enjoy greater support, which in turn leads to greater economic prosperity, quality of life, and world leadership in science and technology". This statement has one shortcoming, however, in that it focuses on delivering specific content instead of helping the public *experience* it.

The process and benefits of experiential learning

As its name suggests, experiential learning emphasizes the central role that experience plays in the learning processes instead of acquisition, manipulation, or the recall of abstract symbols as in other learning styles (Kolb, 1984). It is a holistic approach to learning that combines experience, perception, cognition, and behavior (Kolb and Kolb, 2005; Kolb 1984). Several models of the learning process have been suggested. While slightly different from each other, they have common perspectives on learning which can be summarized into six propositions:

- Learning is best conceived as a process, not in terms of outcomes
- Learning is a continuous process grounded in experience
- The process of learning requires the resolution of conflicts between dialectically opposed modes of adaptation to the world
- Learning is a holistic process of adaptation to the world
- Learning involves transactions between the person and the environment
- Learning is the process of creating knowledge

(Kolb and Kolb, 2005; Kolb 1984)

As the world continues to rapidly develop, we are becoming increasingly aware of how human activities negatively impact the environment around us. Disturbances caused by people have altered, degraded, and destroyed the natural landscape on a vast scale and species are being driven to extinction (Primack, 2010). We must inspire the local and global community into action; education on the issues at hand is of utmost importance. To engage people in environmental issues, one has to provide a connection with nature (Novacek, 2008). Research indicates that sensitivity to environmental issues does not begin in adulthood (Carrier, 2009), but environmental attitudes have been documented in primary school-aged children as young as five years old (Rickinson, 2001). By providing non-formal nature-based experiential education to the public of all ages, we are investing in the future of our community and the well-being of the world.

Today's students have grown up with computers; their constant exposure to the Internet and other digital media has shaped how they receive information and how they learn (Oblinger, 2004). Advances in wireless communication technology have provided educators with an opportunity to develop new educational models. This is especially valuable in non-formal and informal learning, as educational practices can be performed at any time and any place. It can be pre-planned or opportunistic (Chen *et al.*, 2003). Smart phones have become increasingly popular and certain apps can be used to help identify plants, birds, and trees in nature. Geocaching, a GPS treasure hunt, is also becoming popular. Both provide the user an experiential learning experience. Also a smart phone-based application, Quick Response Codes (QR code), are an emerging trend; one takes a picture of the code with their smart phone, then the information is interpreted, like a link on a website (Reimers *et al.*, 2010). Again, the process is learner-centered.

While it's clear that technology has changed human society in favorable ways, such as improved communication and convenience, it's also proven to be a distraction, making us lazy and disengaged with the world around us. Children, in particular, who've never know a time without computers and other electronic devices, sometimes have trouble seeking out pleasure and enjoyment from other forms of entertainment, including spending time playing and exploring the outdoors (Louv, 2005).

The technological arsenal available to parents, teachers, and kids has grown to include handheld devices such as tablets and smartphones. These devices are lightweight, mobile, and they often come with rugged carrying cases making them perfect for use outdoors. This onslaught of technology forces us to rethink how, when, and where children engage nature. As adults and responsible stewards of our children's well being, we should encourage exploration and discovery in the outdoors, but possibly in ways that are far different than what we remember from our own childhood. One way to do this is through the use of mobile software applications (apps). These software applications can be downloaded onto smartphones, tablets and other mobile devices. While many of these apps are available free of charge, others must be purchased.

While most agree that technological literacy is important, today's parents and educators struggle to integrate the use of that technology in such a way that it doesn't interfere with a child's ability to connect to the natural world. So, how can we link today's technologically literate youth and their desire to have fun and be entertained with our desire to raise children who

appreciate and value nature? Perhaps the answer is already in the palm of our hands. Mobile gadgets, such as smartphones and tablets are fun for children to use. With the addition of easily uploaded apps that serve as mobile field guides for exploring natural phenomena, we have the ability to bring learning, exploration and technology into the great outdoors (Schrode, 2012).

The objective of this project was to create a simple, easy to use mobile application that will allow the user to experience an educational self-guided nature walk in a local park, Southdale Woods. While certain nature-based educational apps already exist, such as bird identification, bird songs identification, tree identification and dichotomous keys, they don't provide the user with a personalized experience and sometimes are ineffective (Thompson, unpublished). It was predicted that the application would be well received as it would be tailored to a specific location and demographic.

