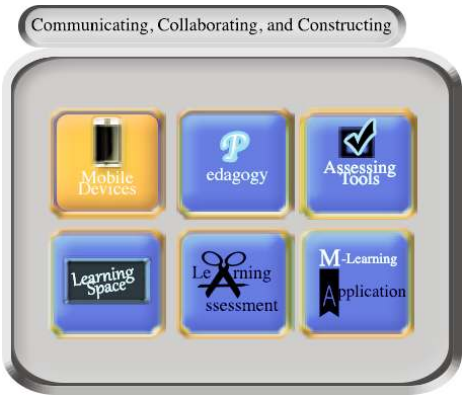
1 Introduction to Mobile Devices



In this chapter you will learn about:

- Mobile device characteristics
- Mobile device applications
- Mobile device importance and prevalence
- Mobile learning
- Mobile device uses in educational settings

The purpose of this chapter is to introduce you to some topics related to mobile devices and mobile learning. As a result mobile devices, applications and mobile learning is defined. Areas of further discussion include the importance of mobile technology, why it should be implemented into instructional settings, potential uses of mobile devices in learning spaces, and the challenges involved in creating m-learning environments.

1.1 Mobile Device Characteristics

Given the rapid rate of technological advancement, device capability and functionality, mobile device definitions change regularly (Jackson, 2013); this will likely continue given the evolution of mobile devices and the soon to be wearable options. However, currently, the National Institute of Standards and Technology (NIST) provide a set of characteristics that determine whether or not a tool is classified as a mobile device. NIST's criterion is noted in Figure 1.1.

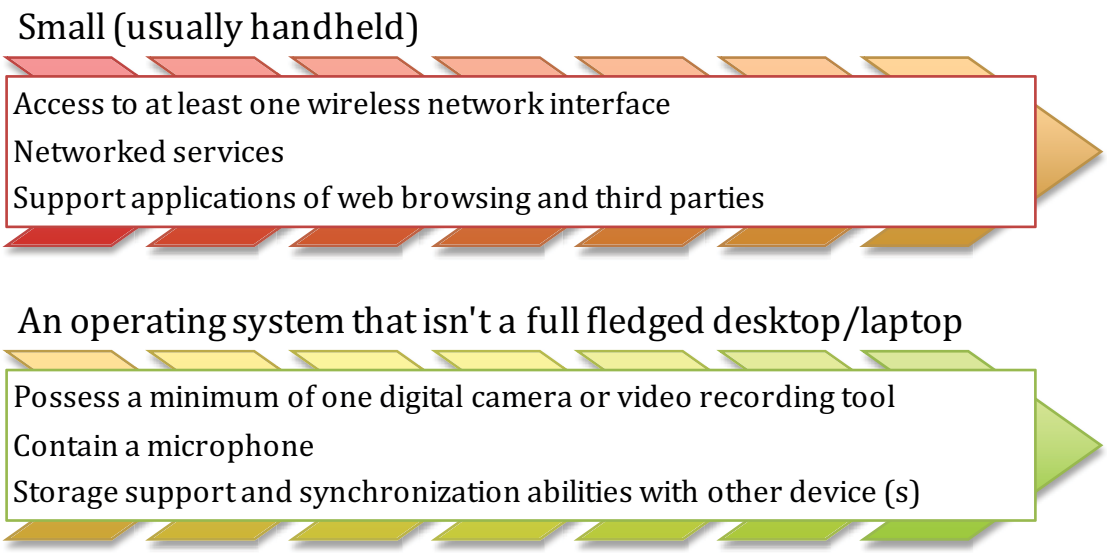


Figure 1.1: Characteristics of a mobile device (NIST).

There are a variety of different mobile devices that are produced by many different companies. Some examples of mobile devices include smartphones, such as the Apple iPhone, Google Android, HTC One, Nokia Lumia, Samsung Galaxy, or Sony Ericsson among many others. Mobile devices also include tablets like the Apple iPad, Google Nexus, or Microsoft Surface, to name a few. Regardless of the brand, all of these digital tools share each of the NIST characteristics, which classify them as a mobile device. However, it is imperative to know that as mobile devices adapt and advance in features, the characteristics that constitute a mobile device will also change.

