Digital Thinking and Mobile Teaching

Communicating, Collaborating & Constructing in an Access Age

Dr. Renee Robinson; Dr. Julie Reinhart

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Abstract

Regardless of instructional level the classroom is a dynamic environment filled with opportunities to explore various subjects as well as to experiment with teaching and learning practices. Due to the pervasiveness of technology and student owned mobile devices, learning spaces are all the more dynamic. To assist teachers and students in thinking about how to utilize mobile devices in instructional spaces, this book explores how mobile devices can be incorporated into learning environments to promote a digitally-rich curricula resulting in a framework that identifies a right time, right place and mobile device aimed at maximizing student learning. Consequently, the authors explore how mobile devices can be used to create mobile learning environments built upon educational theories, methods of assessing mobile devices, apps and student learning and infrastructure considerations required of liquid learning in formal and informal instructional spaces. The text also includes case study examples from elementary, secondary and post secondary settings to assist readers in applying the book's concepts in a concrete fashion.

About the Authors

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Preface

A mobile device is any hand held tool that permits Internet access and allows for communication and collaboration between the end user and others; they are devices that are constantly connected to the Internet. Some specific examples of mobile devices include iPads, smart phones and tablets. Access to these devices has grown significantly as well as the mobile device's capabilities. For example, The 2011 Horizon Report, sponsored by The New Media Consortium shares, "According to a recent report from mobile manufacturer Ericsson, studies show 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). In part this outnumbering will occur due to mobile device advancements and the opportunities they provide regarding access to information, collaboration with others and construction of documents and other materials required of individuals' personal and professional expectations and responsibilities. The increased pervasiveness of these mobile devices will significantly affect educational spaces in various ways.

Educators, as instructional designers and facilitators, will be directly impacted by mobile devices. While educators are experts in their specific fields, they frequently do not possess the knowledge and skills that manifest in the pedagogical practices required of how to incorporate mobile devices into their instructional spaces. This deficiency occurs due to a lack of education, preparation, and training in how to deliver instructional content to a diverse student population (Robinson, 2012) incorporating instructional practices involving mobile technologies that can promote engaged and experiential learning opportunities for students. Technological literacy and fluency, what it means regarding instructor preparedness to teach, and how technological and pedagogical strategies intersect with the educator's content area of instruction as that relates to student learning is an area of concern because of the complex nature of the teaching and learning process, societal expectations and practices consisting of student preparedness to enter the 'real world'/workforce and societal technological prevalence.

Effective classroom [learning space] teaching and research stem from pedagogical content knowledge, or the instructor's understanding of their respective field coupled with an understanding of pedagogical theories (Paulson, 2001). Robinson (2012) notes, "Although pedagogical content knowledge has been explored, little information exists about the technological literacy and fluency that instructors need to successfully navigate the teaching and learning process" (p. 1242). Today, part of that technological landscape includes mobile technology enhanced instruction. Effective use of mobile devices in learning spaces is a subset of pedagogical theory and a foundational component of technological pedagogical content knowledge (Mishra & Koehler, 2006). *Technological pedagogical content knowledge* (TPACK) requires educators to have an increased understanding of the complexities of teaching and learning spaces, especially regarding the inclusion of technology. As a result, Mishra and Koehler argue that "content, pedagogy, and technology…" (p. 1017) represent three of the complex factors present in instructional settings, which require careful thought and planning when designing learning environments, outcomes and activities. TPACK becomes increasingly important given the changing landscape of education from pre-kindergarten to postsecondary instructional settings (P-16) that includes more technologically enhanced curricula, different delivery systems and organizational operations contingent upon technologies and the commonness of student owned mobile devices impacting these already complex learning spaces.

Another outcome produced by the pervasiveness of mobile devices concerns individual (e.g., student, parent and other stakeholder) expectations about having the ability to work and learn when and where an individual chooses (Johnson, et. al, 2011). With this in mind, how can mobile devices be incorporated into instructional spaces to create meaningful learning opportunities that prepare students to learn and work with mobile devices in a rapidly changing world that values technology and incorporates that technology into most of its daily interactions and operations? How can instructors create experiential mobile learning spaces that engage students in course content and tap into their higher order thinking skills? How can mobile devices be used to access information and learning related content, create collaborative learning spaces for groups and peers, and be used to construct learning deliverables to assess and measure student learning in individual, group and peer contexts? And given such rapid advancements in mobile devices and applications what practices might educators adopt that transcend these changes?

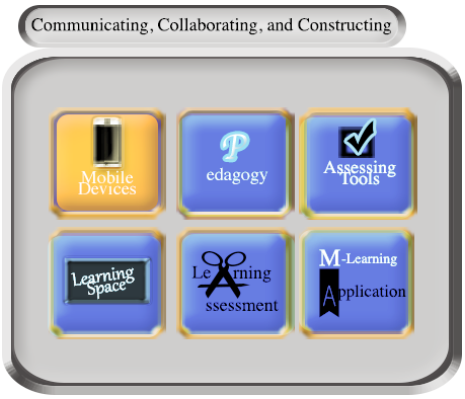
This book explores these questions as well as the purpose of mobile devices in learning spaces as they are incorporated into course curricula resulting in a framework that identifies a right time, right place and mobile device aimed at maximizing student learning. More specifically this text identifies mobile technology applications, implications, and pedagogical situations that increase students' learning in various instructional environments by examining how mobile devices and their applications can be used to:

- alter learning spaces pedagogically
- create access to course content and related interactive information and sites

- enable students to construct and develop various types of deliverables demonstrating learning outcomes
- engage students in course content through group and peer collaboration
- prepare students for a world requiring critical thinking and digital literacy skills and
- provide educators with mobile device considerations and strategies that aid in curricular design and development of learning outcomes for assessment purposes.

The following chapters of this book will introduce you to a) mobile devices and their current and potential uses in educational settings; b) some educational and pedagogical theories of importance when teaching with mobile devices; c) how to assess various mobile devices and apps when considering them for instructional purposes; d) infrastructure and learning space considerations for inclusion of mobile devices; e) ways to assess student learning with mobile devices and applications; and f) examples of instructional activities that implement mobile devices into the teaching and learning process based upon best practices related to the information presented in this text.

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.

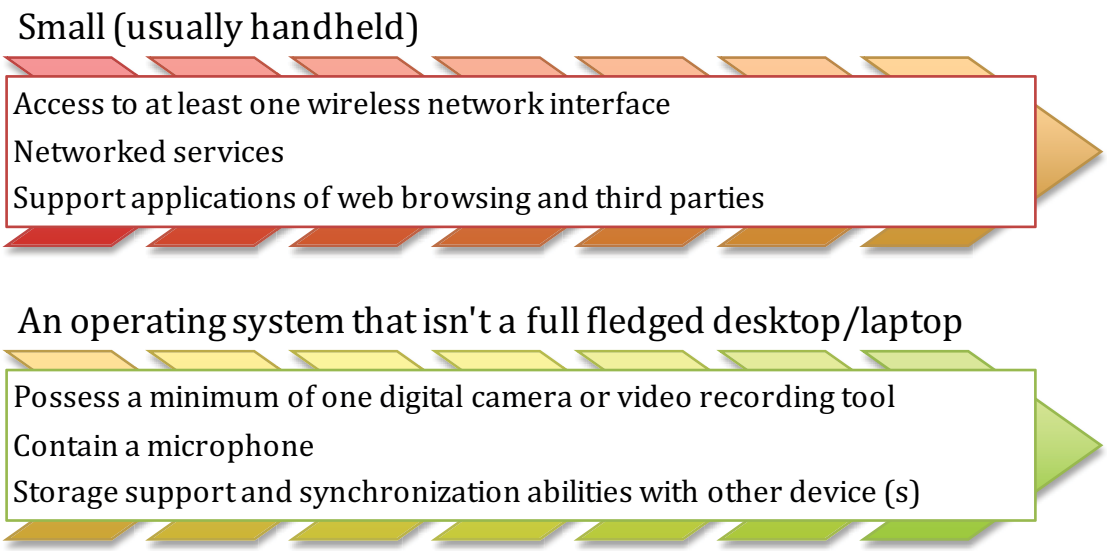


Figure 1.1: Characteristics of a mobile device (NIST).

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.

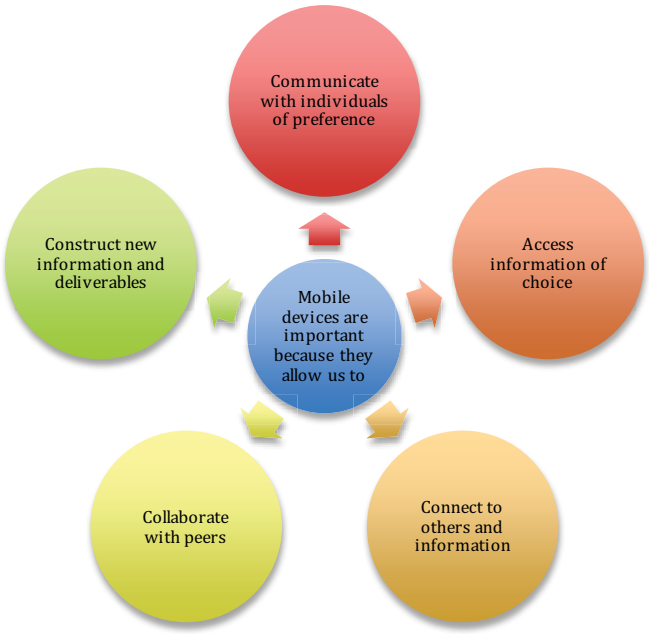


Figure 1.2: Reasons why mobile devices are important.

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).

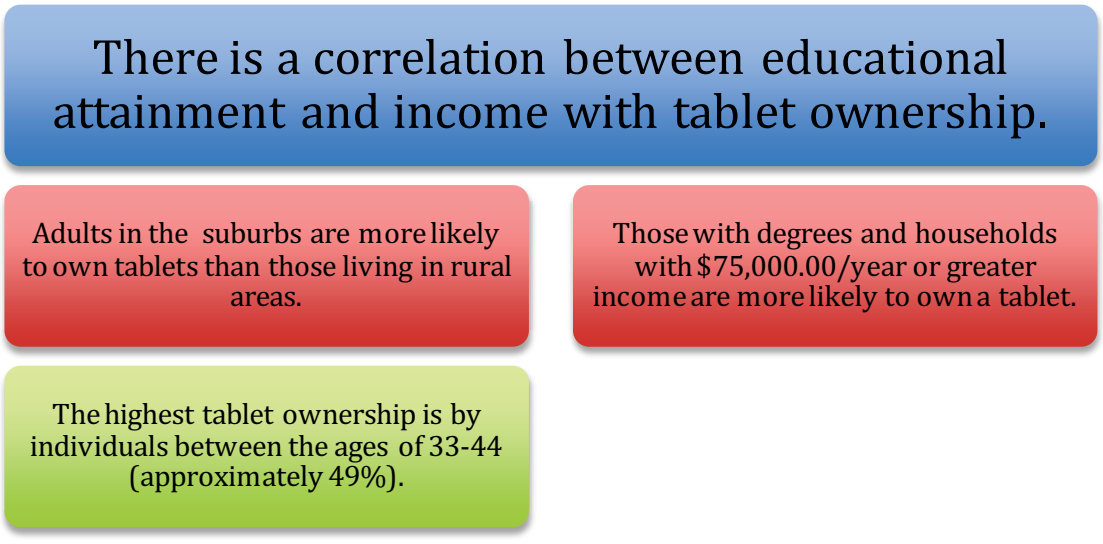


Figure 1.3: Pew Research Internet Project – Tablet Ownership Findings.

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/.

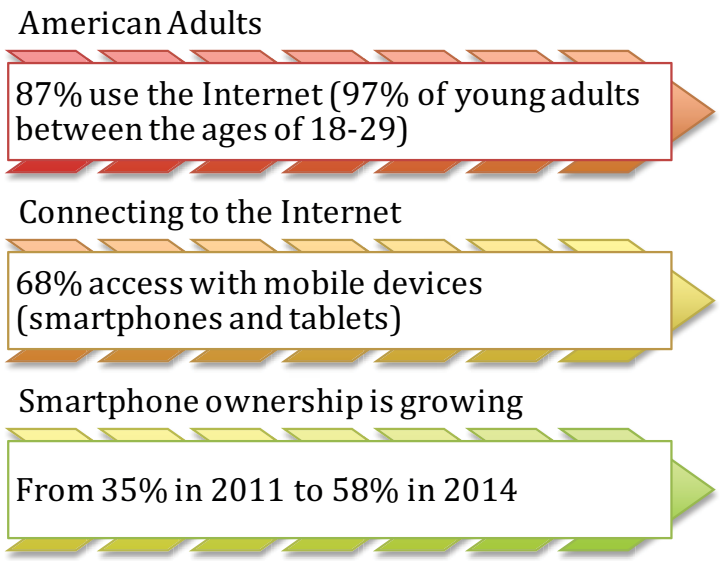


Figure 1.4: Pew Research Project – Internet and Smartphone Findings.

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.

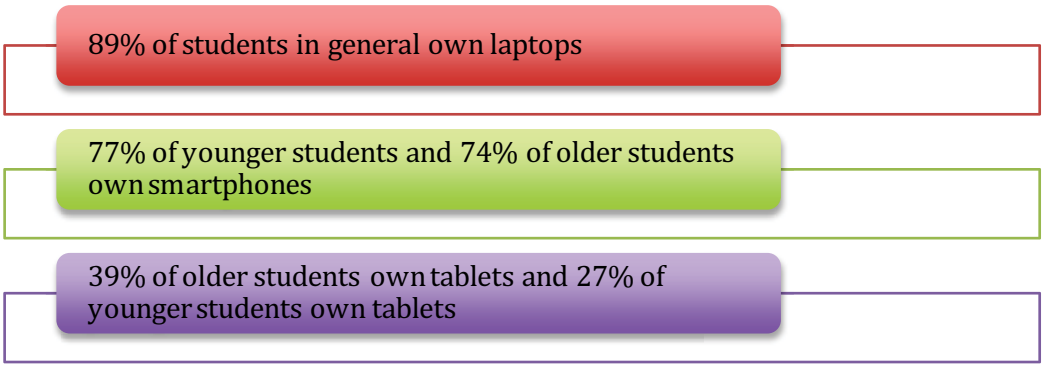


Figure 1.5: Student device ownership (ECAR 2013).

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.

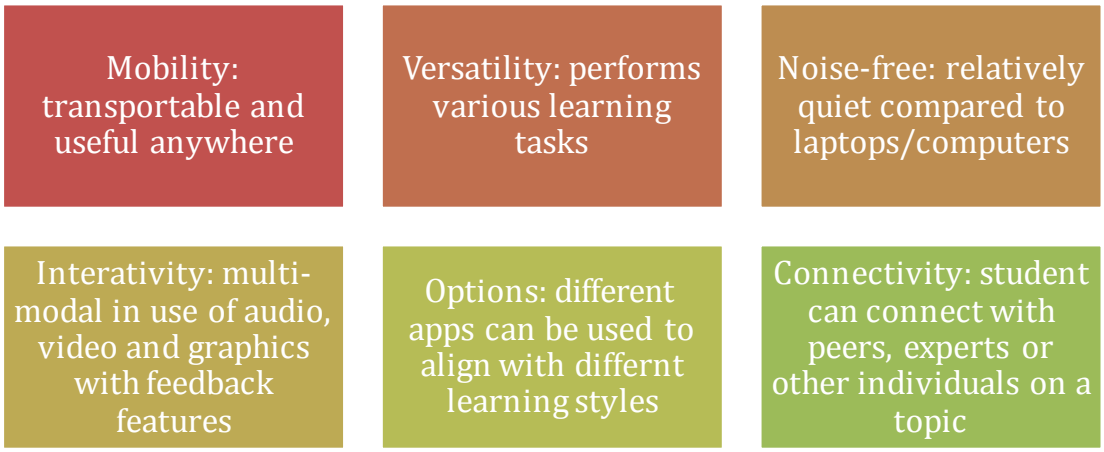


Figure 1.6: Reasons to incorporate mobile devices in learning (Martin, 2013).

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:

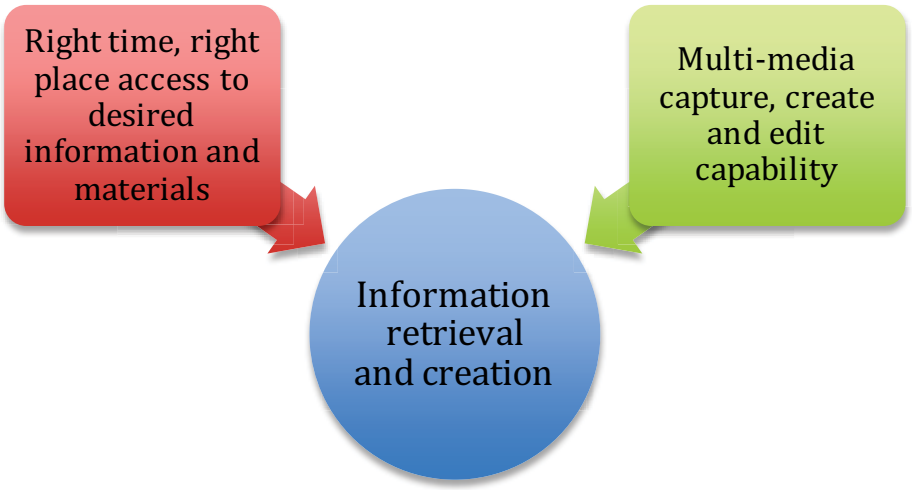


Figure 1.7: Mobile device abilities promoting instruction and learning based on Pike.

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).

