

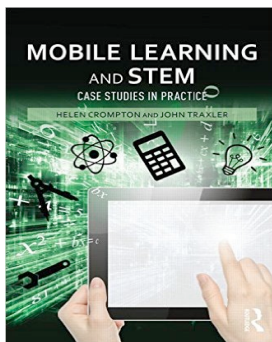
MOBILE LEARNING AND STEM: Case Studies in Practice

Edited by

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Considering the renewed focus on STEM education in the United States in recent years, scholars and practitioners are beginning to utilize the new pedagogical opportunities offered by mobile learning for STEM subjects. *Mobile Learning and STEM: Case Studies in Practice* presents a comprehensive collection of case studies that explore mobile learning's support of STEM subjects. This book can be a useful resource about mobile learning initiatives for teachers into their classrooms as well as STEM achievement for researchers. Concluding with a summary of STEM research and implications, this book is considered to provide contribution for practitioners, specialists, instructors, and researchers who want to establish better practices.

INTRODUCTION

by Helen CROMPTON and John TRAXLER

Introduction section covers the subjects' science, technology, engineering and mathematics (STEM) area and mobile learning approach briefly, then introduces the chapters one-by-one.

Chapter 1:

**Mobile Learning and STEM: First Experiences in A Senior High School in Ghana
by Margarete Grimus and Martin EBNER**

The authors made three workshops with high school students and teachers to examine the capacity of mobile devices for learning STEM with activities. It's found that mobile devices and cooperative strategies can promote creativity during content development and learning process.

Chapter 2:

**Using the Cameras on Mobile Phones, iPads, and
Digital Cameras to Create Animations in Science Teaching and Learning
by Jocelyn WISHART**

The chapter is focused on the use of mobile devices to support students' understanding of scientific concepts and processes via taking photos and making videos and animations. At the end of the study teachers and students both reported the process as effective and engaging.

Chapter 3:

**Evaluating the Use of Mobile Technology in Math Education: A Case Study
by Christina GITSAKI and Matthew A. ROBBY**

In this chapter, the authors used specialized web-based software (ALEKS) in a mathematics course using mobile technology. The findings showed that ALEKS helped students to build skills and self-efficacy. Using iPad increased the student engagement.

Chapter 4:

**The Impact of an Outdoor Mobile-Supported Learning Activity
on Students' Motivation, Perceived Performance, and Satisfaction
by Stavros A. NIKOU and Anastasios A. ECONOMIDES**

The authors implemented a mobile-assisted outdoor educational activity and compared the students' motivation, perceived performance, and satisfaction between the students who used traditional material and the ones that used mobile devices. QR codes are used in this process that led to ubiquitous learning combining real and digital world resources. The authors conclude that mobile devices can provide a promising tool for scientific inquiries in outdoor education and science teaching and learning.

Chapter 5:

**Learning to See With a Different Eye:
Using the Cameras on Mobile Phones and
PDAs in Science Teaching and Learning
by Jocelyn WISHART, Sakunthala Yatigamma EKANAYAKE,
and James FERNANDES**

After an introduction to previous research and relevant cognitive theory to explore how using digital images can support science learning, the authors presented five case studies. They evaluated the scenarios and their outcomes in terms of supporting learning. Findings include the uses by teachers to contextualize learning, create video demonstrations, and for evaluation process.

Chapter 6:

**Supporting Mobile Learning and Citizen Science Through iSpot
by Will WOODS, Kevin McLEOD, and Janice ANSINE**

In this chapter, the authors describe the development of iSpot which is a citizen science initiative engaging people through their interest in wildlife and presents a system that connects novices and experts. Their study aimed to redesign and reengineer the iSpot website.

Chapter 7:

**Creating Concept-Driven Videos to Promote Autonomous Learning
by Alissa K CARTER**

The author used the instructional videos to support mathematics learning in terms of preparation for and taking control of their learning within or outside the classroom. Students' scores and understanding have increased.

Chapter 8:

**EcoMOBILE: Designing for Contextualized STEM
Learning Using Mobile Technologies and Augmented Reality
by Amy Kamarainen, Shari METCALF, Tina GROTZER and Chris DEDE**

In this chapter a pilot study is presented which is conducted as a part of an EcoMobile project. Augmented Reality application is used to create place-

dependent and place-independent outdoor learning experience. Interviews with the students show that they found it engaging and useful. In addition, carefully constructed minimalist designs may support a perception of contextualization that comes from the perspective of the user rather than from the device.

**Chapter 9: Project Outbreak:
Take Biology Out of The Classroom And Into The World
by Farah BENNANI and Kae NOVAK**

This chapter focused on biology in a mobile learning environment. The goal of Project Outbreak's is to engage students in immersive and game-based learning as a way of increasing retention and knowledge transferability. The authors conclude student retention and success rate are significantly increased in Project Outbreak courses.