1.1.1 Applications

One of the criteria for a mobile device involves applications. An application, or *app*, is software that permits a user to perform a designated function on their computing devices. There are many different apps for mobile devices (both smartphones and tablets) created by the mobile device manufacturer as well as third party developers. Apps are compatible with the device that they were designed to support in performing a particular task or function. For instance, iPhones or iPads can only use apps designed for Apple systems and specific to the device (e.g., an iPhone or iPad). The same is true for apps designed for Google Androids or tablets such as the Microsoft Surface.

Apps are generally divided into categories based upon what the app permits the device to do. More specifically, there are Business, Education, Entertainment, Games, News and Productivity apps, to name a few (for Apple apps see http://www.apple.com/iphone-5c/app-store/ and for Google apps see https://play.google.com/store/apps). The cost of apps varies; some apps are free while others have a fee. Although there are many different mobile device apps, this text focuses primarily on creativity, education and productivity apps as these are the most useful for instructional purposes. However, it is also important to note that apps are not required to incorporate mobile devices in the classroom. The beauty of the mobile device lies in its ability to converge information and task functions that allow users to access information, connect and record information. More about this topic will be presented in Chapter 3.

1.2 Importance of Mobile Devices

Although a variety of different technological tools have impacted society and the ways in which humans interact, the computer has probably made the greatest contribution communicatively, educationally and societally. Mobile devices, as a type of computing device or mini-computer, have become all the more important because of their transportability and convergence ability to permit user access to information, communication, connection, collaboration and construction of new deliverables from any location and at any time, what is also referred to as 'right time, right place'.

Mobile devices are especially significant because they allow individuals to communicate with themselves and others. For example, using mobile devices, individuals are permitted to interact with others via email, text message, audio and video recordings, social networking, phone call and video chat. All of these functions are made possible by various apps and the mobile device's ability to exercise convergence (e.g., the ability to do multiple things on one device). This level of communication translates into online communities populated by a digitally connected people. Through communication and connection to specific, and often self-selected, audiences or networks, individuals can collaborate on areas of common interest, projects or work-related tasks using apps or software like Google Docs or Google+Hangouts, mindmeister.com or Skype among many others. Since mobile devices are communicative tools with collaborative capabilities, people are able to construct deliverables of interest to them as well. For example, individuals, working independently or in groups, may use mobile devices and various apps to create multimedia presentations via apps like Explain Everything or PowerPoint via DocstoGo, video or audio productions with apps like Magisto or Voice Memos, Excel spreadsheets for displaying data, and/or Word or Pages for producing word processing documents.

Given that mobile devices permit access, communication and collaboration, these tools have become quite important to individuals, groups and establishments. Consequently, mobile devices are shaping cultures, human behaviors and societies. For instance, the ability to access information, communicate, collaborate and connect with others along with the ability to create and construct new deliverables has led to a U.S. cultural expectation regarding anytime, anywhere access to information or materials of personal preference. This expectation is driving additional technological advancements as well as the day-to-day activities of businesses, people and schools. Figure 1.2 captures the key reasons mobile devices are important to us.

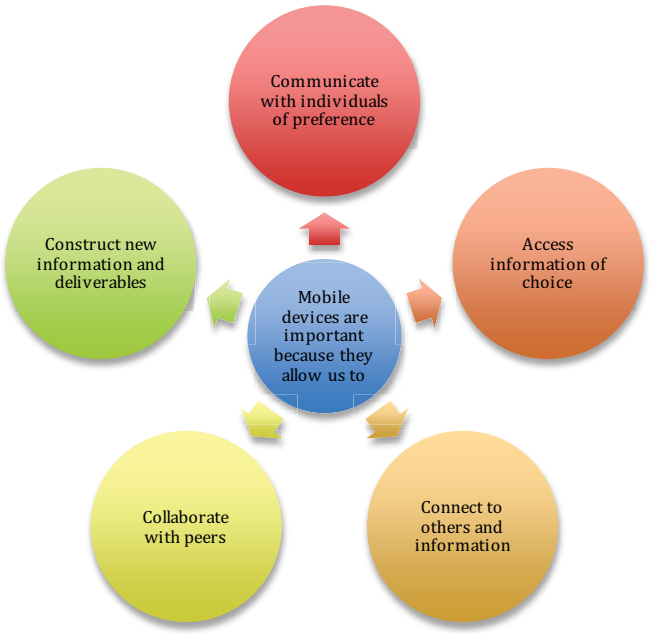


Figure 1.2: Reasons why mobile devices are important.