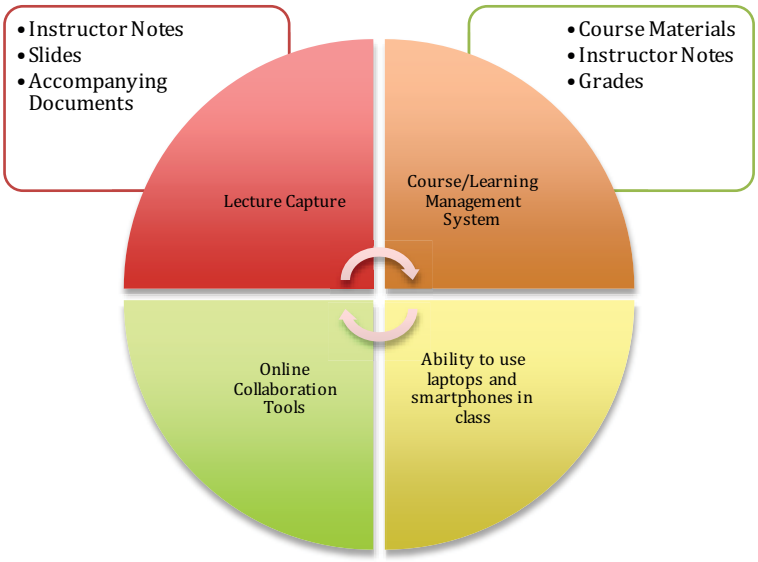


Figure 1.8: Students' preferences and uses for technology in class (ECAR 2013).

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).

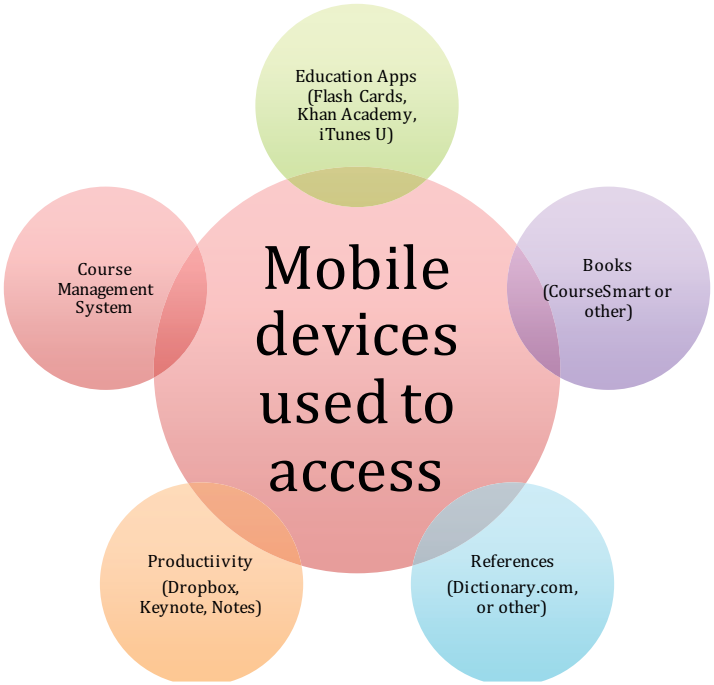


Figure 1.9: Students' use of mobile devices and apps (Chen & DeNoyelles, 2013).

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?

2 Educational Theories to Consider when Instructing with Mobile Devices

In this chapter you will learn about:

- Constructivism
- Experiential learning
- Formal, informal and nonformal learning
- Kolb's Experiential Learning Model
- Learning styles
- Understanding by Design (Wiggins & McTighe, 1993)

This chapter introduces you to a variety of different educational theories. Each of them assists instructors in designing and creating course content and learning spaces that enhance student learning. Of particular importance in this chapter is the discussion of creating experiential learning environments to promote deeper learning experiences for students through careful course design focused on learning outcomes that can be measured and met through access to information, collaboration among peers and the construction of deliverables that assess student learning. These same instructional concepts can be used to tap into students' higher order thinking skills (HOTS), cognitive processes that extend beyond recalling or retaining factual information in a specific context (Bloom, 1956; Greeno, 1989; Anderson & Krathwohl, 2001), which is the ultimate goal of most educators.

2.1 What is experiential learning?

Experiential learning has been defined in a variety of ways. For example, Doolittle and Camp (1999) note that experiential learning is an extension of constructivism. The "basic characteristics of constructivism include (a) learners as active participants in their learning, (b) the acknowledgement of prior learning as foundational to current learning, (c) interaction with others leading to greater understanding and shared meaning of concepts, and (d) as opposed to abstract learning, a focus on "real-world" tasks…" (Hedin & Carroll, 2010, p. 109–110).

Hedin and Carroll (2010) also noted that, "the terms experiential learning and experiential education are often used interchangeably, but at times refer to different things" (p. 108). The authors differentiate the terms by defining experiential learning as ways in which individuals learn while experiential education refers to "programs or contexts that make use of experiential learning" (p. 108).

Yount (2001) further defined experiential learning as "active participation of learners in events or activities which lead to the accumulation of knowledge or skill" (p. 276). However, Lewis and Williams (1994) defined experiential learning as "learning by experience or by doing" (p. 5). Regardless of how experiential learning is defined, student engagement and participation in learning experiences focused in specific contexts is the foundation for such learning and pedagogical practices.

Experiential learning has also been categorized. For example, Etling (1993) identified three types of experiential learning: informal, nonformal and formal. *Informal experiential learning* occurs in everyday life, individually and incidentally as individuals interact with the world around them. *Nonformal experiential learning* usually occurs in experiential education and manifests in learning opportunities like internships or service learning experiences. Although instructors may create or coordinate nonformal experiential learning activities, they are not as involved in the direct learning that students may obtain in that experience. In contrast, *formal experiential learning* occurs primarily in instructional settings and is directed and facilitated by instructors who require students to be engaged in course content through experiencing the topic of study in a predetermined and structured manner.

2.2 Why is experiential learning important?

Now that we have an understanding of how experiential learning is defined, why should educational institutions or instructors want to incorporate experiential learning activities into curricula, instruction or programs? Perhaps one of the most important reasons to incorporate experiential learning into the classroom concerns student achievement. For example, experiential learning develops students' problem solving skills as it requires students to have a direct experience and reflection of learning on that experience which results in developing critical thinking and higher order thinking skills in specific contexts. In addition to developing and enhancing critical thinking skills, experiential learning can also positively impact student interest in course content (Holstermann, Grube, & Bogenholz, 2010). This is supported by various research findings that document incorporating experiential learning in higher education settings can lead to improved student grades (Reitmeier, 2000); assist students with tackling difficult subjects (Pugsley & Clayton, 2003); and help with student motivation to engage course content (Briers, 2005). These results may in part be due to the students' ability to access different kinds of information (e.g., literature, peers or experts), collaborate with peers and groups on problems presented in experiential learning environments (formally, nonformally and informally), and the construction of a specified deliverable related to the experiential activity.

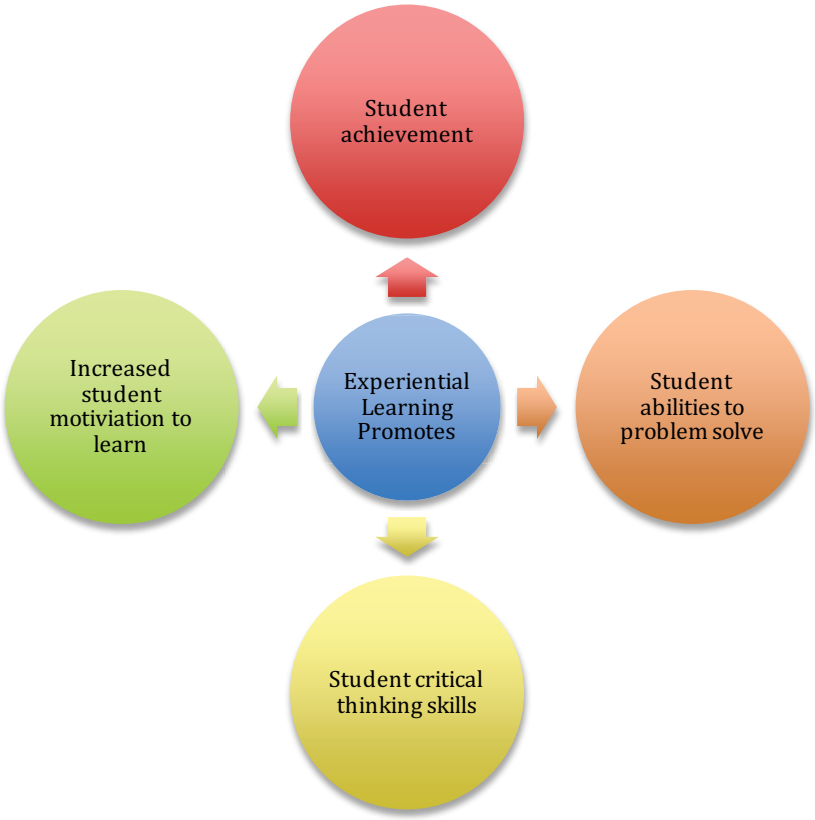


Figure 2.1: Benefits of experiential learning.

A second reason to adopt experiential learning activities concerns school or university image. According to Porter, King, Goodkin, and Chan (2012), "Universities are becoming increasingly conscious of how learning activities align with many institutions as an essential activity for students to gain attributes they desire in their graduates" (p. 24). If universities are identifying the kinds of characteristics and traits they wish students to possess upon graduation, then it is critical that students be provided opportunities to develop and hone those predetermined skills. These university trademarks, manifested in each graduate, creates a positive image for the universities and educational centers that offer them.

Finally, incorporating experiential learning activities into instructional spaces helps prepare students for a world that expects access to information and interaction with that information, collaboration, problem solving and digital literacy resulting in a predetermined deliverable requiring higher order thinking skills. Experiential learning experiences permit these types of skills to be developed while simultaneously preparing students to meet the private sector's desire for knowledgeable workers with these particular abilities and skills. However, to meet the expectations of students and other stakeholders (e.g., parents, businesses and society noted in Chapter 1), mobile devices should be incorporated into instructional spaces to create experiential learning opportunities because they permit greater access to course content, instructional materials, multi-modal information about the topic of study along with apps and tools that can be used to create new products in relation to the instructional activity.

2.3 Kolb's Experiential Learning Model

This section of the chapter focuses on "one of the best known experiential learning theories in higher education" (Chavan, 2011, p. 127): Kolb's (1984) Experiential Learning Model (ELM). This model draws upon the theoretical foundations of Lewin (1951) and Dewey (1933/1938) (see Hedin & Carroll, 2010; Porter, King, Goodkin, & Chan, 2012) and argues that "Experiential learning takes place when, a) a person is involved in an activity, b) he looks back and evaluates it, c) determines what was useful or important to remember, d) and uses this information to perform another activity" (Kolb, 1984 as cited in Chavan, 2011, p. 126). Kolb's ELM is a process or stage model that categorizes learners based upon how they processes and comprehend information. Therefore, the theory seeks to identify and define the various learning styles that students possess and engage in as well as how they move through the stages of learning concepts and ideas grounded within a contextualized experience.

A learning style is "the consistent way in which a learner responds to or interacts with stimuli in the learning context" (Loo, 2002, p. 252). Kolb's ELM identifies four basic learning styles: accommodator, assimilator, converger, and diverger. When participating in a learning environment, the types of activities each group of learners prefers to perform in an instructional context when exposed to new stimuli defines the learning style. Learners perceive and process information differently; consequently one learning style is not better than another. However, individuals should learn how to incorporate various aspects of each learning style into their own learning practices so that they are better equipped with different ways to engage in and understand new information.

Kolb's ELM focuses on how learners perceive and process new stimuli or information; learning requires individuals to perceive and process new material in order to make sense of and understand it. *Perception* involves how students feel and think about a topic when introduced to it via a concrete experience and the abstract conceptualizations that students form about that experience. Concrete experiences require that students recall a prior experience or similar happening to what is being studied so that they are able to relate a new concept to former knowledge; abstract conceptualization requires students to create new ideas or mental constructs about the topic experienced. *Processing* involves learners performing various activities either by doing or observing experience-based content. To determine a learner's preferences for perceiving and processing information, Kolb developed a 12-item survey tool (Kolb's Learning Style Inventory) that allows learners to engage in a series of questions resulting in the calculation of learner scores that are plotted on a grid. The grid provides a visual representation of the learner's preferences for learning. The grid is constructed of an x- and y-axis resulting in quadrants. Opposite ends of the x-axis are labeled *doing/active experimentation* and *watching/reflective observation*. *Feeling/concrete experience* and *thinking/abstract conceptualization* are located at opposite ends of the y-axis. The student's scores associated with the characteristics related to each label on the grid categorize the student as one of four different learning styles: accommodator, diverger, assimilator, and converger. A description of each of the learning styles follows as well as some of the preferred learning activities associated with each style in traditional learning environments as well as m-learning spaces.

2.3.1 Kolb's ELM Learning Styles

Accommodator. The accommodator learns best by combining concrete experiences and active experimentation resulting in these learners needing opportunities to engage course content actively, experiment with it in simulations, and recall past experiences that relate to the new material. To fully understand content, they must be able to work with others (collaborate) to gather (access) information. Accommodators are "hands on" learners and rely on their instincts for problem solving as opposed to logical analysis. Some teaching activities that are best suited for these students in a more traditional learning environment involve film/videos, lab experiments, and role- playing among other activities. However, when using mobile devices to engage these learners apps such as YouTube, Second Life and voki (an avatar creator site) allow students to learn course materials by accessing related information, collaborating with others via digital worlds and/or social media and constructing new deliverables that showcase their knowledge and skills related to a topic.

Diverger. Concrete experiences and reflective observations are the primary ways a diverger prefers to learn. These learners are capable of multi-perspective thinking and viewing. Consequently, they reflect more frequently than act. Therefore, divergers prefer to gather information, research and idea generate which translates into their being highly creative and imaginative. Some potential teaching strategies that are diverger-friendly in more traditional classrooms consist of class presentations, group discussions, and opinion papers. If incorporating mobile devices, some instructional activities that engage divergers are blogging/vlogging via edublogger (an app for creating blogs and posting video presentations) or Notes to craft opinion papers, TED Talks to view presentations, or social media discussions using Facebook, Google+ Hangouts or Twitter.

Assimilator. Reflective observation and abstract conceptualization are the perception and processing choices of the assimilator. This learner's strength is digesting and synthesizing significant amounts of information. Unlike the accommodator, the assimilator prefers ideas over people and often they are more concerned with the logical soundness of a theory as opposed to its practicality. Lectures, models, theorems and term papers are effective teaching strategies that engage this learning style in more traditional learning spaces. However, mobile devices can be used to engage the assimilator by having students access the library databases, read articles and create a product that summarizes what was read/researched. Some apps that could be used to create that summary might include DocstoGo, Explain Everything or mindmeister.com (a mind mapping app).

Converger. The converger is a "thinker" and a "doer" resulting in their learning best through abstract conceptualization and active experimentation. These learners are capable of applying new knowledge and creating ideas. They also prefer assignments or tasks as opposed to people. Case studies, homework problems and service learning opportunities are effective pedagogical strategies for this type of learner. Mobile devices can be used to engage the converger by having them capture via audio or video a course concept or phenomenon, analyze that phenomenon and create a documentary that explains what was studied and the findings associated with it. A variety of video and audio apps are available for creating these kinds of deliverables. Figure 2.2 provides an illustration of the learning styles and their characteristics and preferences for perceiving and processing new stimuli when using mobile devices to create m-learning experiential learning environments.

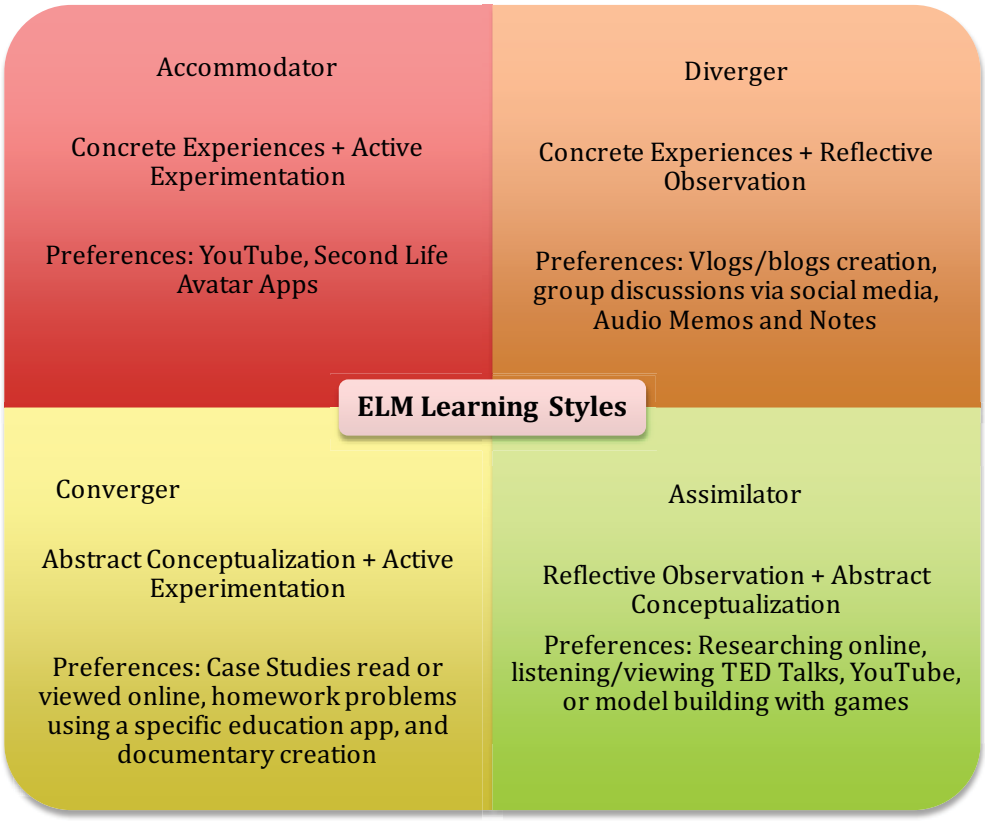


Figure 2.2: ELM Learning Styles, Characteristics and Preferences for Learning with Mobile Devices (Kolb, 1984)

2.3.2 Strengths and Limitations of Kolb's ELM

There are a variety of strengths associated with Kolb's ELM. For example, the ELM is a cyclical or process model that explains how learners perceive and process information based upon their preferences for learning. These preferences are then organized into four distinct and well-described categories making it parsimonious. Furthermore, because the model is well known and utilized in various educational settings, an extensive amount of research spanning over 25 years exists on the theory. The ELM also explains that learners cycle through each stage of the learning styles to ensure that their learning is ongoing and explains that one learning style is not better than another and that learners may enter the learning model from any one of the four stages noted in the model. Kolb's ELM also identifies concrete examples of pedagogical strategies that assist educators in designing and developing curriculum that engages students in course content and learning. Finally, the theory has been revised based upon new information or innovations that may impact it or that require theoretical modifications (Chavan, 2011).

