# Chapter 9
# Building Knowledge:
## Implementing PBL and Using Mobile Apps as an Approach to Learning

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## ABSTRACT

*This chapter argues that the best learning occurs as knowledge is constructed, challenging the assumption that learning occurs mainly when knowledge is gathered and absorbed. This chapter thus builds contrasts between a constructivist epistemology and other approaches toward learning that do not seek the intentional construction of knowledge. Expanding on the current discourse regarding constructivist epistemology, this chapter considers more thoroughly problem-based learning as a pedagogical approach. The chapter begins and concludes with a preliminary study that illustrates how implementing a mobile application into a problem-based learning approach has enhanced learning for students collecting field data for biology and environmental studies research, as well as for students developing the application. This example illuminates a viable approach to translating educational theory into praxis.*

## INTRODUCTION

As mobile devices emerge ever more prominently in the computing landscape, there remains a dearth of research regarding assessments of their effectiveness and best practices for their implementation in various settings. Given the fast pace with which this technology has become available, this lacuna is understandable, and scholars in various fields are working to address it. For educators, the ability to evaluate the effectiveness of such tools in general is crucial to understanding how they impact the construction of knowledge during the learning process specifically. Educators must ask to what extent the special properties of mobile computing devices and applications can aid students in making meaning from educational exercises that incorporate their use. This chapter

contributes to that discourse in several ways: first, by considering constructivism's theoretical promise and Problem-based Learning's (PBL's) potential as a pedagogical approach; second, by describing the implementation of a specific mobile application into a PBL approach to learning; and third, by evaluating whether and to what extent the app assists in knowledge construction.

At Washington & Jefferson College (W&J), the faculty of the Computing and Information Studies (CIS) department has become theoretically committed to a constructivist pedagogy that emphasizes the learner's role in actively building knowledge. This commitment has led to a practical investment in PBL as a methodology for achieving those ends, as PBL requires students to respond to challenges based on prior curricular experiences without the formal structure that might seem more familiar to them within the parameters of a course—in short, to respond to the kinds of open-ended, loosely structured problems they might encounter in the real world. As part of this training, the faculty and students in our program have come together with the faculty and students in the Biology department and Environmental Studies program to develop a mobile application for data collection in the field. In this work, we faculty have been interested in the educational potential of PBL as an approach to both the software development process (CIS) and the scientific data collection and analysis process (Biology). Therefore, our inquiry has been oriented toward the development of a CIS curriculum that supports PBL, using the needs of the project to present CIS and Biology students with a significant problem to solve, and then placing the solution into the hands of students to evaluate its effectiveness.

This chapter begins with a review of the background literature regarding constructivism as an epistemological stance, and PBL as a specific pedagogical approach, along with a brief discussion of the limited scholarship available regarding mobile computing in education. It then proceeds to describe *Appernathy* – a mobile app designed to help students collect data regarding salamander and myriapod populations—and includes the preliminary results of the initial research regarding the mobile app and its impact on learning. It concludes with a reflection upon the use of Appernathy as a case study for implementing mobile solutions for collecting data in the field and how that work can fit into a PBL approach to science education.

## BACKGROUND

### Theory Drives Practice Drives Implementation

In beginning this discussion, it is important to set out the assumptions guiding our work as CIS faculty. We believe that epistemology (our understanding of the ways in which one comes to know things) should shape our pedagogy (our understanding and choice of instructional methods), and our pedagogy in turn should direct our implementation of technology in the classroom. In the case of our work, a constructivist epistemology has led us to a PBL approach, which eventually led us and our students, in conjunction with our colleagues in Biology and Environmental Studies and their students, to develop and implement a new mobile application: Appernathy.

### Constructivist Epistemology

Constructivism posits that people come to build knowledge by making sense out of the world as they reflect on and incorporate what they have learned from prior experiences. Among educational theorists, some of the most relevant discourse concerning constructivism for our purposes originated in the early 1990s, and it holds that learners make their greatest gains through relating educational material to authentic experience, and that such experience informs their ability to conceptualize content (Duffy & Jonassen, 1992). Constructivism calls for active learning opportunities that are

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