1.3 Prevalence of Mobile Devices

The Mobile Statistics Report, 2014–2018, produced by the Radicati Group, a technology market research firm, contains a variety of statistics and projections for mobile devices and users globally. One of the key findings of this document involves the number of mobile users (businesses and consumers) in 2014. Radicati reports that mobile devices/users will reach over 5.6 billion this year. Furthermore, by 2018, mobile device users are projected to increase to 6.2 billion, which translates into "84% of the world population using mobile device technology" (Radicati Group, Executive Summary, p. 2).

Additionally, the Pew Research Internet Project studies a variety of web-related topics. Their focus is primarily on the U.S. and the ways that Americans use the Internet and the kinds of tools Americans use to interact with the Web. In August 2013, Pew conducted research about broadband and smartphone adoption. Their study revealed that 56% of the individuals surveyed owned smartphones. Educationally speaking, 36% of people without a high school diploma, 46% of high school graduates, 60% of people with some college and 70% of individuals who earned one or more degrees owned a smart phone. Pew further reports that 59% of urban, 59% of suburban and 40% of rural dwellers own a smartphone. Complete details regarding this study may be found at http://www.pewinternet.org/2013/08/27/broadband-and-smartphone-adoption-demographics/.

Pew has also conducted research on tablet ownership to examine adoption rates and demographics of ownership. Figure 1.3 contains some of their June 2013 findings
(see http://www.pewinternet.org/2013/06/10/tablet-ownership-2013/ for complete results).

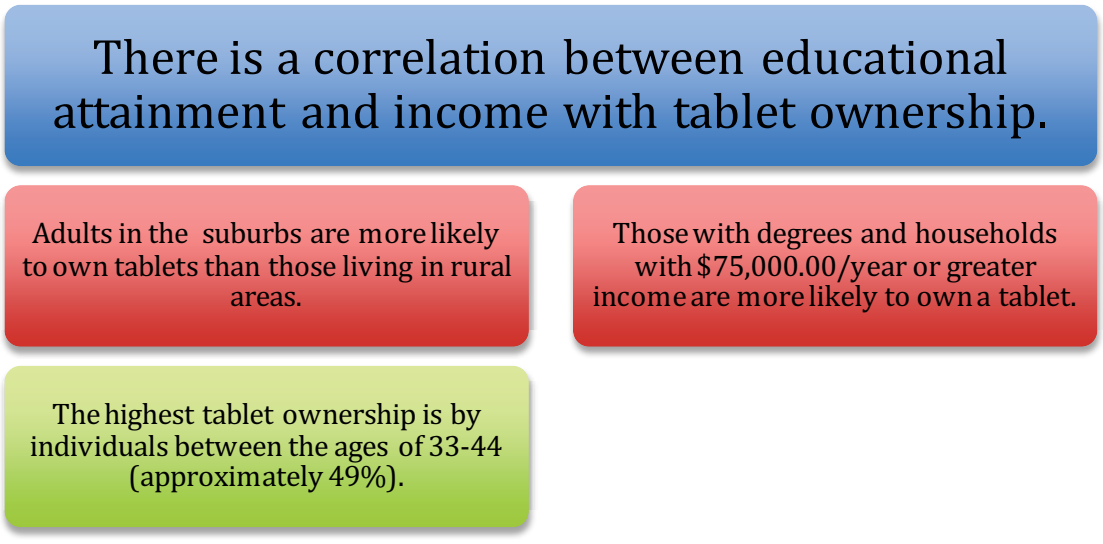


Figure 1.3: Pew Research Internet Project – Tablet Ownership Findings.

More recently, Pew has examined U.S. Internet behavior in celebration of the Web's 25th birthday. In January 2014 Pew surveyed 1,006 individuals to learn more about who was using the Internet and how they were using it. Figure 1.4 contains some of the findings gleaned from this study. For additional information about this study visit the following site http://www.pewinternet.org/2014/02/27/summary-of-findings-3/.