As with all theories, Kolb's ELM is not without limitations. For example, some researchers argue that thinking is too complicated to occur in a stage model and that individuals think differently resulting in different ways they experience, reflect or reach conclusions related to different stimuli; consequently, the model does not apply to all situations (Dewey, 1938/1933; Jarvis, 1987; Tennant, 1997). Another limitation concerns the neatness of the model or how it reflects the ways in which individuals learn within the four learner categories. Additionally, little attention has been given to how the model can be implemented via mobile devices in different kinds of learning spaces or delivery systems that interface with mobile technologies.

The next part of the chapter introduces you to a theory, *Understanding by Design*, focusing on course development. Since experiential learning and mobile device use can be implemented as pedagogical strategies in most courses, the theory can help instructors make decisions about the incorporation of these practices.

2.4 Understanding by Design (UBD)

Understanding by Design (Wiggins & McTighe, 1998) is a curricular development framework that assists instructors in course creation through the consideration of three essential and overarching questions: what do you want students to know, how will you measure their learning and what instructional activities will be incorporated in a course to help students understand what is to be learned. These questions articulate the design process and keep educators focused on course outcomes and emphasizes student understanding of those concepts. The steps of Wiggins and McTighe's UBD is noted below and accompanied by a series of questions that guide each component.

> **Stage 1:** Identify desired results – what should students know or be able to do with the information/knowledge obtained? what is important to learn?

Stage 2: Determine acceptable evidence – what kinds of data will be collected to demonstrate student learning? how is learning determined to have occurred?

Stage 3: Plan learning experiences – what will students need to know and be able to do to meet steps 1 and 2 above?

An understanding of UBD regarding the creation of m-learning environments is critical for instructors. This topic will be discussed in detail in Chapter 4. For now, it is important to note that prior to app selection and defining what students will do to demonstrate their learning using mobile devices, instructors must first ascertain what they want students to know in a specific course, module or unit. Afterwards, educators may plan the learning experience and the details associated with it. Incorporating UBD in the instructional design process ensures that the focus of any course is on the student and their learning and not on the technology used in the course to get there. However, UBD does provide a useful framework to consider when adopting mobile devices as instructional tools and helps the instructor critically evaluate and develop an instructional plan for successfully incorporating mobile devices to promote experiential learning and the engagement of varying learning styles.

2.4.1 Strengths and Limitations of Understanding by Design

Understanding by Design has a number of strengths. First, it is built on the premise that 'teachers are designers' (Wiggins & McTighe, 2005, p. 13). Much of what educators do is design-related. This design characteristic is manifested in the creation of courses and exams, the development of teaching activities and lesson plans, and the methods incorporated to meet course outcomes. UBD articulates and celebrates this artistic and scientific aspect of teaching. Second, the framework provides a set of questions for instructors to consider when developing courses, content and outcomes aimed at advancing student understanding of course material. This framework helps teachers to focus on what students are to accomplish and how they are to reach those objectives. Third, and most importantly, UBD is student focused requiring the instructor to always attend to the audience/learner as a course progresses. Fourth, UBD provides instructors with a strategy to avoid two major challenges found in most teaching environments: teaching to the text and 'activity focused teaching' (Wiggins & McTighe, 2005, p. 3). UBD argues to overcome these challenges, outcomes, activities and assessments should be interconnected (Wysocki, 2009). Finally, *backward design* is a unique feature of the theory and requires that educators focus first on course outcomes in relation to their students. This process requires that the educator attend to the student first in order to identify what the course outcomes should entail. Afterwards, instructors establish a series of activities that learners will engage in to practice what was learned followed by pinpointing the ways in which learning will be assessed. UBD uses a backward approach to curricular design that is counter to most instructional planning practices.

Although there are a number of strengths associated with UBD, there are also some limitations. For example, UBD assumes that teachers know how to design courses and/or curriculum. For many educators, especially those in postsecondary environments, that may not be the case given that most faculty have not had courses or preparation in how to develop courses. Consequently the incorporation of UBD requires faculty training and development that educates faculty on how to plan and facilitate courses that engage students while advancing student learning using an outcomes-based approach. Furthermore, faculty must be educated about how to interconnect outcomes, learning activities and assessment in the teaching context. UBD also requires that faculty build courses that focus on understanding as opposed to textbook driven content. Each of these challenges takes time and additional resources to reteach and re-socialize instructors on how to work backwards when engaging in the course development process. This is more complicated when creating m-learning environments due to the instructor's need for digital fluency and infrastructure support knowledge.

Overall, UBD is parsimonious and allows instructors to ask key questions of themselves, course content and course design as it relates to student learning and understanding. Since experiential learning activities and mobile devices are strategies and tools that can be used to engage and enhance student learning and understanding, UBD can be used to assist us in designing courses that include these practices in a way that interconnects outcomes, learning activities and assessment.

The remainder of this text will apply UBD principles to the incorporation of mobile devices into learning spaces as well as present various mobile device and app concepts to consider when developing experiential learning environments involving these technologies.

2.5 Summary

In this chapter you have learned:

- Experiential learning opportunities assist students in understanding course content, improving their motivation for learning and advancing their critical thinking skills.
- Kolb's Experiential Learning Model (ELM) is one framework for developing experiential learning experiences for students.
- Kolb's ELM consists of four learning styles: accommodator, assimilator, converger, and diverger.
- Learning styles describe the ways in which a person prefers to perceive and process new information presented to them in a learning context.
- Understanding by Design (UBD) is a curricular development framework consisting of three stages.
- UBD requires educators to begin the course or learning activity design process backwards by identifying the desired results of the course/activity as it relates to what students are to know and be able to do with what they have learned.

Key Terms

Experiential Learning Model
Learning Style
Accommodator
Assimilator
Converger
Diverger
Reflective Observation
Informal Experiential Learning
Formal and Experiential Learning
Nonformal Experiential Learning
Active Experimentation
Abstract Conceptualization
Concrete Experiences
Understanding by Design

Reflection to Action

1. Reflect on an instructional activity incorporated into one of the lessons you deliver. Dissect the activity based on Kolb's ELM. Consider the following:
    a) What learning style(s) does the activity appear to cater to?
    b) Label the components of the activity using abstract conceptualization, active experimentation, concrete experiences, and reflective observation.
    c) Does the activity lean more toward one learning style than another? If so, which one? How might this relate to your learning style?
2. Revise the instructional activity selected above to incorporate activities associated with each of the learning styles presented in this chapter. What changes did you make to the instructional activity to accomplish this task?
3. Create one new instructional activity using the theory of Understanding by Design, a mobile device and an app of your choice. Identify the following:
    a) Learning outcomes of the activity
    b) Components of the activity by learning style
    c) How you will ascertain if the learning outcomes were met?

3 Assessing Tools and Ways to Assess

In this chapter you will learn about:

- Assessment Strategies for Mobile Technologies
- Assessing Applications (apps) for Mobile Devices
  - Productivity and creativity apps
  - E-books
  - Subject Specific Apps
  - Games
- Assessing Mobile Devices

A wide variety of mobile devices are available in the consumer market, the purpose of this chapter is to help you navigate the many options available. We suggest that you start by considering how you are going to use your mobile device, then consider which device is most appropriate for you. Mobile devices can be used in many ways. Some instructors use just a few apps, as they may prefer using mobile devices for easy Internet access, the built-in camera, or for data storage to name a few uses. While other instructors prefer using a wide variety of apps that are beneficial for m-learning.

Given that the mobile app market is expansive and there are many apps available that serve the same purpose, we start the discussion by explaining methods for assessing apps that are available for mobile devices. Next we explain how apps differ, what unique criterion you should consider based upon your situation, and how you plan on using mobile devices in your classroom. We then suggest considerations for selecting the actual mobile devices.

3.1 Assessment Strategies for Mobile Technology

It is always best to first review what the experts in the field are saying about available apps. Online professional resources/journals such as Edutopia, School Library Media Journal, and THE Journal are excellent resources for beginning the process. Each resource has a *mobile resources* section.

- Edutopia Mobile Resources: http://www.edutopia.org/mobile-learning-resources
- School Library Journal – App Resources: http://www.slj.com/category/technology/apps-tech/
- School Library Media Journal – Mobile Resources: http://www.slj.com/category/technology/mobile/
- THE Journal Mobile Resources: http://thejournal.com/pages/resource-centers/mobile.aspx

Please note that these are only a few available online resources that provide quality reviews of educational apps. There are many more available resources. These are the resources that we recommend. Expert reviews are an excellent way to begin the process, but your evaluation should not start and end with expert reviews. It is important to conduct your own evaluation of available apps.

It is always a good idea to compare multiple apps that serve a given instructional purpose. We advise against simply selecting the first app or the most popular app as you, or your students, have specific needs and your app needs will be unique to your circumstances. Teams of teachers can review different apps and then work together to determine which apps would meet student needs. What follows is a discussion of criterion that you should consider for different types of apps that can be used for educational purposes.

3.2 Assessing Applications for Mobile Devices

There are different types of applications (apps) available for mobile devices that serve very different purposes; the categories that we will discuss are:

- productivity and creativity apps,
- e-book apps,
- subject specific apps, and
- games.

Additionally, each type of app has a rubric/table that can be printed out for use during the evaluation process. Better yet, you can load the rubric/table into a note-taking app so that you can electronically evaluate the app. The content of the tables and a discussion of what to look for when evaluating the different types of apps are discussed in detail below.

For each app there are key characteristics that need to be taken into account when making a selection.

They include the following:

- How much does it **cost**?
  - How much does it cost to maintain some of the popular apps for your school?
  - Is it a one-time purchase or are subscriptions involved?
  - Do you have to pay for additional storage on a cloud service?
- How much **space** does the app take up on the device?
  - Not only consider the space that the app requires on the device but also consider how much space the students' end products will require.
- Are there reported **bugs** with the app?
- Are there quality **help** features or support for the app?
- Is the app **compatible** with all of your students' devices?
- If the app requires student input, will there be an opportunity to **export** the information? If so, where does the information go, and how can you, as a teacher, access it?
- Will your students be able to use the app in a **collaborative** manner?
- How will you use the app in your classroom? Can it be used for **formal** instruction or **informal** instruction?

The bigger question is, "does the app meet your students' needs?" Consider if your students really need the app to enhance their learning experience. For instance, do the associated apps offer opportunities to expand upon the curriculum, and allow you as an educator an opportunity to meet and exceed the standards appropriate for the subject(s) you teach? Will you be able to leverage the technology to promote learning of the curriculum to the appropriate standards that are defined by your school, district, and other governing bodies? Ultimately, if you are going to use mobile devices in your classroom, the device and its associated apps should be tied to the curriculum and the associated standards in order for the device and apps to be used to promote learning.

We will provide you with many criteria that you can use to evaluate different apps. However, you will have to decide which criteria are most important for you and your situation.

3.2.1 Productivity and Creativity Apps

Productivity and creativity apps are apps that allow students to construct end products. They include movie-making, podcasting, word processing, spreadsheet, and note taking applications to name a few. These apps tend to be scaled-down versions of software available for desktop computers. The purpose of these types of apps is to allow students to construct or build something.

Productivity/Creativity Apps

Name of App:_____
Instructions/Support: Yes No
Reported Grade Level_____
Type of app: productivity, creativity, other_____
Export Media_____
Opportunities for collaboration: Yes No
Developer:_____
Intended use: formal, informal, both
Cost:_____
Operating System:_____

	Meets Needs	Slightly Meets Needs	Does Not Meet Needs	Criteria not relevant	Comments
Relevance	The purpose of the app is relevant to the student and the instructional situation.	Limited connection between the purpose of the app and relevance to student learning.	The purpose of the app does not connect to instruction and is not relevant to students.		
Engagement	Students will be intellectually invested when using this app.	Some students might be engaged with this app.	Students will quickly lose interest.		
Utility	The app includes all the utilities and features necessary to create the desired end product.	Limited utilities and features. Students can create a basic end product.	Utilities and features are lacking. The end product that students can make is not desired.		
Usability	Students can easily manipulate the application without too many special gestures.	Special gestures are required.	It is not clear how to use the app.		
Export End Product	Student product is saved on app and can be exported to the teacher is a manner that is acceptable to the institution.	Student product is saved on app but can NOT be exported.	Student product is NOT saved on app and can NOT be exported to the teacher is a manner that is acceptable to the school.		
Unlimited student products	No limits on the number of end products students are able to make.	Reasonable limit on the number of end products.	Major limits.		

Summary of app/recommended alternatives:

Table 3.1: Productivity and Creativity Evaluation Matrix.

See appendix for printable/exportable version of the above evaluation matrix for productivity and creativity apps.

3.2.1.1 Criterion to consider

In addition to the main criterion discussed above in Section 3.2, the ability to collaborate, and export the student's end product, the number of products that a user can make, relevance, engagement, utility, and usability are important criterion to consider when it comes to productivity and creativity apps.

Collaboration. Will students be able to collaborate using the app? Will they be able to share the work with others so that others can add to the product, modify, and edit as necessary (Schrock, 2014b)?

Relevance. Consider the app and how you will be using it for instruction. Is the app appropriate for your students and will it work well for your classroom? There are a wide variety of productivity and creativity apps available to end-users so you need to consider which apps will be relevant to your students and your instructional situation.

Engagement. Consider the app and how the students will interact with it. Is the app engaging for your students? Will it hold your students' attention?

Utility. What features does the app have for producing and creating the desired end product? Are there enough features and utilities to create an end product that is meaningful for your students?

Usability. Is the app easy to use or will students need to learn special gestures to use different features within the app. Consider how much training you will have to provide your students to use the app and whether the amount of training warrants adopting the app.

Export End Product. The entire purpose of productivity and creativity apps are to enable the creation of some type of end product. Therefore, once students create a product, consider how others will be able to gain access to it (Schrock, 2014b). Will the content be exported to the teacher in a manner that is acceptable to the school? Will the student be able to share the content with others so that they can collaborate? Also, consider how large the end product will be and if you will have enough storage space on your mobile device in order for students to create their products. Movies are prime examples of end products that take up a lot of storage space. One minute of a movie can require 80+ megabytes.

Unlimited Student Products. Related to the ability to export the end product is the question on how many end products the student will be able to create. Some apps allow a specific quantity of end products before you have to buy a subscription. How many end products can be created and is there a cost associated with the creation of end products?

Productivity and Creativity apps are oftentimes scaled down versions of productivity and creativity programs for computers. There are many considerations that come into play when selecting a creativity and productivity app. These considerations include cost, usability, relevance, ability to export students' end products, and the number of end products that students are able to make based on the costs.

3.2.2 E-books

E-books include electronic books such as electronic textbooks, storybooks, reference books, and general reading, among others. Electronic books are evolving. E-books are becoming much more user-friendly and have many more features available within them. These additional features may make the size of electronic books larger, which in turn requires more space on the mobile device. For instance, some electronic books include graphics and videos. Graphics and videos require more storage space on a mobile device than does an electronic book that is solely text-based. Some electronic publishers have found ways to avoid requiring large amounts of storage space on the device by streaming texts from websites to devices (Larson, 2012). While streaming texts save space on the mobile device, it does require that you have active Internet access in order to access the book. Therefore, consider how the electronic book publisher distributes the book to the user and consider if your students have enough storage space on their devices to download the book and/or whether your students have easy access to the Internet.

In addition to criterion discussed above such as storage, access, usability, and cost, you will need to consider the following:

Electronic Books

Name of Book:_____
Reported Grade Level_____ Media_____ Megabytes on device:_____
Instructions/Support: Yes No Developer:_____
Type of book: general reading, reference, textbook, other_____ Cost:_____
Intended use: formal, informal, both Operating System:_____

	Meets Needs	Slightly Meets Needs	Does Not Meet Needs	Criteria not relevant	Comments
Relevance/ Standards	The purpose of the book is relevant to the student and the instructional situation.	Limited connection between the purpose of the book and relevance to student learning.	The purpose of the book does not connect to instruction and is not relevant to students.		
Engagement	Students will be intellectually invested when using this app.	Some students might be engaged with this app.	Students will quickly lose interest.		
Usability	Students can easily manipulate the controls for the book.	Special gestures are required.	It is not clear how to manipulate the book.		
Annotations	Students can input many different types of annotations, highlight, notes, on page comments, etc.	Limited annotations.	No annotations.		
Tags	Students are able to tag specific pages.	Limited ability to tag pages.	No tagging.		
Index/TOC	Index and table of contents available.	Limited index or table of contents.	No index or table of contents.		
Search	Search feature available.		No search.		
Unlimited purchase	No limits on how long students have access to the book.	Reasonable limit on access to book.	Major limits.		
Multimedia	Multimedia extends content and contributes to learning.	Multimedia tangentially contributes to content.	No multimedia.		
Dictionary	Extensive dictionary.	Limited dictionary.	Minimal dictionary.		

Summary of book/recommended alternatives:

Table 3.2: E-books Evaluation Matrix.

See appendix for printable/exportable version of the above evaluation matrix for productivity and creativity apps.

3.2.2.1 Criterion to consider

Relevance/Standards. Consider if the book is age appropriate and meets the appropriate standards for your class. Additionally, consider if the text is written at a level that is appropriate for your audience. While electronic books are becoming more and more popular the number of electronic books relative to paper books is still low, so it will be a little harder to find electronic books that are exactly what you are looking for. Therefore, it is important to consider how the e-book technology can best be used to support instruction within your instructional context (Larson, 2012).

Also, determine if the book is something that you can effectively use in a variety of educational settings, including whole-class instruction, guided reading, literature circles, individual reading experiences, and so on.