**Chapter 10:
Engaging Science Learners Through Lived Practice
via a Collaborative Mobile Game
by Denise M. BRESSLER**

The chapter explores the theoretical foundation for how and why collaborative mobile games foster meaningful learning. Then a specific type of mobile learning activity, a collaborative mobile augmented reality game is introduced which is designed and implemented in this study. Students had an immersive learning experience and exhibited significantly higher levels of engagement and scientific practices than the control group.

**Chapter 11:
Mobile Learning With a Remotely Operated Science Laboratory
by Donggil SONG and Paul KIM**

In this chapter, the authors devised a model that utilizes a remote lab to provide actual scientific experiments to a classroom that lacks science lab resources. The students were highly motivated in the ROSE (Remotely Operated Science Experiment) activity. This instructional model supported students explain phenomena, choose a research question, create a hypothesis, conduct an experiment, analyze the data, construct arguments, and draw conclusions. The study shows the potential for positive contributions to the mobile technology-mediated remote lab in science education.

**Chapter 12:
The Relationship Between Mobile Learning, Instructional Delivery,
and Student Motivation in a Large Undergraduate Science Class
by Kristen H. GREGORY and Helen CROMPTON**

The purpose of the case study in this chapter was to investigate the relationship between mobile learning, instructional delivery, and student motivation in a large science class. The emerging patterns are connected, personal, multimodal, engaged and class management. It is concluded that mobile learning can increase engagement and motivation.

**Chapter 13:
A New Approach to Mathematics Learning K-12 in Turkey
by Gonca TELLİ YAMAMOTO and Emre FIRAT**

The authors' aim was to develop students' self-directed learning skills by providing any time, anywhere learning philosophy for them.

The study is important for being one of the first trials of mobile learning in K-12 level mathematics classes in Turkey. Although the teacher and the students encountered some problems, they showed commitment to using mobile devices and understanding the value of mobile learning.

Chapter 14:

Integrating Two Technologies: Tablets and Teaching

by Jarek SIERSCHYNSKI

This chapter examined the implementation of a teacher-centered mobile application in three classrooms and the larger topics of STEM as part of K-12 technology integration and personalization in m-learning.

The authors imply that there is a need for a design approach to technology integration and emphasize that it's important to answer how, where and when the technology and pedagogy can meet with the strongest impact on students and teachers.

Chapter 15:

Embodied Learning on the Edge of Mobile

by Mattias DAVIDSSON

In this chapter, the author considered embodied learning and developed an application with Nico Reski bringing multimodal learning activity to the iPad. No significant difference was found between the two groups using this application and traditional lecture.

Based on the results and the literature, the author commented on the future of (mobile) embodied learning and what may be the further efforts to provide successful applications.

Chapter 16:

A Case Study of Synchronous Collaboration in Middle School Math

by Billie Jean HOLUBZ

The author investigated the synchronous collaboration experiences of seventh-grade math students.

Holubz expressed that utilizing the related apps was a useful option for integrating collaboration through technology, although the students sometimes challenged by technical barriers.

Chapter 17:

Mobile Learning (M-Learning) As A Paradigmatic Mechanism

To Facilitate Technology-based Learning In A Developing Country

by Suzaan Le ROUX

In this chapter, the aim is identifying the critical success factors (CSFs) that could serve as prerequisites for successful implementation as well as evaluating the m-learning process.

Chapter 18:

Mobile Learning for Online Practical Science Modules in Higher Education

by Victoria NICHOLAS

The author explored the students' perceptions of an online practical science course using mobile learning. Findings show at the end of the course students felt it was a valuable way to learn contrary to the beginning.

Chapter 19:
**An Exploration into Mobile Gamification
in an Information Technology Classroom**
by Laurie BUTGEREIT

The author used Journey model, a mobile gamification in education for adult learners in an online course. The students found it engaging and encouraging to do their homework in a timely manner.

Chapter 20:
**Towards Mobilizing Mathematics
via Gamification and Mobile Applications**
by Ferial KHADDAGE and Christoph LATTEMANN

In this chapter, the authors used gamification and four native mobile apps for math learning. The analysis show that for mobile math apps, game mechanisms and functionalities are more important than design.

CONCLUSION:
**Mobile Learning and STEM –
Challenges, Conclusions, and Perspectives**
by John TRAXLER and Helen CROMPTON

The chapter wraps up the STEM subjects and mobile learning in a broader historical and intellectual context, including competing perspectives and challenges under the following titles: The EAGLE Archetypes, Conventional Mobile Learning, Mobile Learning for a Mobile Society, Mobile Learning Amongst Abundance, Mobile Learning Amongst Diversity. Lastly, Conclusions, Changes and Barriers are presented.

REFERENCES

Crompton, H., & Traxler J. (Eds). (2016). *Mobile Learning and STEM: Case Studies in Practice*. New York, NY: Routledge.

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