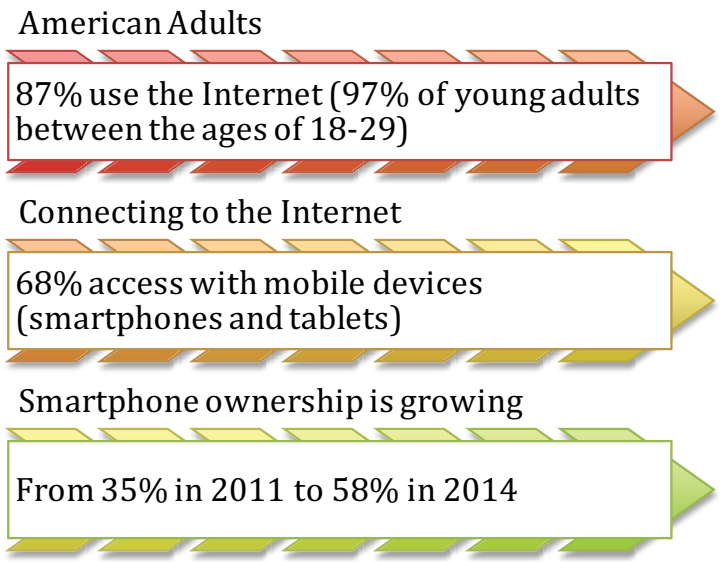


Figure 1.4: Pew Research Project – Internet and Smartphone Findings.

So what do these studies tell us? Smartphone and tablet adoption are on the increase and regardless of geography and socioeconomic status people are adopting mobile devices. Furthermore, educational settings will be impacted by Americans' access to mobile devices and the exposure that their children or families will have to these devices, whereby increasing the expectation and demand for anytime, anywhere access to information and a need for educational systems to educate Americans about how to access, locate and critically think and evaluate information and tasks accessed and obtained or created using mobile devices.

1.4 Mobile Learning

As previously noted, due to mobile device prevalence, educational settings are changing. One of these modifications involves how information is accessed, managed and created via mobile device classroom inclusion. The use of "handheld technologies, together with wireless and mobile phone networks, to facilitate, support, enhance and extend the reach of teaching and learning" (Schofield et al, 2011, p. 2) is referred to as *mobile learning*, or m-learning. M-learning is "highly situated, personal, collaborative and long term; in other words, truly learner-centered learning" (Schofield et al, p. 2) because it makes educational content and materials available to students when and where they need it. M-learning also encourages students to identify what they don't know through personal assessment and questions about specific content or related topics. M-learning empowers students to ask questions and to find the answers to those questions via access to and use of mobile devices and apps.

1.4.1 Why should instructors implement m-Learning?

There are a variety of reasons why instructors should create m-learning spaces. One of the most important reasons concerns students and their preparedness to function in a world that is communicatively and technologically rich and that requires a knowledgeable and digitally literate citizenship. While students understand the value of technology and demonstrate that value through the mobile devices they own and utilize, they "still need guidance when it comes to better using it for academics" (ECAR 2013, p. 4). Consequently, students need assistance, knowledge and skills to help them in learning how to use mobile devices for academic and professional contexts impacted by a 'creator society' (NMC Horizon Report, 2014, p. 1). This knowledge base and skill set derives from instructional opportunities that provide learning simulations for how to solve situations using mobile devices. ECAR 2013 findings report that "students are ready to use their mobile devices more for academics, and they look to institutions and instructors for opportunities and encouragement to do so" (p. 5). As a result students want technological guidance to improve their college experience overall as well as to provide them experiences transferrable to other aspects of their lives, such as careers.

A second reason that educators should implement m-learning spaces concerns the creation of dynamic learning environments. The inclusion of mobile devices and the use of apps that permit access to information and interactivity with content can assist students in seeing the connections between a learning environment and the broader world. The ability to connect these different environments helps learners to understand how information and knowledge is applicable, transferable and useful to and in various contexts (ECAR 2013). These activities also develop students' critical thinking skills, which are necessary to succeed in a complex and global world that is highly connected through mobile devices and other technological tools.

The ability to capitalize on student-owned technology is the third reason m-learning spaces should be developed. According to ECAR 2013 "students hold high expectations for anytime, anywhere access to course materials and for leveraging the use of their personal digital devices inside and outside the class" (p. 5). As noted earlier, student preference for technological tools is demonstrated by their ownership of them. For example, Figure 1.5 represents ECAR 2013 findings about U.S. student device ownership.