Engagement. Consider the book and how the students will be using it. Is the book engaging for your students and will it hold your students' attention?

Usability. Is the book easy to use or will students need to learn special gestures to use different features within the book?

Annotations. Consider if students are able to make annotations within the book. Different types of annotations include typing notes, highlighting passages, and the ability to make on-page comments. Determine if there are enough opportunities for students to interact with the book so that they can make the age-appropriate annotations in order to be able to fully utilize the book.

Tags. Related to the Index and the Table of Contents (discussed below) is the ability for students to be able to tag content within the text. Tagging allows students to be able to categorize content based on their own nomenclature. More advanced students may like the ability to tag passages within electronic text so that they can easily get back to specific content at a later point in time and so that they can have efficient access to other content that they tagged in the same manner.

Index/Table of Contents. Determine if the book provides an Index and a Table of Contents. These are important features for providing an overview of the book and they afford students the ability to put the chapters of the text into a context of the entire book. Additionally, these afford students the opportunity to easily navigate to areas of the book that are relevant to them at the point of need.

Search. Unlike using paper books, students are not able to flip through an electronic book and quickly scan to find information that they need quickly. Therefore a quality search feature within an electronic book can help students with quickly referencing information based on keywords. Search features are very beneficial for electronic books.

Unlimited purchase. Consider if there are limits placed on the purchase of the book. For example, these limits can include time, printing, and copying limits. Time limits refer to how long the user has access to the text. Printing limits refers to how many pages of the text the end-user is able to print. Then, copying limits refers to how many times a user can copy and paste passages from the book. These are all features that are built in to protect the author's work and are reasonable safeguards for protecting the work of the authors. However, you as a consumer will need to determine if these protections will end up limiting your ability to use the book.

Multimedia. Multimedia should contribute to the understanding of the content rather than distract (Dobler, 2013). Consider if the multimedia elements incorporated into the book aid in understanding the material.

Dictionary. Electronic books afford readers access to online dictionaries as they read (Serafini & Youngs, 2013). This can be an important feature depending on the age and competencies of the readers, as well as the content for the text.

Electronic texts are starting to become more popular; however not all electronic texts are equal. Careful considerations for how the book meets the course standards, how students can annotate within the book, use of a table of contents and index, ability to tag, quality search features, and limitations on what can be done with the book all need to be taken into consideration. Additionally, cost where the book resides (on your machine or on a server), and how much space the book takes on your device all play a role in deciding whether to utilize a specific electronic book for your class.

Note on electronic books. Larson (2012, p. 289) notes that it is "important to emphasize that electronic book reading should not aim to replace print books." She further explains "e-book readers are likely to read more print literature than those who do not read e-books at all" (Larson, 2012; p. 289). Thus teachers will not have to worry about electronic books replacing traditional literacies; they simply add to and expand upon students' literacies.

3.2.3 Subject Specific Apps

Subject specific apps are apps that help students build content-related skills, or provide simulations for relevant content within a subject matter. These apps are typically used to supplement instruction and reinforce content knowledge.

Subject Specific Apps

Name of App:_____
Instructions/Support: Yes No
Reported Grade Level: _____
Type of app: general content, skill builder, simulation, other_____
Megabytes on device:_____
Username required: Yes No
Developer:_____
Opportunities for collaboration: Yes No
Cost:_____
Intended use: formal informal both
Operating System:_____

	Meets Needs	Slightly Meets Needs	Does Not Meet Needs	Criteria Not Relevant	Comments
Alignment to standards	App aligns to standards.	App is loosely tied to standards.	Not aligned to standards.		
Engaging	Students will be intellectually invested when using this app.	Some students might be engaged with this app.	Students will quickly lose interest.		
Usability	Students can easily manipulate the controls for the app.	Special gestures are required.	It is not clear how to manipulate the app.		
Students needs	This app meets an educational need of my students.	The app might meet the needs of some of my students.	Doesn't meet my students educational needs.		
Performance summary	Student specific performance summary or student product is saved on app and can be exported to the teacher in a manner that is acceptable to the school.	Student specific performance summary or student product is saved on app however data is not exportable.	Specific performance summary or student product is NOT saved on app and can NOT be exported to the teacher.		
Feedback	Specific feedback is provided to the student.	Student is provided basic feedback.	Limited feedback.		
Differentiation	App will meet the needs of all classroom groups, with multiple difficulty levels and multiple presentation styles.	App has more than one level of difficulty and/or information is presented in only one manner.	App has one level of difficulty and is presented in only one manner.		
Group or Individual	Teams of students or an individual can use this app.	Mainly intended for individual but may be ok with a group.	Only an individual can use this app.		

Summary of app/recommended alternatives:

Table 3.3: Subject Specific Evaluation Matrix.

See appendix for printable/exportable version of the above evaluation matrix for productivity and creativity apps.

3.2.3.1 Criterion to consider:

Alignment to standards. Consider if the app meets the standards for your subject matter. While outward appearances might indicate that the app meets the standards for your content, it is important to investigate further the depth and detail within the app to make sure that the relevant standards are met.

Engaging. As with the other types of apps, consider the app and how the students will be using it. Is the app engaging for your students and will it hold your students' attention?

Usability. Is the app easy to use and control? Or, will students need to learn special gestures to use different features within the app?

Students Needs. Your students most likely already have content specific information available to them. Consider if additional apps will meet the educational needs of your students or simply appear to be busywork for your students. Consider if the app will provide content that will aid in student learning. Does the app meet your students' educational needs? Additionally, consider if group, individual, or teams of students can use this app.

Performance Summary. Consider if the app provides a specific performance summary or student product that is saved at a location that is easily accessible to the teacher or peers if needed. Can the report or performance summary be exported to the teacher in a manner that is acceptable to the school (Schrock, 2014a)?

Feedback. One of the benefits of using an app is the ability to provide feedback to the user in order to be able to aid the student in learning the content. Consider if the app provides the feedback necessary for the content and the context of your instruction.

Differentiation. Consider if the app will meet the needs of **all** students. Are there multiple levels of difficulty? Does the app present content in multiple manners (video and text)?

Groups or Individual. Is that app something that groups of students can work together with or is it an app that only one student can use? For instance, some subject specific apps allow students to collaborate via Bluetooth, which allows for a rich learning experience.

Subject specific apps can be useful resources to supplement instruction. Careful evaluation of these types of apps include, alignment to standards, meeting students needs, presentation, the quality of the feedback, wide enough range of difficulty level that will afford the teachers opportunities for differentiated instruction, and the ability to report out how students did within the app, if necessary.

3.2.4 Educational Games

Educational Games are different from subject specific apps in that they typically include some type of "interactive play" feature coupled with storylines, rules, and so on. Educational games include skill builder, problem solving or strategy, simulation to name a few. Games should extend the curriculum and be used to aid learners in meeting the appropriate standards for the curriculum (Kebritchi, 2010).

Educational Games Apps

Name of App:_____
Instructions/Support: Yes No
Reported Grade Level_____
Type of game: skill builder, problem solving or strategy, simulation, other_____
Megabytes on device:_____
Username required: Yes No
Developer:_____
Opportunities for collaboration: Yes No
Cost:_____
Intended use: formal informal both
Operating System:_____

	Meets Needs	Slightly Meets Needs	Does Not Meet Needs	Criteria not relevant	Comments
Relevance	The purpose of the game is relevant to the student and the instructional situation.	Limited connection between the purpose of the game and relevance to student learning.	The purpose of the game does not connect to instruction and is not relevant to students.		
Feedback	Specific feedback is provided to the student.	Student is provided some feedback.	Limited feedback.		
Engagement	Students will be intellectually invested when using this game.	Some students might be engaged with this game.	Students will quickly lose interest.		
Usability	Students can easily manipulate the controls for the game.	Special gestures are required.	It is not clear how to manipulate the game.		
Replay varies	Game varies with replay.	Game is predictable when replayed.	Same game when replayed.		
Reporting	Summary data is electronically available to teacher.	Student briefly has access to summary data.	Summary data not available.		
Levels of difficulty	Wide range of difficulty that will engage ALL students in the class for a long period of time.	Some range. The game will be useful for some for some time.	Minimal range of difficulty app will not be used long.		
Thinking skills	Game encourages the use of higher order thinking skills.	Mostly lower order thinking skills.	Limited to the lower order thinking skills	Yes No	
Storyline	Game has a complex storyline with characters users care about.	Has a basic storyline.	No storyline.	Yes No	
Replicates real-world	Game replicates the real-world.	Some what realistic.	Game not realistic.	Yes No	

Summary of app/recommended alternatives:

Table 3.4: Educational Games Evaluation Matrix.

See appendix for printable/exportable version of the above evaluation matrix for productivity and creativity apps.

3.2.4.1 Criterion to consider:

Relevance. Students love playing games. We as educators need to make sure that the games are in fact relevant to our instructional content. Does the game support the content you are teaching in your class? Are the skills required for the game beneficial for your students and your desired educational outcomes? Is it appropriate for the student age group?

Feedback. As the student interacts with the game, are they receiving constructive feedback to improve the skills that match your learning objectives? Consider the type of feedback the game provides, is the feedback instructional? Is it providing feedback to students moving forward in the game? Games that provide students with feedback on how to mediate the embedded learning topic effectively, rather than instructing the learner on how to interact with the gaming environment, effect better learning outcomes (Schrader & Bastiaens, 2012, p. 209; Sharma & Hannafin, 2007).

Engagement. As with the other types of apps, consider the game and how the students will be using it. Is the game engaging for your students and will it hold your students' attention?

Usability. As with the other types of apps, consider if the game is easy to use and control. Or, will students need to learn special gestures to use different features within the game? If the game requires training, do the educational benefits of the game outweigh the time needed to provide the training?

Replay varies. One of the benefits of using apps for instructional purposes is that students can use the app over and over again. However, it is important to determine if there is enough variety in replay options. Will students eventually figure out the patterns of the game and learn how to navigate it rather than learn the content? Thus, it is important to consider how many times the game varies with replay.

Good games provide students with feedback on their learning as they progress; often times students are unable to progress to the next level until they have illustrated that they have mastered the current skill set (Hommel, 2010). When games require students to replay a specific level, that level should be different enough to illustrate that the learner has in fact mastered the requisite skills rather than the specific level of the game.

Reporting. As students complete different phases of the game, does it generate a report that indicates what skills, competencies, or abilities the students have shown that they are capable of doing? Who has access to the report? Will teachers be able to see the outcomes and store the outcomes somewhere?

Levels of Difficulty. Classes have a wide range of students therefore the game needs to be able to provide a wide variety of difficulty levels for all students in the class to be able to progress through. Is the range of difficulty wide enough that the game will be useful for the entire class and for a reasonable period of time?

Thinking Skills. Games can encourage problem solving, critical thinking, and other higher order thinking skills (Hommel, 2010). Consider if the game does in fact foster higher order thinking skills.

Storyline. Storylines are an important part of the game. Consider what the storyline of the game is; will it encourage engagement with the students because they want to participate in the game? Does it have characters that the students care about, thus encouraging deeper game playing? Is the storyline appropriate for your students?

Replicates Real-World. Consider the quality of the graphics when evaluating game apps. Students currently have access to very high quality graphics and they can have negative reactions to games that appear to not be of high quality.

When evaluating games it is tempting to focus on the fun factor and, while that is important, there are many other important characteristics to consider. Relevance, variety of replay, the storyline, reporting out of results, ability to promote higher order thinking and quality of graphics all play an important role in deciding if you should utilize different games in your classroom situation. Curricular considerations and alignment to standards are very important when it comes to selecting educational games to be used in the classroom. While this was discussed in Section 3.1, it is important to further emphasize that when it comes to educational games, they need to be tied to the curriculum and should lead to meeting or exceeding standards if they are at all going to promote learning in your classroom (Brysch, Huynh, & Scholz, 2012).

3.3 Assessing Mobile Devices

When selecting mobile devices, it is important to consider how the device is going to be used as discussed is Sections 3.1 and 3.2. Once you have a good sense of the apps that you would like to use in your classroom, consider which mobile devices will allow you to use the apps that will be beneficial for your educational situation. Consider the operating system for the mobile device and confirm that it will work appropriately with your institution's ICT infrastructure. As discussed earlier, you should consider the cost of the device and its available storage. Additionally, you should consider battery life and ease of updates. Each of these criteria is discussed in detail below.

3.3.1 Criterion to Consider

Operating System. As mentioned earlier, consider if the operating system for the mobile device will work with the ICT infrastructure at your institution, such as network compatibility. Also, check the compatibility with other institutional computing applications such as the institutions' integrated learning systems, email, records and registration systems, and so on.

Cost. Costs of mobile devices and the associated apps/software are less than the traditional desktop computer and software. However, cost is something that needs to be carefully considered.

Storage. There are a plethora of apps available to download and the costs are relatively nominal compared to the cost of software for a desktop. Thus, there is the risk of simply downloading apps so that you can test them out without any consideration for the space that these "trial" apps might take on the device.

Additional considerations are how much space is available to store products that students make. Multimedia products take up more space than text documents. It has been the authors' experience that storage space is one of those criteria that surprisingly ended up being an important consideration that was not considered important at the onset. This is especially true in schools with shared mobile devices.

E-books tend to take up more space as compared to subject specific apps and games. This is due to the multimedia nature of many E-books.

Battery Life. Under normal conditions how long does the battery last? Will it last the entire workday? In regards to the apps, read reviews to see if the app tends to drain the battery faster. As a general rule of thumb, apps that download from the Internet frequently tend to drain the battery faster. This means, that E-books that require Internet access may end up draining the battery life faster. While E-books that are streamed from the Internet might not take up as much storage space, they will decrease battery life.

Ease of Updates. Updating apps is important not only because it can help prevent batteries from draining too quickly, but also most times the updates are fixes to problems in earlier versions. Therefore it is important to be able to update the operating system on the device and the apps so that you can keep your mobile device and the associated apps/software functioning as efficiently as possible. The easier it is to update devices the better.

Mobile devices can be used in many ways. You need to consider your situation and how your students will use the devices for learning. As mentioned earlier in the chapter, the device and its associated apps should be tied to the curriculum and the associated standards in order for the device and app to be used to promote learning.

3.4 Summary

In this chapter you have learned:

- There are a lot of mobile devices out there and selecting the most appropriate device for you is dependent on how you are going to use the device. Consider the many different uses of the device and how the different apps/software will interact with it.
- Productivity and creativity apps allow students to create end products. These are scaled down versions of similar software available for desktop/laptop computers. Special considerations are the ability to export the end product, the number of products that students can make, and relevance.
- E-books include books such as electronic textbooks, storybooks, reference books and general reading. Special considerations are cost, length of ownership, relevance/standards, ability to annotate, index/TOC, tagging, multimedia, search features, and dictionaries.
- Subject specific apps are apps that help students to build content-related skills, or a simulation for relevant content within a subject matter. Considerations for these types of apps include alignment to standards, meeting students' needs, scholastic presentation, feedback, differentiation, and reporting out of results.
- Educational games are different from subject specific apps in that they include skill builder, problem solving or strategy, simulation. Considerations for these types of apps include relevance, feedback, varied replay, reporting out of results, a variety of levels of difficulty, promotion of thinking skills, quality storyline, and replication of a real-world experience.

Key Terms

Productivity and creativity apps
E-books
Nomenclature
Educational Games
Subject Specific Apps

Reflection to Action

1. Reflect on two apps that you currently use for instructional purposes. Use the appropriate evaluation sheet provided in the appendix and determine how your apps meet the different criteria. Did the evaluation turn out as expected? Were there surprises?
2. Evaluate apps that you have not used before in an instructional situation. Consider revising a lesson using one of the apps that ranked highest on the evaluations. What revisions to the lesson would you make? How does this new app improve the learning experience?
3. Create one new instructional activity using an app(s) of your choice. Identify the following:
    a) How does the app meet curricular needs for your classroom?
    b) Does the app provide feedback to your students?
    c) Is the app engaging for the learners?
    d) Are you, as the teacher, able to export data from the app that you will be able to use for assessment purposes?

4 Infrastructure: Learning Spaces

In this chapter you will learn about:

- Paradigm shift from the industrial age to the postindustrial age
- Learning Spaces Defined
- Physical Learning Spaces
  - Classroom
  - Informal
- Virtual Learning Places

The capacity to use technology for instruction has greatly increased because more students have access to mobile technologies as noted in Chapter 1. Teachers can greatly enhance the likelihood that they will be able to implement instructional practices that utilize mobile technologies by creating a few pre-planned configurations of furniture/physical space for the whole class, small group, pairs, and individuals, as well as planning for formal and informal instruction (Cleveland, 2009). When teachers make small, simple changes to instructional spaces they will be richly rewarded in learning benefits (Temple, 2008). Additionally, the careful planning of virtual spaces can greatly improve learning experiences.

Moving from a setting in which information is disseminated via a traditional lecture setting to a setting in which constructivist instructional and learning activities are utilized involves a paradigm shift. The paradigm shift associated with moving from one setting to the other is explained in this chapter. Additionally, we discuss what learning spaces are and how teachers can effectively use physical and virtual learning spaces to maximize student learning. We also discuss formal and informal learning spaces.

4.1 Paradigm Shift

In the 1920s American schools were modeled after factories and were heavily influenced by the Social Efficiency theorists (Kliebard, 2004). During the early 1900s behaviorism was the dominant learning theory and instruction was exceedingly teacher-centered. The school system needed to be that way because the predominant form of work was manual labor (Reigeluth, 2012). In the early 1900s the educational system sorted students into two groups – those who should do manual labor, and those who should be managers or professionals (Reigeluth, 2012).

The paradigm of the 1900s, in which the teacher presents information, the learner receives information, and then the learner demonstrates understanding has been largely displaced by a more modern, constructivist paradigm. Constructivist practices actively involve students in knowledge construction. In the modern, postindustrial world, instruction is learner-centered, hands-on, attainment-based, customized, collaborative, and enjoyable (Reigeluth, 2012). Social skills and building "relationship capital" are important competencies that students need in order to succeed in the modern knowledge-based, digital world (Reinhart, Thomas, & Toriskie, 2011). Therefore, learning by doing, interpersonal interactions, and student-to-student collaborations need to be facilitated in classrooms to promote student learning.