Methods

Mobile Guide Development

The ability to use mobile software application (app) as a means of an informal learning experience was explored with a free existing app, EveryTrail. Developed by Global Motion Media, Inc (available for Android and Apple devices), this app allows users to create and download 'trips' or 'guides' using a mobile device or computer. GPS technology allows the user to tag points of interest (POI) along a particular route via GoogleMaps interface on the computer or in real time by annotating a walk. Other EveryTrail users can then search for 'trips' and 'guides' either by proximity using their mobile device, or can download specific content to their app via the computer.

A new trip was created by registering for a free personal account with the EveryTrail app. The author went to Southdale Park, Kettering, OH, and walked through the woods while tracking the route taken using mobile GPS. POI locations were recorded by taking pictures (graphical location information imbedded)(Figure 1). These locations were pre-determined and selected based on topics that are often discussed with students (preK-5) and their parents who visit the Habitat Environmental Center for informal programming. Topic included: invasive species awareness; bird watching and identification; stream ecology and pollution; decomposition and the relationships between plants and animals in a community; and tree identification. The

completed walk was then uploaded to the EveryTrail online database; further editing was then completed online.

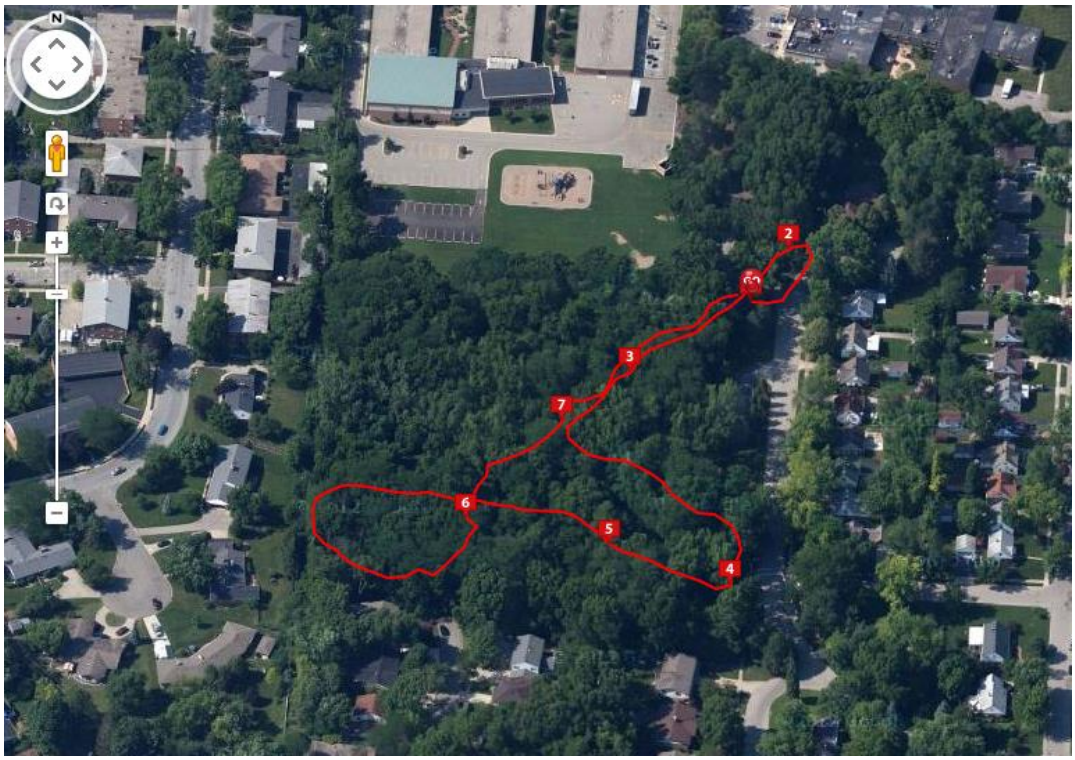


Figure 1 GPS Mapping of Southdale Woods. Using mobile GPS, user's walking path was tracked through Southdale Woods within Southdale Park. By taking a photo or making an annotation while tracking, the user creates a POI; POI locations are stored and show up along the route with numbers. This allows other people using the trip within the app to travel to POIs in the same order.