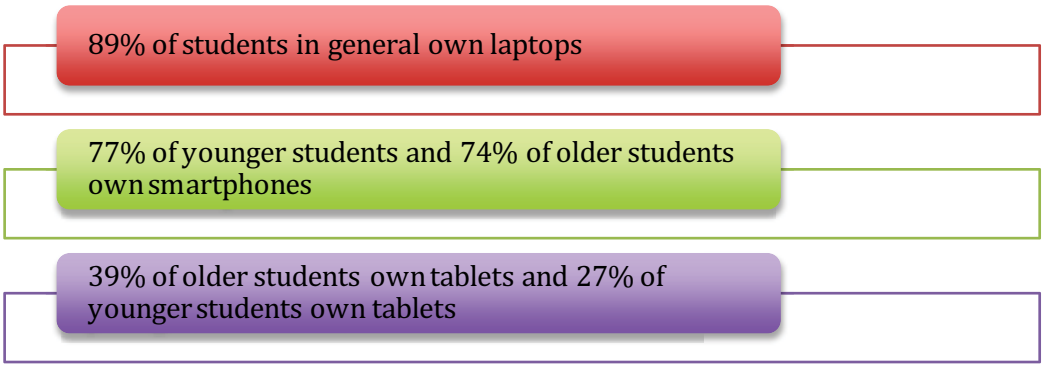


Figure 1.5: Student device ownership (ECAR 2013).

In reflecting on the ECAR findings it appears that there is a difference in who owns a particular device (e.g., smartphone or tablet). However, regardless of the demographic of device ownership (e.g., younger or older students who own smartphones or tablets), students possess mobile devices in addition to their laptops. The incorporation of these devices into instructional spaces could help students learn how to use them in academic and professional contexts. Additionally, the inclusion of these devices into instructional settings could also result in a cost-benefit savings to educational institutions. For example, The 2011 Horizon Report, sponsored by The New Media Consortium notes that, "…by 2015, 80% of people accessing the Internet will be doing so from mobile devices. Perhaps more important for education, Internet-capable mobile devices will outnumber computers within the next year" (Johnson, et. al, p. 12). Instead of educational institutions developing computer labs to enhance course instruction, they could implement student-owned mobile devices to do so resulting in their ability to reallocate financial and technological resources. Some of this rerouting of resources could offset challenges presented to various student populations when it comes to the digital and second level digital divide (Reinhart, Thomas, & Toriskie, 2011).

Another important reason to consider m-learning space development involves instructional space flexibility. Mobile devices permit instructional space flexibility regarding applications and device inclusion along with the ability to relate to multiple learning styles. Mobile device inclusion also creates a highly customizable learning environment built upon student device ownership and the multi-modal nature of the mobile device. Students who learn best via audio, video or text can use apps that display information using these channels and are able to be accessed via different mobile device types. Martin (2013) provides some additional compelling reasons to use mobile devices in the classroom when it comes to instructional design and infrastructure in Figure 1.6.

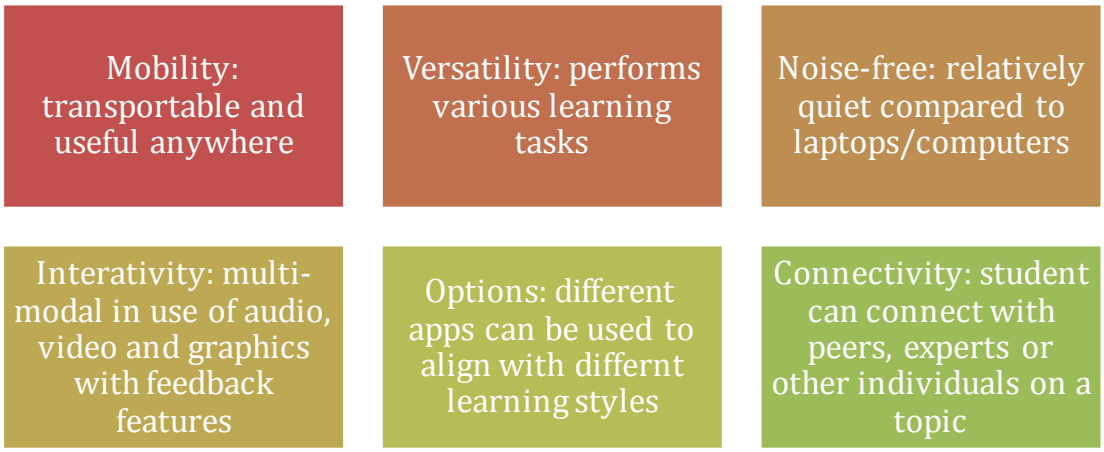


Figure 1.6: Reasons to incorporate mobile devices in learning (Martin, 2013).