Today learning and teaching is complex. The teacher's role changes from the disseminator of information to "…designer of student work, facilitator of the learning process, and caring mentor" (Reigeluth, 2012, p. 81), while the new roles for students include worker, self-directed learner, and teacher (Reigeluth, 2012). During one class session, the learning process can progress from whole class instruction led by the teacher (5 minutes), to small group work (20 minutes), to pairs of students collaborating (20 minutes), and then back to whole group instruction (5 minutes) all within a 50 minute span of time. Flexible learning spaces need to be taken into consideration in order to efficiently and effectively facilitate modern teaching and learning.

4.1.1 What does this mean for the learning space?

We still have classrooms that look the same way they did in the early 1900s. The major difference is simply that we have retrofitted the classrooms to be "smart classrooms" with projection systems that project computer output, movies from DVDs, or other visual aids to the front of the room. With the shift in information and communication technology moving towards mobile technologies, we no longer are limited to whole-group instruction with the teacher standing in front of a classroom and with students all facing forward in their nice neat rows because the technology mandates it. Teachers can move learning from whole-class learning, to small group learning, or individual learning. Not everyone needs to be focused on the teacher and the screen in the front of the room. Small changes, planning ahead, and teaching students about the configurations and what is expected of them will improve the chances of favorable instructional outcomes while using the power of mobile technologies.

Below are four different classroom arrangements for a standard "retrofitted" classroom with 32 student desks. If students know these arrangements from the beginning of the course, they can assist in rearranging the classroom to meet the class' instructional needs (Neill & Ethridge, 2008). Over time the students' efficiency in reconfiguring the room improves, saving instructional time with little interruption to learning. Simple classroom reconfigurations allow teachers to address learning needs at the time of need. Reconfigurations also provide the most appropriate method of instruction at the time of need. With some thought and pre-planning, teachers can leverage mobile technology to maximize learning by providing instruction in the **right place**, at the **right time**, and with the **right method**. This is a revision of the learning experience from 'anywhere, anytime' to 'right place and the right time' (Punie, 2007).

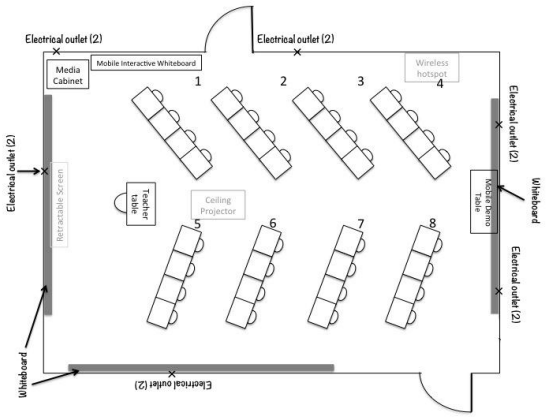


Figure 4.1. Whole class arrangement

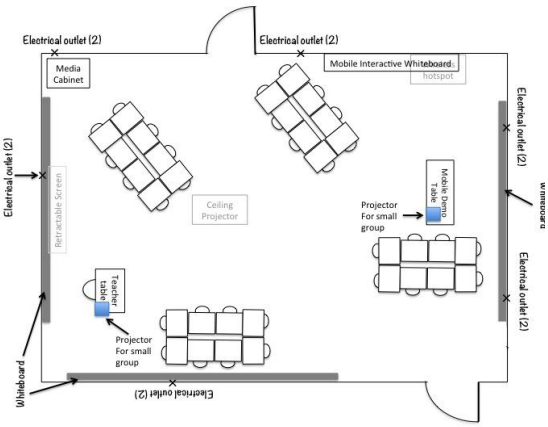


Figure 4.2. Small group arrangement

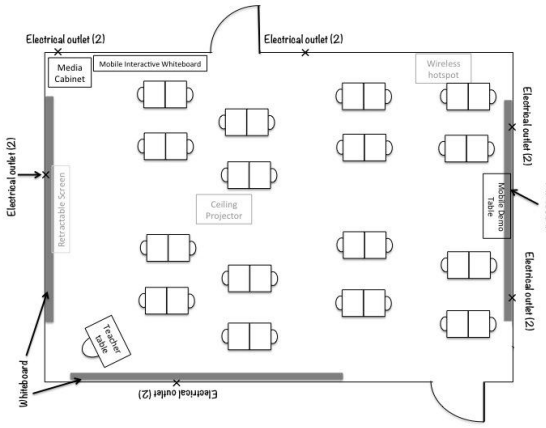


Figure 4.3. Pairs

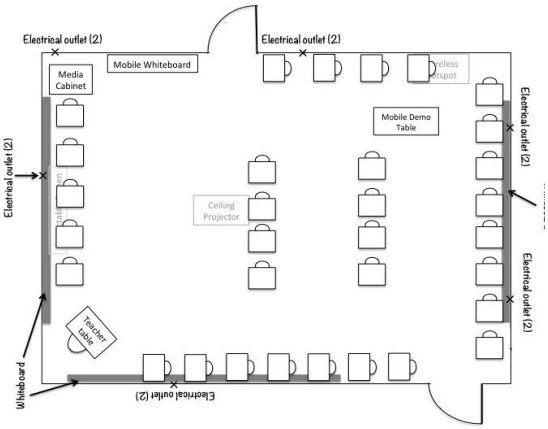


Figure 4.4. Individual

4.2 Learning Spaces Defined

A learning space can be defined as any location where learning takes place. These spaces can be formal physical locations such as classrooms and conference rooms. Furthermore, these spaces can be informal spaces such as libraries, cafeterias, and study rooms. They can also be virtual spaces such as instructor-led discussion boards in course management systems, or they can be student-to-student communication. Modern technology has greatly changed the way learning spaces are conceived.

However, it is important to note that learning spaces should be informed by information and communication technology (ICT) trends, but not determined by ICT. These spaces need to be flexible and have the potential to evolve based upon the learning needs of students and the latest technology that is available to students. For many years we have filled our classrooms with technology to support the teaching process such as LCD projectors, computers, and video conferencing. "Frequently the equipment did not work or faculty were ill prepared to deal with the technical intricacies. When it worked, the equipment supported the teaching process but yet probably did not do much to promote individual learning" (Skiba, 2006, p. 103).

Today's learning spaces need to be thought of as transitional spaces where students are able to interact with content and cogitate about their learning experiences (Sagan, 2007). These are spaces where the students' knowledge base is transformed (Savin-Baden, 2011). These spaces are locations where learners are "allowed enough risk to learn, develop and create, a space where the natural anxiety provoked by learning and development is contained" (Sagan, 2007). These spaces can be one-to-one spaces, peer interactive spaces, a desk cubicle, an exhibition space, or virtual worlds. The teacher and students define a space as a space for learning. These spaces can be locations within formal classrooms, or even outside the classroom.

Reigeluth (2012) discusses the importance of two types of learning spaces: *task space* and *instructional space*. These spaces can be physical spaces and also conceptual, mental, and metaphorical spaces. The *task space* is the space where students are introduced to an authentic problem or project, usually in small groups (Reigeluth, 2012). The *instructional space* is where the student works independently to build the necessary knowledge for the learning task before them (Reigeluth, 2012). Student-centered instructional approaches require that students be able to move between what Reigeluth (2012) calls the *task* and *learning* space. This type of liquid learning requires flexible learning spaces (Savin-Baden, 2011). The design of such learning spaces is discussed below.

4.2.1 Physical Learning Spaces

There are different frameworks for designing learning spaces. There is the engineering process CDIO (conceive, design, implement, and operate) that considers the learning environment as a product. CDIO was proposed by Phillip Long and Ed Crawley at MIT (Skiba, 2006). Another model that facilitates whole class, small group and teacher interactions is the SCALEUP model (Student Centered Activities for Large Enrollment Undergraduate Programs) (Skiba, 2006). For both models it is important to have infrastructure in place to move from whole class instruction to small-group, active learning experiences, and then to informal learning if necessary.

The common thread to both models is the flexible workspace for individuals to work and take notes and for the groups to work together. These rooms typically have round tables with electrical receptacles for the students' technology. The teacher's space is located somewhere in the middle of the room, and includes multiple projection systems. Typically there is at least one whiteboard per table where small groups can work collaboratively (for examples see: http://www.ncsu.edu/PER/SCALEUP/Classrooms.html).

Please note that if you don't have round tables, your students can still effectively collaborate by moving tables together as illustrated in Figures 2 and 3 above. Collaboration and interaction are the key considerations for most physical learning spaces. Additionally, consider ways that you can provide multiple display systems that can be used independently or shared with others including small and large groups. Display systems that can be used with small groups are an important part of the collaborative process (Morken, Divitini, & Haugalokken, 2007). Note that in Images 4.1 and 4.2 there is a mobile, interactive whiteboard that can be moved depending on the instructional context. Note that the screen on the mobile, interactive whiteboard can be raised or lowered for better viewing depending on the room arrangement. For the whole class arrangement, the mobile, interactive whiteboard is towards the front of the room so that the instructor and students alike can project the content of their devices for the entire class to see on both the mobile whiteboard as well as using the projection system that is hardwired in place in the front of the room. For the small group arrangement, the board is moved so that one group can use it for collaborative purposes, sharing content from individual devices or collaborating with one computer. Note that other groups will also have their own dedicated projection system as indicated in Figure 4.2 above.

Image 4.1 Photograph of whole class arrangement; standard classroom.

Image 4.2 Photograph of small group arrangement; standard classroom.

4.2.1.1 Classrooms

Wireless Internet access is critical for classrooms that use mobile technologies. Wireless access needs to be robust enough to handle a large number of wireless devices at one time taking into consideration that many students have multiple mobile devices. Students will be engaged in many types of learning experiences that may require Internet access, including activities such as synchronous and asynchronous online discussions, Internet-based research, accessing online resources through the institutions' learning management system, or referencing online books to name a few. Additionally, classrooms need to support multiple types of learning activities by having a collaborative workspace where groups can interact and comfortably work together (Skiba, 2006). Classrooms must also support spaces where individuals can work independently (Skiba, 2006). It is important to note that as mobile devices become more common, teachers will need to teach students how to work independently with such devices without getting distracted with non-educational tasks. As with teaching students how to reorganize the learning space, we will need to teach students how to effectively use the devices for the task at hand.

4.2.1.2 Informal Learning Spaces

Learning doesn't always take place in the classroom. Students spend many hours outside of class learning. Informal learning shifts the responsibility of initiating the learning process onto the learner or learners (Rossett & Hoffman, 2012). Technology, in our case mobile technology, is used to leverage information and provide support for the learning process. The role of the teacher in informal learning is to provide support by providing quality resources and gentle guidance to the students (Rossett & Hoffman, 2012). It is important for schools and educational institutions to have informal learning spaces that are appropriate for small groups of students, pairs of students, and individual students. These informal learning spaces should take into consideration students' use of mobile devices.

The table below shows the characteristics of flexible learning spaces that takes into account students' use of mobile devices during their learning experiences for different types of instruction, both formal and informal.

Type of instruction	Physical Characteristics	What to avoid
Whole class Examples: lecture, presentations, video (formal learning)	Multiple displays for people to be able to see from. Plenty of power outlets that are easily accessible. Access to virtual learning workspaces for the entire class.	Teacher computer "locked" to the front of the room.
Small group Examples: small group discussions, research projects, problem solving exercises, case studies (formal & informal learning)	Round tables with electrical receptacles. Wireless internet access. Group virtual workspaces. Dedicated whiteboard space for each group. Plenty of table space for mobile devices, books and materials.	Loud noise from the group that it distracts others close by.
Pairs Examples: role play, peer critiques (formal & informal learning)	Ability to see the display on each other's mobile devices, while still being able to have a comfortable conversation. Access to virtual, collaborative workspace for the pair of students.	Avoid distracting others by being too close.
Individual Examples: Read and reflect, practice, simulations (formal & informal learning)	Free of distractions, enough space to work with mobile devices, books, paper and other learning materials.	Small workspaces. Limited internet access. No electrical access.

Table 4.1 Characteristics of Learning Spaces Based upon Type of Instruction.

The following is an image of an informal small group and/or pairs learning space. This is an area where groups of students can work together and collaborate outside of class. Notice that students are able to project the content of their mobile device to the monitors in the center of the group.

Image 4.3 Photograph of informal, collaborative learning space for a small group and/or a pair of students.

4.2.1.3 Virtual Learning Places

Virtual learning places are defined here as any virtual learning environment that utilizes technology to support teaching and learning, both formally and informally. Instructional designers borrow concepts from architecture to define different spaces within the virtual environment. Further, Wahlstedt, Pekkola, and Niemela (2008) draw the distinction between virtual learning spaces and virtual learning places. *Space* in architecture gives meaning to the 3D environment, while *place* defines the behavior expected within the classroom. Space definition is necessary because students need to have an understanding of the expected behavior required within the different spaces. Unlike physical spaces where students have visual cues as to how they should behave in a space, the virtual learning space is not well established.

By definition, virtual learning places require technology. The types of technology vary depending on the instructional need. Therefore the field of education technology uses the term "functional architecture" to mean the various functional entities and components involved in an instructional system as well as the collaborations and interactions among them (Dempsey & Van Eck, 2012). In other words, how does the technology promote new ways of thinking and interacting? An example would be the use of various social learning technologies to promote purposeful learning exchanges.

Components within the functional architecture would be instructional *technics*. Dempsey and Van Eck (2012) coined the term, *technics*, to mean "activities or tactics that use technology designed or selected to reach learning outcomes." Technics are influenced or driven by instructional strategies.

One example of functional architecture within a virtual space is a small group-learning place. This virtual place is a space where a subset of the class can collaborate on a project for the class. This space is intended only for the group of students and the teacher. Within this space the group of students might have access to various technologies that will promote various learning outcomes. These instructional technics could be a shared interactive whiteboard, blogs, etc. The teacher and the students need a shared vision of how the space will be used as well as how the various technologies, or technics within the space, will be used to use make it a small group learning place.

As with physical learning spaces, students should be able to freely move between spaces. In fact, participants can also multitask, "inhabiting" more than one virtual space at a time (Brown, 2005). In terms of Reigluth's *task and instructional* spaces discussed in the Learning Spaces Defined section, participants in virtual learning spaces should be able to move back and forth between the two types of spaces.

The table below shows the characteristics of virtual learning places that take into account students' use of mobile devices during their learning experiences for different types of instructional situations, both formal and informal. The listing is a sampling of the types of instruction and technics available.

Functional Architecture Examples of type of instruction	**Technics (mobile devices enabled)**	
	Asynchronous	Synchronous
Whole class Examples: lecture, presentations, video (formal learning)	• Multiple options for content presentations: including video, audio, narrated slide show, text supplemented with video and photos. • File sharing • Reference websites • Podcasts • Discussion boards • Wikis or other collaborative documents	• Interactive online presentations (often referred to as Webinars) • Interactive Web Conferencing • Shared whiteboard • Student response systems
Small group Examples: small group discussions, learning tasks, research projects, problem solving exercises, case studies (formal & informal learning)	• Discussion boards • File sharing • Blogs • Wikis or other collaborative documents	• Interactive Web Conferencing • Shared whiteboard • Chat
Pairs Examples: role play, peer critiques (formal & informal learning)	• Peer review system • Discussion boards • File sharing • Blogs • Wikis or other collaborative documents	• Interactive Web Conferencing • Shared whiteboard • Chat
Individual Examples: Read and reflect, practice, simulations (formal & informal learning)	• File management • Access to remediation website or online resources • Access to online textbooks and textbook resources • Personal electronic portfolios • Online quizzes • Simulations and games	• Access to online technical help • Access to homework assistance/tutoring sites

Table 4.2 Virtual Learning Places: Functional Architecture and Technics Based upon Type of Instruction.

We need to re-conceptualize our learning spaces to represent the postindustrial workplaces that our students will be working in today. Small changes to physical and virtual spaces can be made to shift our instructional practices to customize these practices to learner needs and to shift the focus to student's learning, rather than teachers instructing.

4.3 Summary

In this chapter you have learned:

- Today, learning and teaching is complex. The teachers' role moves from the disseminator of information to "…designer of student work, facilitator of the learning process, and caring mentor."
- Learning spaces can be physical and/or virtual and formal and/or informal spaces.
- Small changes to your classroom physical space can have a big impact on learning with mobile technologies.
- Virtual learning places require instructors and students to have a shared understanding of the types of activities and behaviors that will take place within the virtual learning places.
- Functional architecture refers to the functions of a virtual learning space. Technics refers to activities or techniques that use technology designed or selected to reach learning outcomes.

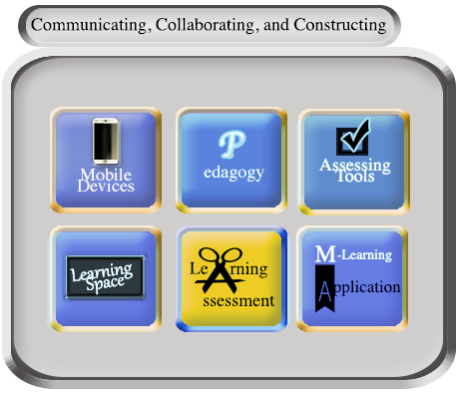
Key Terms

Task Space	Instructional Space
Functional Architectures	Technics
Learning Spaces	Physical Learning Spaces
Virtual Learning Spaces	Virtual Learning Places

Reflection to Action

1. Revise an instructional activity that would normally be teacher-led so that it is more student-centered. Consider your current classroom, what changes can you make to the instructional activity and to your classroom's physical space in order to make the instructional activity more student-centered.
2. Create one new instructional activity using a mobile device and app(s) of your choice. Identify the following:
    a) How will the app be used in your physical classroom space?
    b) Can students access a virtual space in order to use the app during your class time? Outside of class time?
    c) Will the app be used for formal or informal learning?