Following online instructions, the trip was converted into a guide accessible to the public. This process allowed for extensive expansion of POI text (Appendix A), as well as the opportunity to provide additional resources (website links/photos/audio/video) for the user. Completed guide was then able to be classified into several categories, including the level of activity (easy/medium/hard), the type of activity (mountain biking, hiking, walking etc), and who the guide was intended for (family friendly/dog friendly). Completed guide was then submitted to be reviewed by EveryTrail for public access.

Beta-testing Mobile Nature Guide and Community Assessment

To assess the practicality and success of app creation, a focus group of 10 Kettering residents was created. Members, ranging in age from 28-58, of different race and socio-economic

backgrounds were brought together to test the mobile guide and discuss reactions after use; the only prerequisite for participation was possession of a smartphone. The focus group met for a period of approximately 90 minutes at the Habitat Environmental Center, which neighbors Southdale Woods. During the session, group members were first shown how to access the app and mobile guide and then were dismissed to explore the woods using the self-guided nature walk guide. Upon completion, discussion resumed; participants were asked several open-ended questions (Table I) and encouraged to share honest feelings regarding their experience.

Focus Group Questions
Have you been to Southdale Woods before? If yes, did you enjoy your visit? Did you come on your own, or with someone else?
For what reasons do you primary spend time outdoors? Leisure? Educational? Exercise? Time with family? etc
Was accessing the application difficult or confusing? Would you have preferred if the guide was its own app instead having to search for the guide within the EveryTrail app?
Did you learn anything new from using this app?
Did you use any of the supplemental links provided to gain additional knowledge?
Was using mobile technology a deterrent from your outdoor experience?
To what age level do you think the app is appropriate? Adult use? Family use?
Would you use other self-guided nature walks if additional Kettering parks were mapped?

Table I Focus group discussion questions. Open-ended questions were used to facilitate discussion with the focus group in order to gauge their experience with created mobile self-guided nature walk.

Results

Beta-testing Mobile Nature Guide and Community Assessment: Focus group—Nov. 22, 2013

Focus group discussions on the use of the created EveryTrail mobile nature walk were generally positive with several areas of constructive criticism (Table II).

Focus Group Questions	Highlighted Focus Group Answers
Have you been to Southdale Woods before? If yes, did you	-Majority of members had not been to Southdale Woods before. Those who had attended typically were participating

enjoy your visit? Did you come on your own, or with someone else?	as a Land Lab volunteer or volunteering for Kettering Parks. Previous experiences were enjoyable. -Of those who had not attended, several community members were unaware that woods were present in this location.
For what reasons do you primary spend time outdoors?	-Responses included: Leisure, exercise, and spending time with family as primary reasons. Educational opportunity was not identified as a response.
Was accessing the application difficult or confusing? Would you have preferred if the guide was its own app instead having to search for the guide within the EveryTrail app?	-Accessing information was not confusing since a step-by-step process was reviewed before app use. -Had this not been provided, has the potential to be confusing since the guide is found within an app, not as an app itself. -Stand alone app would have been beneficial and could likely be opened/accessed without instruction.
Did you learn anything new from using this app?	-Very mixed results. (Further elaborated within response to age-appropriateness)
Did you use any of the supplemental links provided to gain additional knowledge?	-Most responses were no. -Some members did not see links.
Was using mobile technology a deterrent from your outdoor experience?	-Very mixed results. -Potentially more distracting since using app alone instead of with a group. Had to keep phone out in order to see if following the right path and when a POI approached. -Walk became more of a learning experience, and provided material enhanced experience in nature.
To what age level do you think the app is appropriate? Adult use? Family use?	-Most agreed that POI text would be appropriate for use with young children. Concepts and activities are easily tailored to a variety of ages. -Concepts presented were below the level of most members, therefore while many did not learn anything new, it was agreed that younger users, especially those accompanied by an adult would benefit.
Would you use other self-guided nature walks if additional Kettering parks were mapped?	-Most agreed that this kind of application would be best suited for a family or group outing (teachers/students, parent/child, grandparent/child). -Popularity would likely be only among those who have direct correlation with Habitat Environmental Center (from the aspect that people wouldn't know the opportunity existed) -Would use if some adjustments were made to current application style/delivery.