Due to the flexibility that mobile devices offer educators, instructional settings and learners, they promote inclusivity and versatility in creating instructional activities involving individual, group or entire classroom content-related tasks as well as interactivity and diversity in the kinds of deliverables that students can create to demonstrate their learning and mastery of course concepts.

The need to close the gap between students' use of formal and informal learning in relation to mobile device use is an additional consideration for m-learning space creation. Formal learning occurs in a more structured environment like that associated with a classroom. Informal learning is the type of learning that occurs in less structured and organized environments usually on one's own. This topic will be discussed in more detail in Chapter 2. However, it is important to note that students are using mobile devices in many different ways resulting in a *second level digital divide* (Reinhart, Thomas, & Toriskie, 2011) and in ways that are more informal than formal. Consequently, educational institutions need to address these gaps in order to increase student understanding of mobile devices and their uses in academic and professional settings that will impact their ability to advance in their personal and professional pursuits.

1.4.2 Creating M-Learning Spaces

The numerous mobile devices and accompanying apps currently available to users provide infinite instructional possibilities regarding how they can be incorporated into various educational environments to create m-learning spaces. Although the discipline/subject, educational outcomes of the course and the instructor's curricular design skills and abilities affect the m-learning space, there are many basic ways that mobile devices can be included in instruction. As noted earlier in this chapter on applications, of greatest use to instructors are creativity, education and productivity apps. Each of these app categories presents unique instructional planning and learning opportunities to students and teachers. However, there are some broader more fundamental ways that educators can incorporate mobile devices into their classes given their capabilities and contingent upon the instructor's skill level or knowledge of specific apps or desire to use primary functions of the device that do not require apps at all.

For example, Dale Pike, director of academic technologies at Boise State University, in a 2012 interview with Academic Impressions noted, that mobile devices may be used in educational settings (https://www.academicimpressions.com/news/showcase-examples-mobile-technology-used-teaching-and-learning) due to their following abilities noted in Figure 1.7:

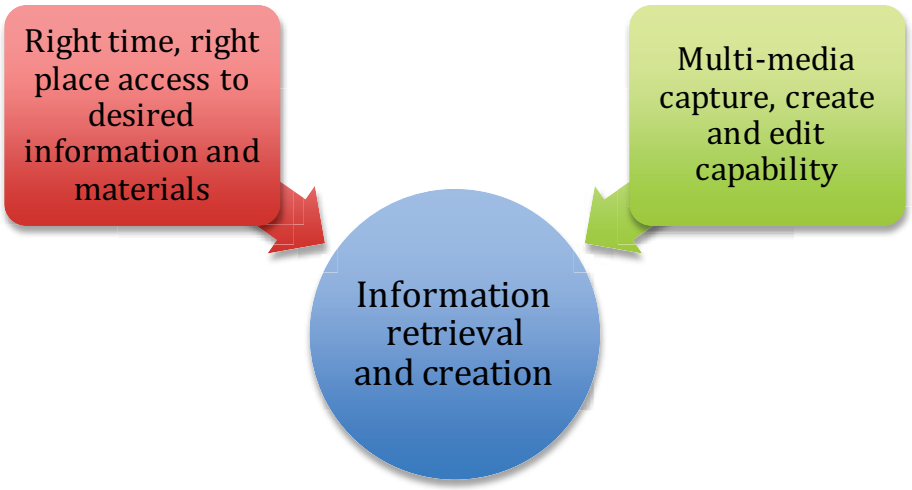


Figure 1.7: Mobile device abilities promoting instruction and learning based on Pike.

Pike further explained how these mobile devices translate into learning spaces. He provided three specific educational uses of mobile devices:

1) student ability to capture data and comment on it in real time (e.g., using video and audio mobile device capabilities to capture a phenomena and to interact with others using communication tools available via the device to discuss what was collected);
2) student created multimedia consisting of data that can be enriched to promote deeper learning (e.g., timestamps, video or audio notes about a course-related topic);
3) and the acceleration of feedback opportunities between the instructor and the student (e.g., using text messaging, social media or the learning management system to provide information to students about future action or performance on a task).