5 Mobile Technologies and Assessment of Student Learning



In this chapter you will learn about:

- Using mobile devices for different types of assessments
  - Formative Assessment
  - Summative Assessment
- Selected Response
- Performance-based assessments
  - Written Responses
  - Presentations
  - Portfolios

5.1 Formative Assessments

Assessment of learning is a very important part of instruction. In Chapter 2 we discussed the Understanding by Design (UBD) curriculum development framework and the importance of the interconnectedness of outcomes, assessments, and activities. A major premise of the UBD framework is that you first determine what you want your students to know by the time the instructional activity is complete. By first determining the desired outcomes, you can then determine which assessments will be used to assure that your students know what you want them to know. Based upon the assessments you have selected, you determine the learning activities that will best effect the learning outcomes and assessments. Assessments are central to the UBD model, as assessments tie desired outcomes together with the learning activities.

In this chapter we begin by providing an overview of assessment for student learning. We then discuss how mobile technologies aid with the variety of assessments that teachers utilize. We discuss formative and summative assessments and then discuss specific types of assessments; assessment types include selected response assessments and performance-based assessments. We also provide a brief listing of apps that can be effective tools for the various types of assessments.

5.2 Summative Assessments

According to McMillan (2011, p. 99) formative assessment "involves the gathering of evidence of student learning, providing feedback to students, and adjusting instructional strategies to enhance achievement." The goal of formative assessment is to improve student learning and motivation (McMillan, 2011). These types of assessments are diagnostic in nature, meaning that they help determine student's strengths and weaknesses. In other words, teachers and students are able to adjust their course of action based upon the results of the assessment.

Mobile technologies afford teachers and students the opportunity to communicate efficiently. Having an efficient means of communication allows teachers to gather information about students' learning and then provide timely feedback to the students. Timely feedback is a key component of formative assessment. Results of such diagnostic assessments enable timely feedback for students and teachers alike, effecting more efficient use of class time, as teachers will be able to teach based on the needs of students.

Recall that with the UBD approach teachers need to first determine the desired student outcomes; what do you want the students to understand after they complete the instruction? Teachers then decide on the assessments that will lead to the desired results. Teachers should choose formative assessments that will help their students build knowledge so that they can attain the desired results. These formative assessments should, in turn, allow the students to understand/complete the summative assessment.

Generally speaking you will want to select a variety of formative assessments in order to assure that students fully understand your instructional content, demonstrating that they have met the lesson's behavioral, cognitive, and/or psychomotor objectives. Again, feedback from the teacher is critical. There are many different ways to conduct formative assessments, which include both formal and informal formative assessments. Below we discuss a sampling of methods of formative assessment.

5.2.1 Formative Assessments: Formal

Formal formative assessments include assessments that are designed to be given to the students and that students are expected to complete. Student completion of the formal formative assessment may be noted in the teachers' grade book. These types of assessments are built into an instructional unit to assess students' learning as they progress through the unit. Typical formal formative assessments include: homework assignments and quizzes. The intention of these types of formative assessments is to give the student and the teacher opportunities to communicate understanding and to guide the student's learning towards the end goal.

5.2.2 Formative Assessments: Informal

Informal formative assessments are assessments that are context-specific and may arise based on need at a given time. These assessments are not necessarily built into the instructional plan ahead of time. Rather the teacher or student determines when there is a need and then they use the assessment as needed. Rather, informal formative assessments are the extra formative assessments that are used when the teacher or students determine that there is a need for such assessment.

For students, informal formative assessments are assessments that students can take independently as they see fit, or as the need arises. These types of assessments allow the students to self-assess.

For teachers, informal formative assessments can be used within an instructional context to gauge students' understanding at a given point within the instruction. For instance, a teacher might not be sure that students understand a mathematical concept that she is teaching. She could quickly ask the students to solve a mathematical formula and write the answer on a whiteboard app. She can then ask students to hold the mobile device up so that the teacher can see the students' answers. The teacher can then quickly determine if the students understand the content and then adjust her instruction as needed. The teacher didn't formally plan to do this, however she has this technique and others readily available to check students' understanding when the context warrants. Exit surveys are other common types of informal, formative assessments that teachers use to determine what the students learned during the just-completed class session.

Informal formative assessments include drill and practice, educational games, and web resource sites, among others. Oftentimes teachers provide a listing of tools to students as a resource for additional instruction and practice outside of class.

Examples of Informal, Formative Assessment Apps/Web sites

Kahn Academy (khanacademy.org). Website/resource developed by Sal Kahn. Kahn Academy is free for students and teachers to use and has an extensive collection of online instructional videos, materials, and resources. Students can review instructional videos and then test their understanding using the resources available on this site.

Math Blaster (mathblaster.com). Math skill development games for k-12 students.

National Manipulatives Virtual Library (nlvm.usu.edu). Utah State University's virtual library of manipulatives for a wide variety of mathematical concepts--a National Science Foundation supported resource. Allows students to use mathematical manipulatives to self-assess their understanding of mathematical concepts.

Quizlet (quizlet.com). Online flashcard site that students can use to self-assess their understanding of concepts and ideas.

Whiteboard Lite (www.greengar.com/apps/whiteboard). Tool that allows students to draw, sketch and write on a blank slate. Teachers can allow students to work problems on the whiteboard in order for teachers to quickly, visually assess understanding. Students can also work collaboratively using a peer-to-peer connection to peer assess.

As mentioned previously, an important part of the formative assessments is the feedback that students gain from the assessment, regardless of the whether the assessment is formal or informal. The assessment should provide constructive feedback and aid in student learning.

5.2.3 Summative Assessments

According to McMillan (2011, p.156) summative assessments "are used primarily to document student performance; it is an assessment of learning, completed after instruction." In other words, what has the student achieved after completing the unit of study? As noted previously, the summative assessment should build off of the formative assessments. Formative assessments should have provided the students with the necessary skills and knowledge for the summative assessments. Recall that with the UBD process these summative assessments should be determined before the instruction is designed. These assessments should be used to determine the type of instruction that will be used.

5.3 Selected Response Assessments

Selected response assessments include multiple choice, matching, or true/false items among other types of questions. The students are provided with alternative responses and they then select the most appropriate response. Oftentimes, these types of assessments measure the students' factual knowledge. These may be formal or informal.

Oftentimes formal assessments, such as quizzes and tests, have selected response assessments associated with them. Teachers use this type of assessment due to the objective nature of the assessment.

Informal selective response assessments might be set up to allow students to self-assess. When the student is ready to check their understanding, they can quickly quiz themselves with this type of assessment and get feedback quickly and efficiently.

Selected Response Apps/Web sites

Nearpod (nearpod.com). A tool that teachers can use to create interactive presentation that allows teachers to assess students during the class so that they can adjust the instruction as needed. Nearpod enables teachers to poll students and collect selected response assessment information about students. Teachers can also used Nearpod for written responses and performance tasks as discussed below. Nearpod can be used in class, or for student homework.

Socrative (socrative.com). A Student response system that allows students to engage in educational exercises during class via their mobile devices. Teachers can create selected response assessments that provide students and teachers alike with a clear understanding of students' knowledge at that point in time.

5.4 Performance-based assessments

Performance-based assessments, also known as constructed response or alternative assessments, are alternative methods for measuring a student's ability to perform a task within a contextual situation (VanTassel-Baska, 2014). These types of assessments tend to measure higher levels of thinking such as comprehension, application, analysis, synthesis, and evaluation as compared to the selected response assessments discussed above which tend to measure factual knowledge.

One of the main differences between selected response assessments and performance-based assessments is that typically a teacher needs to evaluate the performance-based assessment where selected response assessments can be set up to be scored by a machine. Oftentimes rubrics, checklists and other assessment tools are used to note and evaluate observable competencies. These types of assessment are widely used in the common core. Examples of performance-based assessments include, written works, presentations, group collaborations and interactions, observations, performance tasks, exhibitions and demonstrations, and portfolios, to name a few. Written responses, presentations and other performance tasks, and portfolios are discussed in detail below.

Additionally, performance assessments work well with what was discussed in Chapter 2, about Kolb's ELM Learning styles (Kolb, 1984). Individuals with different learning styles as outlined in Kolb's ELM theory, may prefer alternative types of performance-based assessments.

For example, students with an *accommodator* learning style might prefer to build portfolios, as they prefer concrete experiences and active experimentation. Thus, portfolios allow for concrete experiences while allowing *accommodators* to build a collection of work as they experiment with concepts and ideas and grow intellectually. *Assimilators* would be well suited for assessments where they can record their analysis of a concept. *Assimilators* can research online, digest the information, and then synthesize the information using a tool such as ExplainEverything. *Convergers* would do well with creating video documentaries using iMovie, since they prefer learning by abstract conceptualization and active experimentation. While *divergers* would do well with assessments that use blogs or vlogs, as they prefer concrete experiences and reflective observations.

In addition to using mobile devices for students to create products that the teacher assesses, mobile devices can also be used as tools for teachers to assess students. Using mobile technologies, teachers can evaluate students while students engage in performance-based assessments. Teachers are able to enter evaluative information into the device as the student is performing a task. Teachers can evaluate students and digitally send the information for student review in a much more efficient manner than is typically possible.

General Performance Assessment apps/Web sites

Easy Assessments (thepegeekapps.com/assessment). An assessment tool that allows teachers to create rubrics and perform written assessment of students. The results can be emailed to students.

The Answer Pad (theanswerpad.com). An assessment tool that allows teachers to assess students formatively during class. Or, teachers can create assessments for students that are tied to standards. The results can be shared electronically.

5.4.1 Written Responses

Written responses are commonly used as alternatives to selected responses. Some performance-based assessments tend to take the form of essays, research papers, and journals. They tend to begin with a prompt that the teacher provides to the student and then the students respond appropriately. Different kinds of written responses provide students with opportunities to illustrate different types of cognitive, affective, and psychomotor abilities. For instance, essays allow students to show a wide range of cognitive skills such as comprehension, analysis, and synthesis, dependent upon the prompt that the teacher provides. Students are also able to illustrate affective skills in written responses such as values, beliefs, and opinions. Mobile apps/websites such as ***Nearpod*** allow students to provide written responses to teachers during the class, so that teachers can review student responses in context as the learning occurs.

Other forms of written responses include journals. Journals allow students to reflect on their learning over a period of time and to illustrate their growth over time. Blogs allow for journaling in a chronological progression as each blog posting is date and time stamped. Additionally, students can tag their postings to aid in organizing their thoughts. This type of synthesis illustrates higher-order thinking as well as the ability to organize their thoughts. Another mobile device tool that is popular for journaling is 53's award-winning app ***Paper.*** This app allows students to quickly and efficiently use a stylus to write their thoughts into their own journal. Students can electronically send journal entries to the teacher for review.

Students who are considered *divergers* based on Kolb's learning styles, would most likely prefer written assessments.

5.4.2 Presentations and Other Performance Tasks

Another way for students to show what they learned, beyond selected response assessments, is through presentations and other performance tasks. These types of assessments include real-time, observable tasks that teachers typically evaluate based upon predetermined criterion. These performance-based assessments can include formal presentations, group work, and other observable classroom interactions, performance tasks, and exhibitions/demonstrations to name a few. As discussed above, teachers can use electronic rubrics or checklists, to efficiently provide feedback to students as the students perform the task at hand and communicate the feedback in a timely manner. This efficiency in assessment provides timely feedback to students and cuts down on possible teacher memory lapses between the time that the student completed the task and when the evaluation is recorded.

In addition to using mobile devices to evaluate students, mobile devices can be used to record the performance of students. Students can create videos of themselves giving a presentation, or students can use recordable whiteboards to perform computational problems while verbally explaining their thought process.

Students who are *assimilators* and *convergers,* in the context of Kolb's learning styles, would most likely prefer assessments such as presentations and other performance tasks discussed in this section.

Presentation Apps/Web sites

Explain Everything (morriscooke.com). An award winning interactive whiteboard and screencasting tool that can be used by students and teachers alike.

EduCreations (educreations.com). A popular recordable interactive whiteboard for students and teachers that also has publically available directory of lessons created using EduCreations.

iMovie (http://www.apple.com/ios/imovie) User-friendly movie production tool for the iPad.

54.3 Portfolios

A student *portfolio* is a collection of a student's schoolwork. Generally speaking these collections are organized based on chronology, criterion/standards, or a student's best work (also known as showcase).

For portfolios to be meaningful they must be organized in some way and for a particular purpose. Furthermore, for portfolios to be meaningful there needs to be some way for the student to reflect on his/her work and a way for students to articulate the importance and significance of pieces included in the portfolio.

Mobile technologies can be useful in portfolio creation as portfolios in the past were typically housed in three-ring binders. The physical nature of the portfolios in the past made it difficult for students to go through their portfolio and reflect on their work, while also allowing teachers opportunities to review their work as a portfolio is being built. Electronic portfolios, however, foster greater communication between students, teachers, and caregivers (Harris, 2009). Students can actively build portfolios while gaining feedback from teachers and caregivers. Being able to move students' work to electronic portfolios, and the ability to virtually share a portfolio, makes the process much more efficient when compared to the three-ring binder portfolios of years past. The technology has advanced enough as students' work can be protected in secure, password-protected sites in order to protect students' educational records and assessments.

Students who are considered *accommodators,* based on Kolb's learning styles, might prefer to build portfolios, as they prefer concrete experiences and active experimentation. Thus, portfolios allow for concrete experiences while permitting students to build a collection of work as they experiment with concepts and ideas, and grow intellectually.

Portfolio Apps/Websites

LiveBinders (livebinders.com). Online resource multimedia management tool that offers security features to protect confidential student documents.

Google Drive/Docs (drive.google.com). Google drive is an online file storage site that works with Google docs and allows individuals and teams to collaborative create and develop documents, spreadsheets and presentations.

EduBlogs (edublogs.org). Educational blogging site that can be used by teachers and students in a safe and protected environment. Students can use the blogs for journaling or for online electronic portfolios.

There are many different ways that mobile devices can be used to assess students' learning as we learned in this chapter. The teacher can input evaluative scores and feedback for students into mobile devices, or, students can use mobile devices to create products that will be evaluated by the teacher. As noted many times in the chapter, mobile devices afford an efficient means for communicating between student and teacher, thus enabling timely feedback for student learning.

5.5 Summary

In this chapter you have learned:

- How mobile devices can be used for formative and summative assessments.
- Mobile devices can provide feedback to students via selected response assessments.
- Mobile devices can be used to assess performance-based assessments using rubric and checklists, while students can create performance-based products that will be assessed by teachers can also use mobile devices.

Key Terms

Constructed Response Assessments
Formative Assessment
Performance Based Assessments
Portfolios
Selected Response Assessments
Summative Assessment

Reflection to Action

1. Reflect on an instructional unit that you teach on a regular basis and consider how you assess your students.
    a) How can you use mobile technologies to conduct formative assessments of your students?
    b) How can you use mobile technology for summative assessments?
2. Revise the instructional activity so that you use mobile technologies for both the formative and summative assessments. Consider using both selected response assessments and performance-based assessments. Use the following table as a template for this activity.

Unit Name:

# of Class Sessions for the Unit:

General Description:

Type of Assessment	Current Assessments	Mobile Technology Enhanced Assessments
Formative	Current formative assessment, with brief explanation Current formative assessment, with brief explanation <Repeat as necessary>	1. Mobile Technology enhanced formative assessment, with brief explanation…. <Repeat as necessary>
Summative	Current summative assessment 1, with brief explanation Current summative assessment 2, with brief explanation….(if you have it) <Repeat as necessary>	Mobile Technology enhanced summative assessment 1, with brief explanation Mobile Technology enhanced summative assessment 2, with brief explanation…. (if you need it) <Repeat as necessary>

3. Create a portfolio using one of the portfolio tools discussed in Section 5.3.3. Consider how students can use the tool for reflection and to track their own intellectual growth.

6 M-Learning Instructional Application

In this chapter you will learn:

- How to apply Understanding by Design (Wiggins & McTighe, 1998) and Kolb's Experiential Learning Model (1984) to instructional planning via three case studies.
- How instructors can create m-learning spaces using the information presented in this text about app selection, assessment and infrastructure considerations.

This chapter presents three classroom-tested mobile device and app inclusive instructional activities. These activities have been implemented across grade levels and represent how educators currently use mobile devices in elementary, high school and college environments to assist students in developing communication, collaboration, construction, critical thinking and information literacy skills. These activities also demonstrate how formal learning can occur with mobile devices in addition to the informal ways that students have used their devices for academic purposes. Furthermore, these case studies depict examples of mobile device and technology use that engage learners in the subject content while also meeting students' expectations and desires to learn with technology which may result in a transferrable skillset to other more broader contexts (e.g., courses, careers). Each instructional activity could be modified and utilized with different learner ages/levels. The following case studies are analyzed using the information presented in Chapters 1–5.

6.1 Theoretical Perspectives Revisited

This text has introduced you to the theories of Understanding by Design (UBD; Wiggins & McTighe, 1998) and Kolb's Experiential Learning Model (ELM; 1984). It has also presented information about infrastructure needs when creating m-learning spaces as well as app/device evaluation and assessment of student learning. To assist you with better understanding these concepts, three case studies are presented and deconstructed using the information in this book. To get started, let's briefly revisit some key points of the topics covered thus far.

6.1.1 Understanding by Design (UBD)

Understanding by Design (Wiggins & McTighe, 1998) is a curriculum planning process involving a series of specific overarching questions that guide an instructor's conceptualization of how to design a course. These guiding questions are: what do you want students to know, how will you measure their learning and what instructional activities will be incorporated in a course to help students understand what is to be learned. The UBD process consists of three stages supported by questions related to each stage. The UBD stages and questions are noted in Figure 6.1 (see Chapter 2 for a complete explanation of UBD).