Table II Highlighted responses and generalizations to focus group questions. Compiled focus group responses to discussion questions.

Discussion

Focus group discussions on the use of the created EveryTrail mobile nature walk were generally positive with several areas of constructive criticism. Southdale Woods at Southdale Park is a very small city park completely surrounded by residential homes; it was not surprising to learn that the majority of focus group members had not only never visited the park, but also had never heard of it. I was, in fact, unaware of this park until I became a city employee six months ago. Out of the discussion, several points stuck out to the author as most important.

Mixed results were received whether if using technology deterred member's experience outdoors. Responses tended to correlate with age; younger members were less distracted with carrying their mobile device. The EveryTrail app unfortunately does not use an audible signal to notify users when they are coming upon a POI; as such, user's must keep their phone in their hand to ensure they are traveling the correct route and to find POI. I completely agree that this would be a deterrent in application use. People would perhaps spend more time looking at their phone than experiencing the nature around them. Some indicated that the learning experience began to feel formal as the app use was so rigid.

Not all members felt as if they had learned something new after participating in the walk. As this was explore deeper, it became apparent that this was related to age. POIs and concepts presented were selected and written to be accessible to families and able to be understood by children in elementary school. Members agreed that often, concepts presented were below their education level or that they were already knowledgeable on a particular topic (mainly Emerald Ash Borer and invasive honeysuckle). Perhaps in hindsight, it would have been more appropriate to include families in the focus group, instead of only adults.

When members were asked if they would use a similar app in a different Kettering park, most agreed that they would not use the application unless they were in a group (with family). It becomes cumbersome to use the app alone and severely deters from one's solitary walk in nature. When in a group, however, the dynamic of the outing is different, and an accessory app is more conducive. It was also pointed out that this app could be beneficial for teachers at the neighboring elementary school. They could take their students into woods during the school day and have lessons about biological processes and issues in biodiversity literally in the palm of their hand.

For the health of our planet, it's imperative that we reconnect with the natural world by acquiring more knowledge of it (Louv, 2005). It's clear that technology has changed human society in favorable ways, such as improved communication and convenience, but technology can also be a distraction (Louv 2005). As adults we need to teach our children to be responsible environmental stewards. Mobile field guides for exploring natural phenomena have the ability to bring learning and exploration into the great outdoors (Schrode, 2012). Children, teachers, parents and others all need to be aware of the biodiversity that surrounds us and if embracing technology encourages this awareness, it's a step in the right direction (Saag, et al., 2010).

Conclusions and Next Steps

It is my intention to take the feedback from the focus group and make changes to the mobile application to improve it. Several comments that were made by focus group members were things that had crossed my mind while developing the application. Due to time limitations, it was not possible to develop a stand-alone app; the EveryTrail app was used to provide a proof of concept. A personal contact who has knowledge on app development has agreed to expand on what has already been completed and build a stand-alone application. It is my hope that the app will include different self-guided nature walks through many public parks within Kettering's city limits. It is my hope that the application can change to simply display the map of all walking trails, but not encourage the user to take a particular route throughout the park. An audible notification would go off when the user was nearing a POI. It is my opinion that this would create a less 'intrusive' application and would still encourage users to have their own meaningful experience in the outdoors.

Literature Cited

Bonney, R, H Ballard, R Jordan, E McCallie, T Phillips, J Shirk, and CC Wilderman. (2009). Public Participation in Scientific Research: Defining the Field and Assessing Its Potential for Informal Science Education. A CAISE Inquiry Group Report. Washington, DC: Center for Advancement of Informal Science Education (CAISE).

Carrier, S. J. (2009). Environmental Education in the Schoolyard: Learning Styles and Gender. *The Journal of Environmental Education*, *40*(3), 2–12.

Chen, Y. S., Kao, T. C., & Sheu, J. P. (2003). A mobile learning system for scaffolding bird watching learning. *Journal of Computer Assisted Learning*, *19*, 347–359.

Kolb, A. Y., & Kolb, D. A. (2005). Learning Styles and Learning Spaces : Enhancing Experiential Learning in Higher Education. *Academy of Management Learning and Education*, *4*(2), 193–212.

Kolb, D. A. (1984). The Process of Experiential Learning. In *Experiential learning: experience as the source of learning and development* (pp. 20–38).