For specific examples of these mobile device uses visit https://www.academicimpressions.com/news/showcase-examples-mobile-technology-used-teaching-and-learning.

While Pike identifies these broad mobile device features that are easily implemented into learning spaces, U.S. students have also shared their perspectives about mobile devices and instructional environments. More specifically, students reported that they either use or *desire* to use their mobile devices to "look up information, photograph information, access digital resources, record instructors and participate in activities" (ECAR 2013, p. 29). Each of these student uses or suggestions is easily incorporated into instructional spaces with little preliminary instructional design planning or educator training; they also draw upon the most user friendly and accessible device capabilities offered by the tool and most of which don't require a particular app.

Figure 1.8 contains additional student thoughts about the specific technologies that they would like to see incorporated into their instructional settings (see ECAR 2013).

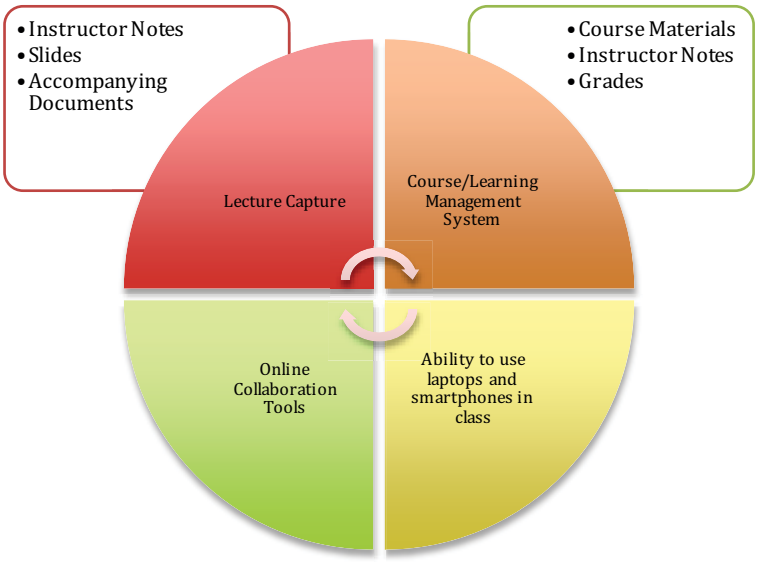


Figure 1.8: Students' preferences and uses for technology in class (ECAR 2013).

Like the earlier list of student recommendations for instructional uses, the activities identified in Figure 1.8 can also be easily incorporated into an instructional space and performed via a mobile device and app that supports it.

Chen and DeNoyelles (2013) also noted that college students are using mobile technology more for academic related purposes. The researchers found that although all students (n=1,082) reported using their mobile devices for gaming, listening to music and social networking, they also reported using a variety of academic and educational apps. Figure 1.9 lists some of the academic apps students used to learn formally (in a learning environment or classroom) and informally (outside of a class-related context).

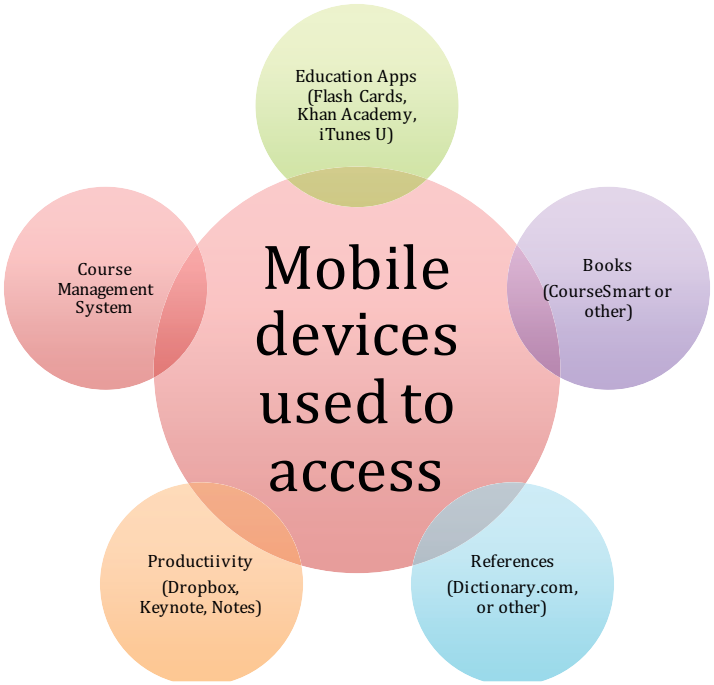


Figure 1.9: Students' use of mobile devices and apps (Chen & DeNoyelles, 2013).