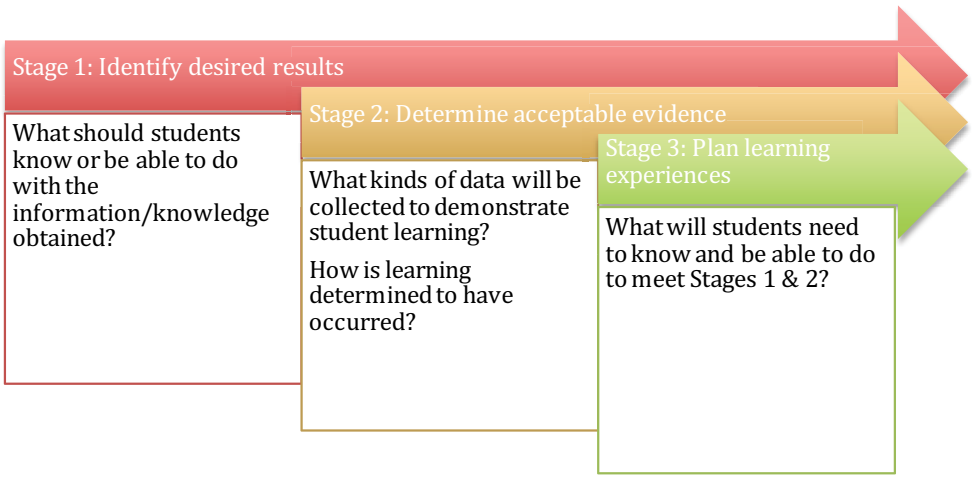


Figure 6.1: Understanding by Design Stages (Wiggins & McTighe, 1998)

6.1.2 Kolb's Experiential Learning Model

Like UBD, Kolb's ELM is also a process or stage model; however, it explains how learners process and perceive information. The ways in which a learner processes and perceives new information reveals a learning style. As previously noted, learning styles refer to the way in which a learner prefers to engage new information in a learning context. According to Kolb's ELM, there are four basic learning styles: accommodator, assimilator, converger, and diverger (see Chapter 2 for a detailed discussion about Kolb's ELM and learning styles). Learners are categorized based upon their preferences for doing/active experimentation OR watching/reflective observation AND feeling/concrete experience OR thinking/abstract conceptualization. Figure 6.2 provides a brief explanation of each learning style.

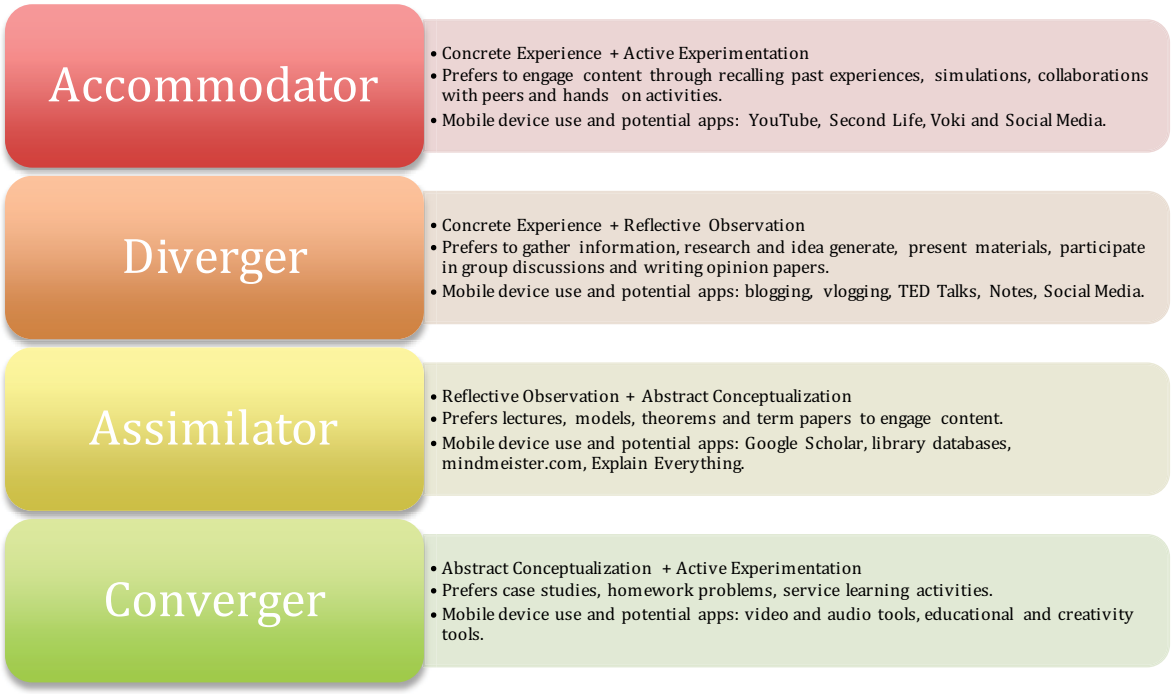


Figure 6.2: Kolb's ELM (1984) Learning Styles and Characteristics with Preferences for Learning with Mobile Devices

6.1.3 Assessing Tools and Ways to Assess

Chapter 3 presented information on tool assessment and ways to assess mobile devices and apps. This chapter noted the prevalence of mobile devices and apps and called for instructors to consider carefully how the mobile device would be used and how various apps might interact with the device. Four specific app categories were also introduced to you: productivity/creativity, e-books, subject specific and educational game apps. Figure 6.3 explains each app.

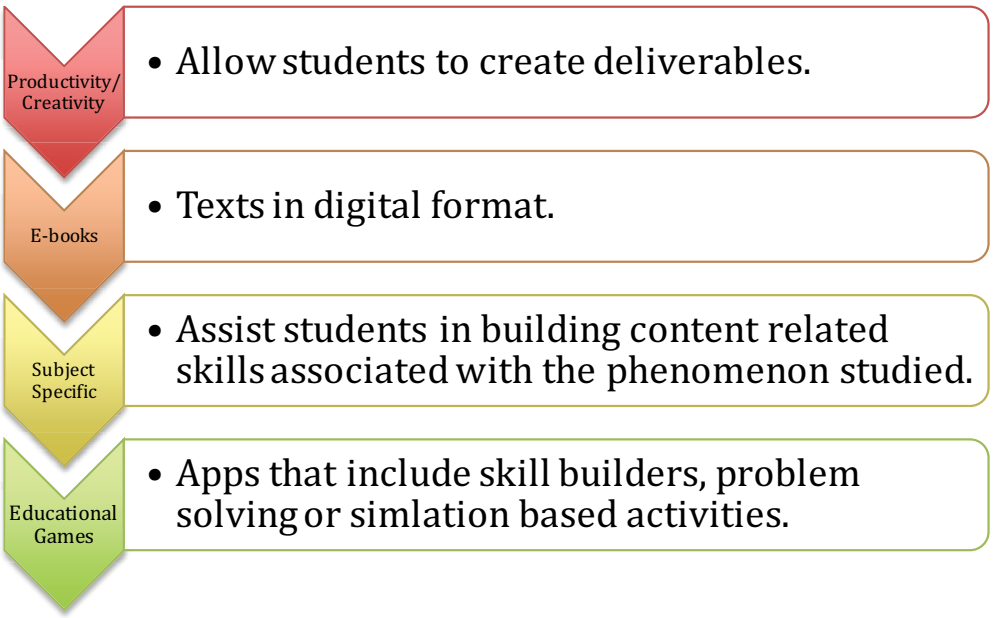


Figure 6.3: App Categories and Descriptions

When adopting mobile devices and apps, instructors must evaluate additional factors as well. The following diagrams highlight some of these considerations when creating an m-learning space. For more detailed information about mobile device and app considerations, revisit Chapter 3. Tables 6.1, 6.2, 6.3, and 6.4 provide a summary checklist to assess each app type as instructors make decisions about the tools required of instruction.

Productivity/Creativity Apps

Name of App:_____
Instructions/Support: Yes No
Reported Grade Level_____
Type of app: productivity, creativity, other_____
Export Media_____
Opportunities for collaboration: Yes No
Developer:_____
Intended use: formal, informal, both
Cost:_____
Operating System:_____

	Meets Needs	Slightly Meets Needs	Does Not Meet Needs	Criteria not relevant	Comments
Relevance	The purpose of the app is relevant to the student and the instructional situation.	Limited connection between the purpose of the app and relevance to student learning.	The purpose of the app does not connect to instruction and is not relevant to students.		
Engagement	Students will be intellectually invested when using this app.	Some students might be engaged with this app.	Students will quickly lose interest.		
Utility	The app includes all the utilities and features necessary to create the desired end product.	Limited utilities and features. Students can create a basic end product.	Utilities and features are lacking. The end product that students can make is not desired.		
Usability	Students can easily manipulate the application without too many special gestures.	Special gestures are required.	It is not clear how to use the app.		
Export End Product	Student product is saved on app and can be exported to the teacher is a manner that is acceptable to the institution.	Student product is saved on app but can NOT be exported.	Student product is NOT saved on app and can NOT be exported to the teacher is a manner that is acceptable to the school.		
Unlimited student products	No limits on the number of end products students are able to make.	Reasonable limit on the number of end products.	Major limits.		

Summary of app/recommended alternatives:

Table 6.1: Productivity/Creativity App Evaluation Tool

Electronic Books

Name of Book:_____
Reported Grade Level_____ Media_____ Megabytes on device:_____
Instructions/Support: Yes No Developer:_____
Type of book: general reading, reference, textbook, other_____ Cost:_____
Intended use: formal, informal, both Operating System:_____

	Meets Needs	Slightly Meets Needs	Does Not Meet Needs	Criteria not relevant	Comments
Relevance/ Standards	The purpose of the book is relevant to the student and the instructional situation.	Limited connection between the purpose of the book and relevance to student learning.	The purpose of the book does not connect to instruction and is not relevant to students.		
Engagement	Students will be intellectually invested when using this app.	Some students might be engaged with this app.	Students will quickly lose interest.		
Usability	Students can easily manipulate the controls for the book.	Special gestures are required.	It is not clear how to manipulate the book.		
Annotations	Students can input many different types of annotations, highlight, notes, on page comments, etc.	Limited annotations.	No annotations.		
Tags	Students are able to tag specific pages.	Limited ability to tag pages.	No tagging.		
Index/TOC	Index and table of contents available.	Limited index or table of contents.	No index or table of contents.		
Search	Search feature available.		No search.		
Unlimited purchase	No limits on how long students have access to the book.	Reasonable limit on access to book.	Major limits.		
Multimedia	Multimedia extends content and contributes to learning.	Multimedia tangentially contributes to content.	No multimedia.		
Dictionary	Extensive dictionary.	Limited dictionary.	Minimal dictionary.		

Summary of book/recommended alternatives:

Table 6.2: E-book Evaluation Tool

Subject Specific Apps

Name of App:_____
Instructions/Support: Yes No
Reported Grade Level: _____
Type of app: general content, skill builder, simulation, other_____
Megabytes on device:_____
Username required: Yes No
Developer:_____
Opportunities for collaboration: Yes No
Cost:_____
Intended use: formal informal both
Operating System:_____

	Meets Needs	Slightly Meets Needs	Does Not Meet Needs	Criteria Not Relevant	Comments
Alignment to standards	App aligns to standards.	App is loosely tied to standards.	Not aligned to standards.		
Engaging	Students will be intellectually invested when using this app.	Some students might be engaged with this app.	Students will quickly lose interest.		
Usability	Students can easily manipulate the controls for the app.	Special gestures are required.	It is not clear how to manipulate the app.		
Students needs	This app meets an educational need of my students.	The app might meet the needs of some of my students.	Doesn't meet my students educational needs.		
Performance summary	Student specific performance summary or student product is saved on app and can be exported to the teacher in a manner that is acceptable to the school.	Student specific performance summary or student product is saved on app however data is not exportable.	Specific performance summary or student product is NOT saved on app and can NOT be exported to the teacher.		
Feedback	Specific feedback is provided to the student.	Student is provided basic feedback.	Limited feedback.		
Differentiation	App will meet the needs of all classroom groups, with multiple difficulty levels and multiple presentation styles.	App has more than one level of difficulty and/or information is presented in only one manner.	App has one level of difficulty and is presented in only one manner.		
Group or Individual	Teams of students or an individual can use this app.	Mainly intended for individual but may be ok with a group.	Only an individual can use this app.		

Summary of app/recommended alternatives:

Table 6.3: Specific Subject App Evaluation Tool

Educational Games Apps

Name of App:_____
Instructions/Support: Yes No
Reported Grade Level_____
Type of game: skill builder, problem solving or strategy, simulation, other_____
Megabytes on device:_____
Username required: Yes No
Developer:_____
Opportunities for collaboration: Yes No
Cost:_____
Intended use: formal informal both
Operating System:_____

	Meets Needs	Slightly Meets Needs	Does Not Meet Needs	Criteria not relevant	Comments
Relevance	The purpose of the game is relevant to the student and the instructional situation.	Limited connection between the purpose of the game and relevance to student learning.	The purpose of the game does not connect to instruction and is not relevant to students.		
Feedback	Specific feedback is provided to the student.	Student is provided some feedback.	Limited feedback.		
Engagement	Students will be intellectually invested when using this game.	Some students might be engaged with this game.	Students will quickly lose interest.		
Usability	Students can easily manipulate the controls for the game.	Special gestures are required.	It is not clear how to manipulate the game.		
Replay varies	Game varies with replay.	Game is predictable when replayed.	Same game when replayed.		
Reporting	Summary data is electronically available to teacher.	Student briefly has access to summary data.	Summary data not available.		
Levels of difficulty	Wide range of difficulty that will engage ALL students in the class for a long period of time.	Some range. The game will be useful for some for some time.	Minimal range of difficulty app will not be used long.		
Thinking skills	Game encourages the use of higher order thinking skills.	Mostly lower order thinking skills.	Limited to the lower order thinking skills	Yes No	
Storyline	Game has a complex storyline with characters users care about.	Has a basic storyline.	No storyline.	Yes No	
Replicates real-world	Game replicates the real-world.	Some what realistic.	Game not realistic.	Yes No	

Summary of app/recommended alternatives:

Table 6.4: Educational Games App Evaluation Tool

6.1.4 Infrastructure and Learning Spaces

Beyond assessing apps and mobile devices required of m-learning, instructors must also examine the spaces in which learning will occur and what kinds of resources will be needed to support this new environment. Because m-learning spaces involve mobile devices and apps as well as different classroom functions, learning environments are both digital and physical. Consequently, instructors must account for a number of variables ranging from class configurations (e.g., will learners work as a class, small group, pair or individual) to wifi access and electrical outlets to how technology will be used to meet learning outcomes. Figure 6.4 details task spaces and configurations while Table 6.5 outlines activities that can be conducted via mobile devices and related technic considerations in these configurations.

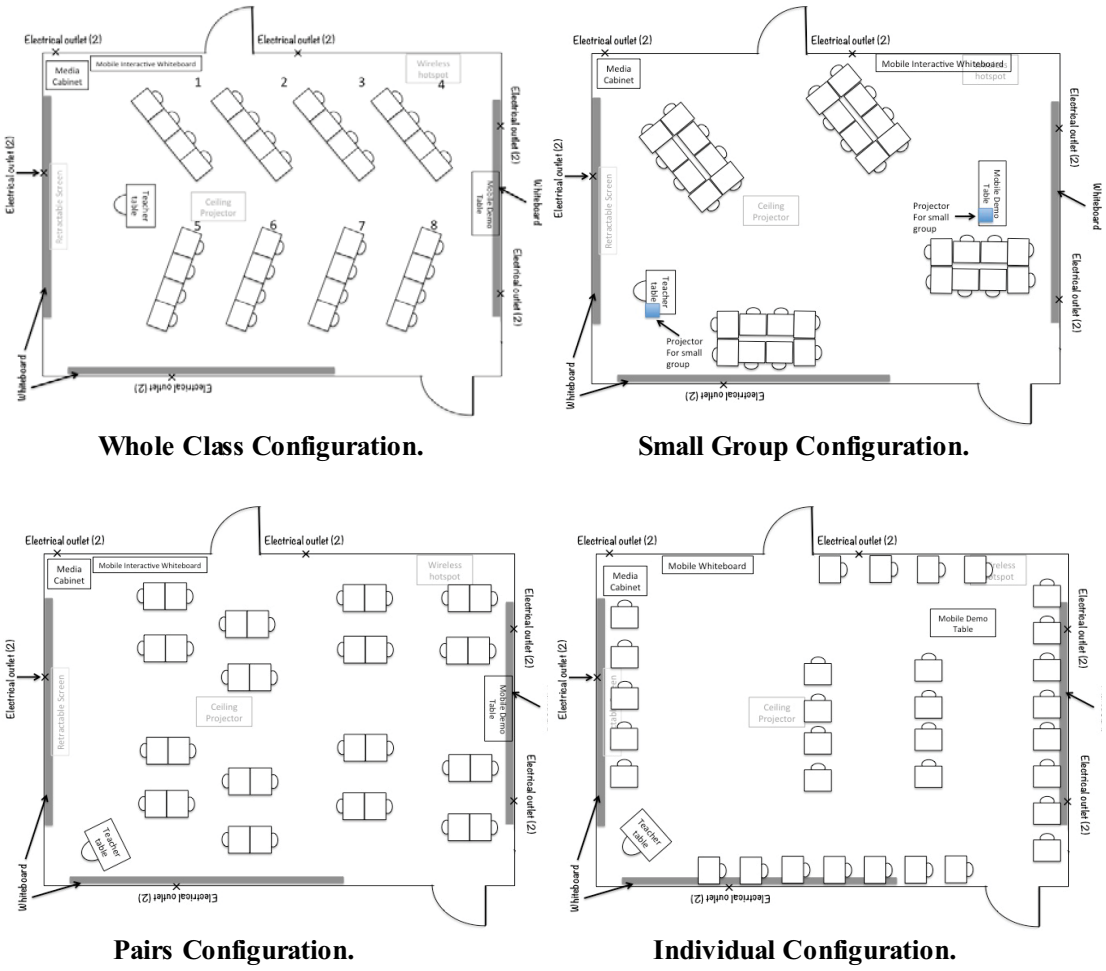


Figure 6.4: Classroom Configurations for Physical Instructional Space.