Louv, R. (2005). *Last child in the woods: Saving our children from nature-deficit disorder*. Chapel Hill, NC: Algonquin Books of Chapel Hill.

Novacek, M. J. (2008). Engaging the public in biodiversity issues. *Proceedings of the National Academy of Sciences of the United States of America*, *105*, 11571–11578.

Oblinger, D. G. (2004). The Next Generation of Educational Engagement. *Journal of Interactive Media in Education*, *2004*(8), 1–18.

Primack, R. (2010). *Essentials of Conservation Biology*. 5th ed. Massachusetts: Sinauer Associates, Inc.

Reimers, C., Nischelwitzer, A. K., & Smith, D. (2010). Mobile Applications for the ATLAS Outreach Programme. *Proceedings of the 7th International Conference on Hands on Science*, 65–72.

Rickinson, M. (2001). Learners and Learning in Environmental Education: a critical review of the evidence. *National Foundation for Educationnal Research*, *7*(3), 207–320. doi:10.1080/1350462012006523

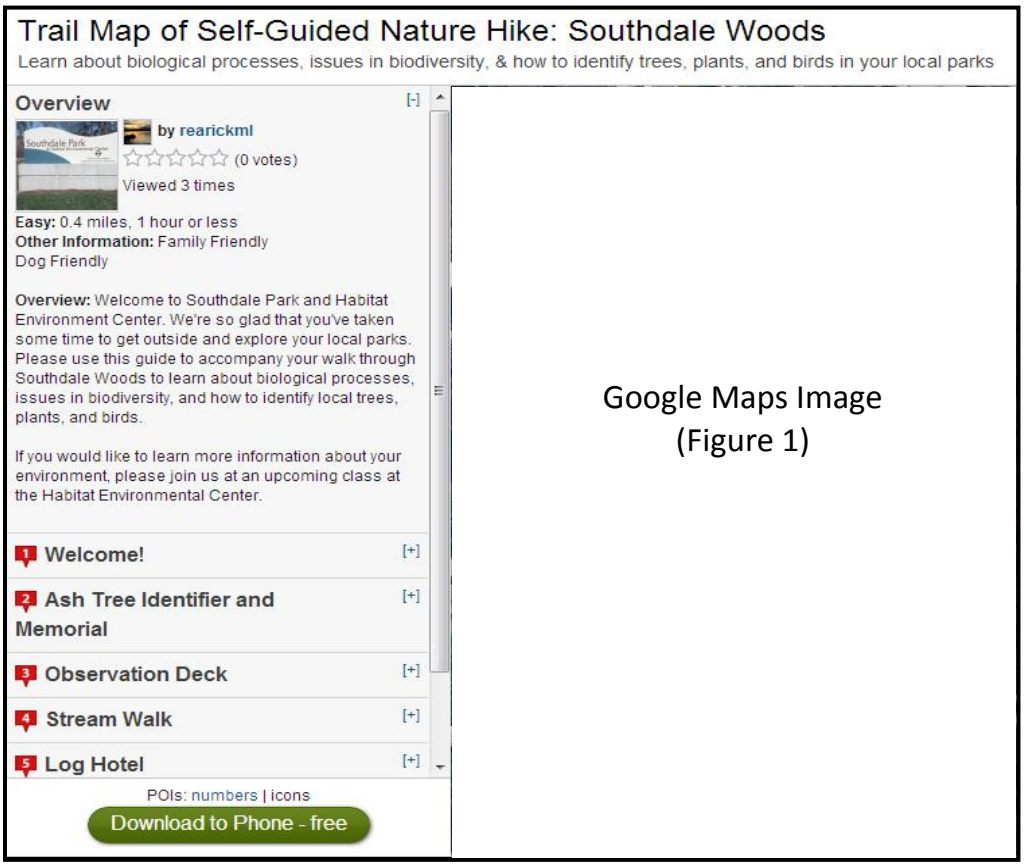
Saag, A., Randlane, T., & Leht, M. (2010). Keys to plants and lichens on smartphones: Estonian examples.

Shrode, F. (2012). Mobile apps for nature field guides. *Reference Reviews*, *26*(7), 4-6.

Appendix A: Mobile application text and images

Guide title: Self-Guided Nature Hike: Southdale Woods

Subtitle: Learn about biological processes, issues in biodiversity, & how to identify trees, plants, and birds in your local parks



Supplemental Figure A.1 Online Guide. Screenshot of completed guide, as it appears on EveryTrail's website (everytrail.com). Left-hand pane overviews the hike, and POIs are expandable for review.