Some other instructional possibilities involving mobile device and app use consist of students accessing e-books, e-portfolios, educational gaming apps, open educational resources and simulations. ECAR 2013 describes these m-learning instructional activities as experimental given students are not using their devices as frequently to access these resources and tools.

1.5 Instructional Challenges to M-Learning

Incorporating mobile devices into instructional settings changes the learning environment and challenges the ways in which teaching and learning has normally occurred. Many of these changes and challenges emerge due to student access to information, ability to communicate and collaborate with the instructor and peers, and the instructional planning and training required to create m-learning spaces.

Adoption of mobile devices into educational settings is also challenging due to instructor 'low digital fluency' (NMC Horizon Report, 2014, p. 2) combined with changing educational paradigms regarding the role of the instructor, student and models for teaching and learning in the midst of these modified roles and expectations. For example, Kessler (2011) argued that mobile phones [devices] might help to create inquiry-based learning approaches. These pedagogical strategies usually support *flipped classrooms* or activity-based learning environments as opposed to listening/absorbing learning environments. This pedagogical approach requires educators to change their instructional practices, and in some instances beliefs, about their role in the teaching and learning process. It also demands that students assume a greater responsibility in their learning of course content.

In addition to the changing roles of instructor and student is the newness of mobile technology. The newness of mobile devices coupled with the rapid rate of technological advancement and innovation (especially pertaining to mobile devices and apps) will require a student-teacher relationship focusing on the different uses of mobile devices in academic, personal and professional environments. Consequently, discovering how to incorporate technology, like mobile devices, into instructional spaces will necessitate "a partnership involving students, their instructors and the institution" (ECAR, 2013, p. 22). It will also require educators to have a greater understanding of specific educational theories, design principles and mobile technologies, both devices and apps, to implement successfully along with a knowledge of the infrastructure and the resources needed to support mobile devices and app adoption, implementation and sustainability in specific learning contexts.

To assist educators with addressing these challenges, the following chapters of this book introduce you to a variety of mobile device topics of consideration when incorporating mobile devices into learning spaces (as suggested by Chen & deNoyelles, 2013). More specifically, we explore how to:

- ❖ teach with mobile devices using education theories and pedagogical practices that engage diverse learners
- ❖ assess mobile devices and applications when considering tool adoption
- ❖ support m-learning via learning space infrastructure and support considerations
- ❖ develop teaching activities that demonstrate the application and incorporation of educational theories and concepts into everyday instruction via classroom tested examples.

1.6 Summary

In this chapter you have learned:

- Mobile device definitions change regularly due to tool innovation and specifications; however, criterion for determining if a tool is currently a mobile device exists. However, this definition will also change as mobile device capabilities evolve.
- Some characteristics of a mobile device include small size, network access, synchronizing capabilities and video and sound capture functions.
- Applications (apps) are software specific to a mobile device that permits that device to perform particular functions.
- Mobile learning is the result of incorporating mobile devices into learning spaces to extend teaching and learning activities.
- Students use mobile devices more informally than formally to learn resulting in a gap in when and how mobile devices are used in- and out-of-class.
- As educators, we will need to teach students how to employ mobile devices in learning spaces as well as how to accurately access and assess information, communicate effectively, and think critically about mobile device selection and use.

Key Terms

Mobile Device
Apps
Mobile Learning (m-learning)
Smartphone
Tablet
Flipped classroom

Reflection to Action

1. Reflect on the technological tools you own. Are any of them a mobile device? Using the information presented in this chapter explain why the tool is or is not a mobile device.
2. Examine a mobile device of your choosing. How could you imagine using one feature of the mobile device in your classes, both inside and outside of the learning space?
3. Create one teaching activity involving mobile devices that could be implemented in one of your courses. Consider the following questions:
    a) What are the learning outcomes of the activity?
    b) What do you want students to accomplish using the mobile device?
    c) How is using the mobile device similar to or different than a comparable activity you implement in your instructional space?