POI Text:

1) Welcome: Welcome to Southdale Park and Habitat Environment Center. We're so glad that you've taken some time to get outside and explore your local parks. Please use this guide to accompany your walk through Southdale Woods to learn about biological processes, issues in biodiversity, and how to identify local trees, plants, and birds.

2) Ash Tree Identifier and Memorial: Ash trees in Ohio and throughout the Midwest are being affecting by a wood-boring insect, the Emerald Ash Borer.

The EAB is an exotic, invasive wood-boring insect that was first discovered in North America in June 2002, and in Ohio in 2007. These larvae hatch in crevices in the tree's bark and proceed to feed in the phloem and cambium. Extensive feeding disrupts the movement of nutrients within the tree and ultimately results in tree death, typically within1-3 years, depending on tree size. In 2006, it was estimated that 15 million ash trees in urban and forest settings had been killed by EAB. Not only is this a problem for our forests, but the ash tree's wood is used to make several products including baseball bats, furniture, cabinets, cardboard and paper; the compensatory value of the forest ash in the US has been estimated at $282.3 billion!

Learn how to identify ash trees by their compound leaves and monitor health of those on your property or in your neighborhood. Should you notice an insect exit hole, contact your local Parks Department.




3) Observation Deck: Take a few moments to be still and listen. What do you hear? Leaves rustling? Birds chirping?

More than 300 species of birds call Ohio home annually. How many local birds can you think of? Have you ever seen a cardinal or a robin? These residents play a vital role in our local ecosystems as they are critical links in life's food webs; they occupy levels from mid-level consumers to top predators. They also act as agents of dispersal, distributing seeds for birds.

Use the additional resources attached to try your hand at birding! Remember to be quiet as to not scare the animals away.





4) Stream Walk: There are more than 326 million trillion gallons of water on Earth. Less than 3% of all this water is fresh water and of that amount, more than two-thirds is locked up in ice caps and glaciers. With so much water around it seems like there is enough to see us through for millions of years. But did you know that even water, which seems to be in abundance, might one day become scarce?

   As you arrive at our small stream, ask yourself these questions to experience first-hand how natural habitat can be impacted by land use and human actions.

   1) Is the stream channel natural of changed by people?
   2) What color is the water? Can you see signs of pollution that might change the stream's color.
   3) Do you see trash in the stream? What kinds?
   4) Do you smell any unusual smells like oil, sewage, or rotten eggs?
   5) Do you see any pipes along the stream that might discharge water? Where do you think the pipe come from? What do the pipes discharge into the stream?
   6) Do you see any signs of wildlife? How does the wildlife depend on the stream for survival?

5) Log Hotel: Perhaps you would ordinarily walk past a fallen tree and feel sad that a once majestic tree was now dead? Or maybe you wouldn't even notice it all

   But a fallen tree, a log, is an amazing thing; it gives us a perfect example of a simple, observable, community of plants and animals.

   When a healthy, standing tree dies, it is called a snag. When the snag falls to the ground, it becomes a log and begins to decompose. Some species, such as insects and fungi, help with the process of decomposition. Weather conditions, such as wind, rain, and light, also play a role in decomposition.

   As the log decays, different plants and animals come to stay at the 'Log Hotel'. At the beginning of decomposition, the residents are small, like fungi or insects. But as decay continues and the log begins to hollow you might find larger inhabitants like birds and snakes.

   Eventually, the log will decay completely into soil. This nutrient rich soil will perhaps one day allow a need seed to grow into another majestic tree.

   Look closely at this 'Log Hotel' and see who's living there right now!

6) Invasive Honeysuckle: Currently, Southdale Woods is full of invasive Amur Honeysucke. While this particular location was chosen as a POI, honeysuckle can be observed all over the woods.

   Amur Honeysuckle is a noxious woody shrub, introduced in southern Ohio in the late 1950's, but now rampant across the state and throughout much of the Eastern United States. A native of northeastern Asia, this vigorous, invasive shrub has displaced many native shrubs with its aggressive growth and ability to abundantly reseed itself in neighboring areas via bird-dispersed fruits. Often the first plant to bloom and last to drop its leaves, honeysuckle shrubs shade would-be low growing native plants and severely decrease plant diversity.

   With a rapid growth rate, tolerance of sun or shade, and ability to withstand heat, drought, and severe winter cold, one could incorrectly assume that this is a well-adapted native shrub. Amur Honesuckle has an arching growth habit, reaching 15 feet tall and 15 feet wide in about ten to fifteen years of growth.

   Amur Honeysuckle has no significant disease or pest problems. However, it will take over an area within a few years of initial seeding, by a combination of its rapid growth rate, arching growth habit, and ability to prolifically reseed itself nearby. The only positive in terms of control is that its root system is shallow during the first several years of its life, so plants can literally be pulled up or dug out with relative ease, if caught early enough.

   Learn to identify Amur Honeysuckle by its leaf pattern: opposite, elliptical to ovate, with long drawn-out tips. Remove it from your yard if possible.



7) Meet a Tree: Identifying wildflowers, plants, and trees can be very useful when spending time outdoors, especially to enable one to be able to identify and avoid harmful plants, such as poison ivy.

   One tree that is easily identifiable in Southdale Woods is the honey locust (pictured). These trees produce large thick spike surrounding their trunk. Why would a tree such as this need such a deadly looking defense mechanism? Herbivores. Who ever said a vegetarian never hurt anybody? Would be leaf-poachers such as deer and other small mammals find that when munching on leaves, the spines of this tree are a bit too much pain to make up for a tasty dinner.

   A tree's leaves are used most often in order to identify the tree. In the last several years, a variety of mobile apps have been developed as portable dichotomous keys. These enable the user to answer questions regarding visual leaf characteristics, step-by-step, ultimately bringing the user to one (or more) possible tree IDs.

   While some kinks are still being resolved, these mobile keys act as a great alternative to the traditional printed versions.

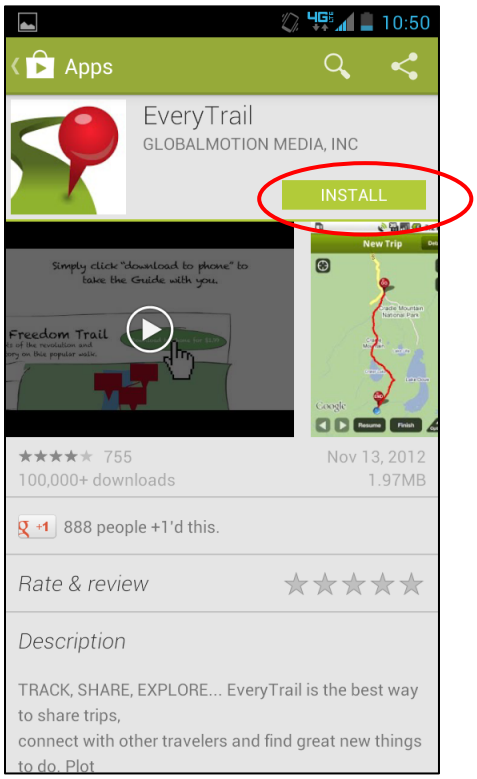
   (cont'd)

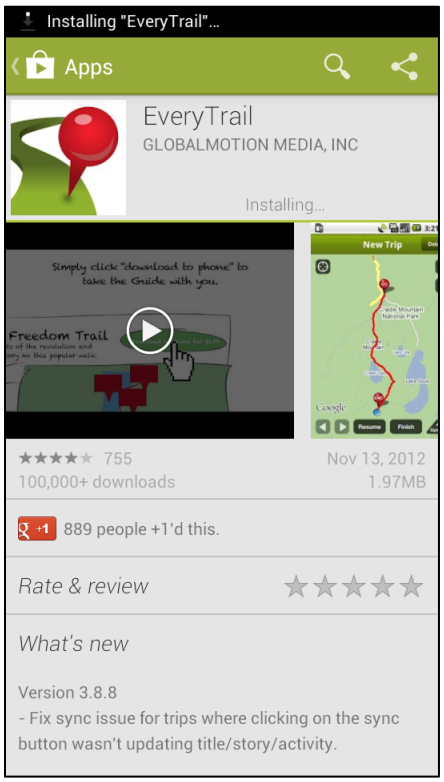
Perhaps the name of the tree isn't the most important thing to take away, however. Close your eyes and try having a friend lead you to a tree in the woods. Meet your tree. What does the bark feel like? Can you wrap your arms around it? Can you find animal signs or plants growing on it? Have your friend lead you away from the tree in an indirect manner. Open your eyes and see if you can find your tree again. Perhaps you've found a newly-formed bond with your new friend who lives in these woods. Come back and see her next time you are here!



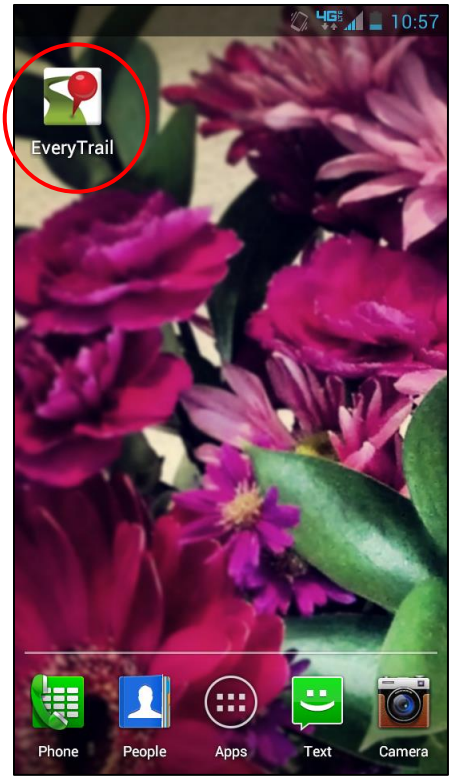
Appendix B

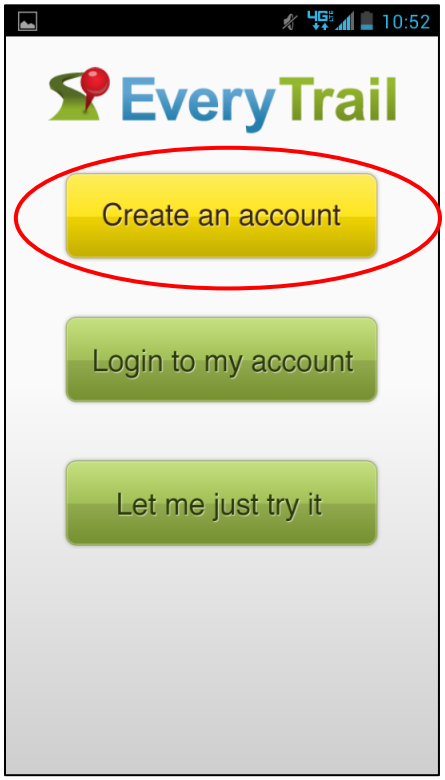
Accessing the application from your mobile phone



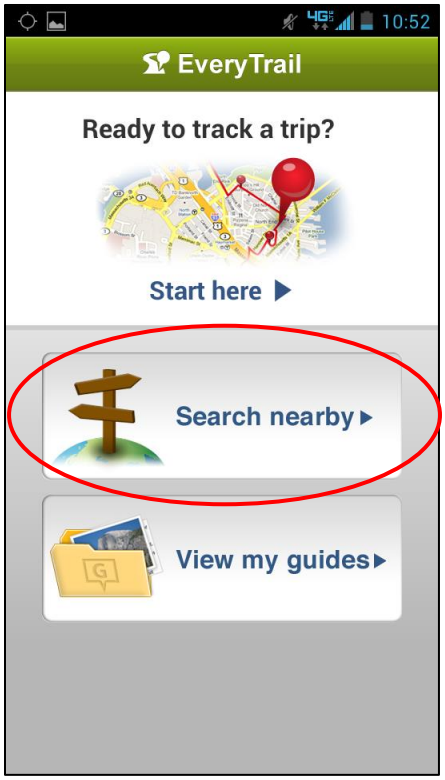


-Search for EveryTrail in your app store (available for Android and iPhone).
-Install application on mobile device





-When application is finished installing, a shortcut will be created.
-To open the application, select the EveryTrail icon.
-When logging in for the first time, you will be prompted to create a new account. This process is free and is recommended.



-Search for nearby trips and guides to access 'Self-guided Nature Hike: Southdale Woods'.