Functional Architecture Examples of type of instruction	**Technics (mobile devices enabled)**	
	Asynchronous	Synchronous
Whole class Examples: lecture, presentations, video (formal learning)	• Multiple options for content presentations: including video, audio, narrated slide show, text supplemented with video and photos. • File sharing • Reference websites • Podcasts • Discussion boards • Wikis or other collaborative documents	• Interactive online presentations (often referred to as Webinars) • Interactive Web Conferencing • Shared whiteboard • Student response systems
Small group Examples: small group discussions, learning tasks, research projects, problem solving exercises, case studies (formal & informal learning)	• Discussion boards • File sharing • Blogs • Wikis or other collaborative documents	• Interactive Web Conferencing • Shared whiteboard • Chat
Pairs Examples: role play, peer critiques (formal & informal learning)	• Peer review system • Discussion boards • File sharing • Blogs • Wikis or other collaborative documents	• Interactive Web Conferencing • Shared whiteboard • Chat
Individual Examples: Read and reflect, practice, simulations (formal & informal learning)	• File management • Access to remediation website or online resources • Access to online textbooks and textbook resources • Personal electronic portfolios • Online quizzes • Simulations and games	• Access to online technical help • Access to homework assistance/tutoring sites

Table 6.5: Virtual Learning Places, Infrastructure Considerations

6.1.5 Mobile Technologies and Assessment of Student Learning

As noted in Chapter 5, a fundamental component of instruction is the assessment of student learning. Instructors assess student learning using formative and summative assessments. Formative assessment is used to assess student learning as they progress through a module or unit of instruction. This kind of assessment is usually performed for a grade. Informal assessment involves tools that students can use to self-assess their own learning and understanding of content and usually isn't associated with a formal grade on their performance. Both of these assessment types are used to convey to students their degree of understanding of course concepts throughout instruction and prior to a summative assessment. Summative assessments are administered after instruction to measure student learning of course concepts or units of instruction. Assessments can be objective (e.g., multiple choice, true/false or short answer), performance-based (e.g., presentations or task demonstrations) or portfolio developed. As noted in Chapter 5, mobile devices can be utilized to develop, access, administer and collect various formative and summative assessments.

We will now turn our attention to analyzing the case studies that follow via an application of what's been discussed thus far.

6.2 Case Study 1 (Elementary School): Advancing Creative Writing Skills via Student Generated Multimedia Books

Luke teaches the fifth grade creative writing unit. Last year he noticed that his students would spend very little time reworking their text. He noticed that most of the time students turned in their initial draft of their writing. While Luke taught his students about the writing process (Prewriting, Drafting, Revising, Editing, and Publishing/Evaluating), the practice of the students was very different.

This year Luke is determined to have his students fully participate in the complete writing process. He truly believes that they will build the skills necessary to continue to use the entire writing process in their personal writing. He decided to have the entire class use the process multiple times over a series of days so that they would become comfortable with the process. They would then create multimedia books that parents could view during their school's next open house.

To begin, Luke created a brief 5-minute video, using a screen casting software that explains the complete writing process. He asked his students to review the video prior to class. At the start of class Luke provided a quick review of the writing process. He then gave the students a writing prompt "the snow came down like soft cotton balls and all the children…." The whole class took 5 minutes to brainstorm story elements that would be appropriate to the topic while Luke quickly wrote the notes on the interactive whiteboard in the front of the room. The results of the whiteboard were then displayed on several screens in the room.

After the five-minute brainstorming session was over, the students worked independently on their own winter snowfall story. The students spent five-minutes free writing, either typing directly on their mobile device or by using a speech-to-text converter (using headphones and attached speaker). Then they spent 7–8 minutes working independently on the first draft of their story.

Luke then asked his students to work in pairs and provide each other with a peer review of their work. Once the peer review was complete the students then revised their short story based on the winter snowfall theme. Luke continued having the students revise and edit their stories two more times until the students had revised the story a total of 4 times.

6.2.1 Understanding by Design

In planning this instructional activity, Luke began the process by moving through the stages of UBD and responding to the related questions. Below are Luke's responses to this part of the planning process:

Stage 1: What should students know or be able to do with the information/knowledge obtained? After instruction, students should be able to demonstrate the writing process (Prewriting, Drafting, Revising, Editing, and Publishing/Evaluating) via a summative assessment (performance-based) in the form of a multimedia book project.

Stage 2: What kinds of data will be collected to demonstrate student learning? How is learning determined to have occurred? Luke will collect the students' brainstorming ideas for crafting the essay verbally and depict them on the whiteboard. He will also gather the students' first draft of the practice essay with peer-reviewer comments. The student-created multimedia books are the final deliverable of this assignment that demonstrates student mastery of having learned the writing process.

Stage 3: What will students need to know and be able to do to meet Stages 1 & 2? Students will need to know the steps of the writing process and have an opportunity to practice the process individually, in pairs and as a class. Students will also need to have feedback from Luke and their peers about their independent free writes as well as their multimedia books to further revise their writings.

6.2.2 Kolb's Experiential Learning Model and Learning Styles

Luke's instructional activity engages each of Kolb's learning styles. The relationship between the activity components and the learning styles is noted below.

Accommodators were engaged in learning the writing process by doing the hands on activity of brainstorming and writing an essay as well as collaborating with their peers in the peer-review process and class discussion components of the activity.

Divergers were engaged in learning the writing process via idea generation, participating in a group discussion and writing their essay.

Assimilators were engaged in learning the writing process by examining the model of writing (the process components), overview (mini-lecture) of the process and creating the essay.

Convergers were engaged in learning the writing process by solving a problem via the prompt, "*the snow came down like soft cotton balls and all the children….*"

6.2.3 Tool Identification and App Selection

Because Luke wanted the students to work through the writing process, he selected productivity/creativity apps to fulfill the learning outcomes. To help the students through this process, Luke created a 5-minute video using a free screencast software that students would view outside of class. He then used the class whiteboard to display information related to the class discussion about the writing process and prompt. Mobile devices with a writing app (e.g., Notes) or speech to text app such as SpeakIt! were then incorporated into the activity to engage learners in the content on the writing process. These apps were selected because they were free, had a small learning curve and are user friendly across devices. These apps also allow for finished deliverables (like the essay) to be emailed to Luke or collected elsewhere for assessment and providing student feedback about their learning. These apps also relate to varying learning styles. For example, accommodators are engaged by videos while divergers enjoy activities like blogging or writing with technology. Assimilators relate well to tools that permit constructing a deliverable like the essay (via Notes or SpeakIt!) and convergers are engaged best with apps that involve video or audio tools.

6.2.4 Infrastructure Considerations

Luke also had to think through a number of other classroom circumstances to create an effective learning experience for his students. One of his first considerations involved physical space and how he might arrange the space to accommodate student engagement and learning. This instructional activity required students to work individually (from home viewing the video and in constructing their essay), as a class (to brainstorm) and as teams (during the peer-review process). Consequently, Luke had to determine how best to organize the class so that students could move between these learning contexts and arrangements.

Luke had to also consider the logistics of this activity. For example, Luke had to identify how the whiteboard would be used, the video shared for home/individual viewing, the apps that the students would use and file sharing pertaining to the students' sharing of essays for the peer-review aspect of the activity.

6.2.5 Assessment of Student Learning

This activity exemplifies formal formative assessment. During the instructional activity, students are provided peer feedback and instructor feedback about their performance. This activity isn't graded but allows for student practice in mastering the course content while also providing valuable information from their instructor and peers about their writing performance as they progress through the stages of the writing process. Summative assessment will occur upon student submissions of the multimedia book assignment.

6.3 Case Study 2 (High School): Exploring Biological Concepts via Student Created Video Projects

Rachel has been teaching biology at the local high school for three years. She has found that students always grapple with meiosis and mitosis. These are important concepts in biology. Rachel has found that if students don't have a strong understanding of these concepts they will have problems with other related biology concepts that they will be learning as the course progresses. She decided to dedicate more time than usual on meiosis and mitosis to assure that all of her students fully understand these concepts.

Prior to coming to class she asked her students to visit websites that explain what cancer is and how it relates to meiosis and mitosis (note: cancer is the uncontrollable growth and reproduction of cells—in other words when mitosis is uncontrollable).

When the students came to class after they reviewed the websites, Rachel used a student response system on the mobile devices to check students' understanding of the topic. Depending on how the students answered the questions, she was then prepared to review and remediate as necessary.

Once Rachel was sure that the students had a solid understanding of mitosis and meiosis she has the students to work in small groups to make movies on the concepts. The students were asked to use their cameras on the mobile devices to take pictures of drawings of the stages of meiosis and mitosis. The students were then instructed to create movies using the photos of their drawings accompanied by an audio voiceover explaining the stages.

6.3.1 Understanding by Design

In planning this instructional activity, Rachel began the process by moving through the stages of UBD and responding to the related questions. Below are Rachel's responses to this part of the planning process:

Stage 1: What should students know or be able to do with the information/knowledge obtained? After instruction, students should be able to demonstrate their understanding of meiosis and mitosis via a series of questions they answer using a student response system accessed from a mobile device and by creating a video about these biology concepts.

Stage 2: What kinds of data will be collected to demonstrate student learning? How is learning determined to have occurred? Rachel will collect the students' responses to the questions about meiosis and mitosis using a student response system on a mobile device. The final deliverable is a small group-produced video, which will also provide evidence of student learning.

Stage 3: What will students need to know and be able to do to meet Stages 1 & 2? Students will need to know what meiosis and mitosis are as well as some variables that impact them. Students will need to read materials about the concepts prior to the class response system activity and the small group video activity. Students will also need to have feedback from Rachel during the response system activity to assess if they have an understanding of meiosis and mitosis prior to moving forward with the video making process.

6.3.2 Kolb's Experiential Learning Model and Learning Styles

Rachel's instructional activity engages each of Kolb's learning styles. The relationship between the activity components and the learning styles is noted below.

Accommodators were engaged in learning about meiosis and mitosis by doing the hands on activity with the student response systems, collaborating with peers on the video project and in viewing websites about the topic.

Divergers were engaged in learning about meiosis and mitosis by participating in a group discussion, drawing the stages of meiosis and mitosis and presenting their group's finished video.

Assimilators were engaged in learning about meiosis and mitosis by examining the diagrams and models of the concepts, the content on the websites, and assembling the video components.

Convergers were engaged in learning about meiosis and mitosis by solving the problem of how to create a video that depicts the stages of meiosis and mitosis as well as the use of audio and video materials to learn the concepts.

6.3.3 Tool Identification and App Selection

Because Rachel wanted to provide students with a deeper learning experience, she created a multi-component assignment. The first part of the activity required students to access information online about meiosis and mitosis available on specific websites that she directed them to view. The second part of the assignment required students to create a final deliverable – a group video. This aspect of the assignment called for a productivity/creativity app to fulfill the learning outcomes. To help the students progress from the first part of the assignment to the second component, Rachel ensured student understanding of the readings on meiosis and mitosis by using a student response system app which allowed students to answer a series of questions about the readings. During this time Rachel used the student responses to ascertain what aspects of the concepts needed re-teaching. Mobile devices were used to respond to the questions as well as to capture student produced images and audio, which were then edited into a video about meiosis and mitosis. The apps selected and tools used on the devices were free (e.g., iMovie and the response system app Socrates), had a small learning curve and are user friendly. These apps also allow for the videos to be emailed, texted or submitted to Rachel elsewhere. These apps and tools also relate to varying learning styles. For example, videos appeal to accommodators and divergers enjoy creative activities with technology. Assimilators like creating illustrations and theories while video and audio components of activities engage convergers.

6.3.4 Infrastructure Considerations

When creating this assignment, Rachel considered a number of other classroom variables, too. Because this activity involved independent (website viewing/reading and student response system) and small group work (video creation), Rachel had to determine how she would use the physical classroom space to encourage student learning and engagement. This would require her to contemplate moving chairs/tables as well as how to position students in work groups.

Rachel also considered instructional activity components. For example, Rachel identified what websites to incorporate into student readings, student response app to implement (e.g., Socrates), and what video/audio and editing app to incorporate in the student development of videos. File sharing matters also needed to be resolved.

6.3.5 Assessment of Student Learning

This activity contains formal formative and summative assessment. Formative assessment was conducted via the student response system exercise that provided evidence of student learning of meiosis and mitosis. During this part of the activity, Rachel was able to see what students understood and the areas that learners were struggling with comprehending. When Rachel identified an area of challenge, she was able to provide student feedback during instruction that allowed students to master the concepts through Rachel's re-teaching of the material. Summative assessment occurs upon the submission of the groups' video projects to Rachel.

6.4 Case Study 3 (Higher Education Setting): Investigating Historical Figures via a Class Created Documentary

Larry has been teaching history at a university for over a decade. He teaches primarily introduction to U.S. history classes to first year students in the general education program and some special topics classes that are intended for history majors as well as students looking to fulfill a history/social science requirement in their program of study. Larry has found that in teaching history, students often feel that the courses are unnecessary and outdated. He has been looking for ways to make history more meaningful and relevant to his students. In doing so, Larry is also interested in developing his students critical thinking skills as well as their ability to read closely, research, write and collaborate in teams and as a class. He also wants to include more technology in his instruction as a way to engage students in the course.

To meet these course objectives, Larry created an assignment that requires his students to create a class documentary about a historical figure. To complete this assignment, students will work with mobile devices and varying apps. To start the process, students work in small groups of four to five to brainstorm a historical figure of interest. After each group identifies a person, the teams share with Larry who they would like to study along with a rationale for their selection and a brief summary of the person. Larry then creates a polleverywhere.com site with this information. Using their mobile devices, students access polleverywhere.com and vote on the individual who will become the subject of the class-produced documentary.

Next, the class identifies individual skills that each learner possesses that could contribute to the overall documentary assignment. For example, students who were interested in writing would be responsible for creating the documentary's script and supporting research documents; students who wanted to research the figure oversaw this component of the assignment; and learners who were familiar with digital audio and video recording were in charge of collecting the video and audio components of the assignment along with editing it.

Once students were assigned to a work team, the students had to organize their tasks and coordinate how each of the groups would interact and meet the assignment objectives. This requires the class to develop a timeline, project management strategy, and mechanisms to interact with one another to meet the assignment criteria. Students were given the option to use a variety of different communication and technology tools to assist them in fulfilling their responsibilities. For example, students could use email, instant messaging, video conferencing or social media to communicate and work in- and out-of-the class; the final documentary will be created using iMovie or Movie Maker.

In terms of the final documentary, students would have six class sessions over the course of the semester to work on the assignment; the remainder of the work would need to be completed outside of the course. Additional assignment criteria consisted of the following: a) the movie length was 30 minutes; b) scholarly materials had to be used to create the contents; c) a script must accompany the documentary; d) the movie must be of professional quality and e) students must submit an individual report about their contributions to the assignment which was reviewed by their group and required each group member's signature attesting to the contributions. The assignment was due at the end of the semester and would be viewed by the class as a whole with key university members and individuals the class wanted to invite to the showing.

6.4.1 Understanding by Design

Larry began the instructional planning process by progressing through the UBD stages and responding to the following questions:

Stage 1: What should students know or be able to do with the information/knowledge obtained? After instruction, students should be able to demonstrate their abilities to critically think, **read closely, research, write and collaborate in teams and as a class** to illustrate their understanding of a historical figure by creating a class-produced video documentary using various mobile devices and apps.

Stage 2: What kinds of data will be collected to demonstrate student learning? How is learning determined to have occurred? Larry will collect digital and performance-based/physical evidence of student learning during the six class sessions dedicated to the documentary and work group project deliverables (e.g., annotated bibliographies, summaries of scholarly works, group reports on student meetings, draft scripts and tasks completed) as the assignment progresses. The final deliverable is a class-produced documentary, which will also provide evidence of student learning.

Stage 3: What will students need to know and be able to do to meet Stages 1 & 2? Students will need to know how to conduct research, evaluate scholarly sources, write a video script, and use editing apps to produce the class project. Students will need to read materials about the documentary subject and complete tutorials on research and editing. Students will also need to have feedback from Larry during the class sessions to assess if they have an understanding of the project and its various components as well as the related subject matter prior to moving forward with the documentary filmmaking process.

6.4.2 Kolb's Experiential Learning Model and Learning Styles

The instructional activity Larry created engages the learning styles Kolb identified. The activity as it relates to these learning styles is explained below.

Accommodators were engaged in the instructional activity by doing the hands on work of documentary filmmaking, collaborating with peers on the video project and in viewing audio/video materials about the topic to which they self-selected to work.

Divergers were engaged in the instructional activity by participating in group discussions, class work sessions, outlining the stages of the filmmaking process and showing the group's finished documentary.

Assimilators were engaged in the instructional activity by learning about the film's subject, researching the topic, diagraming film scene sequences and editing the video components.

Convergers were engaged in the instructional activity by problem solving how to create a video that depicts the subject, and the use of audio and video materials to create the final product.

6.4.3 Tool Identification and App Selection

Because Larry's course objectives were to develop his students' critical thinking skills as well as their ability to read closely, research, write and collaborate in teams and as a class, he had to carefully construct a creative assignment that allowed his students opportunities to do so. Consequently, Larry created a multi-component assignment built upon constructivist practices (see p. 15 for a detailed explanation) that empower students to learn formally and informally about a concept defined by the instructor. The first part of the activity required students to identify a subject of study and to vote as a class, using student response systems, on the focus of the documentary. The second aspect of the assignment required students to identify a work group to assist in the documentary filmmaking process. This aspect of the assignment demands that students communicate and collaborate in- and out-of-class on the film and its supporting tasks. Each of the tasks is related to the learning outcomes Larry established for the course. To help the students' progress through the assignment, Larry identified some specific apps for class use. Some of the apps involved social media such as Twitter or Facebook while other apps involved iMovie or Movie Maker. The apps selected and tools used on the devices were free (e.g., iMovie and the response system app Socrates), had a small learning curve and are user friendly. These apps also allow for the videos to be emailed, texted or submitted to Larry elsewhere such as a dropbox. These apps and tools also relate to varying learning styles. For example, videos appeal to accommodators and divergers enjoy creative activities using technology. Assimilators like creating storyboards while video and audio components of activities engage convergers.

6.4.4 Infrastructure Considerations

Larry considered a number of other classroom variables in his planning process. Because this activity involved independent (website viewing/reading and student response system) and small group work on subparts of the assignment (e.g., script writing, editing, researching), Larry had to determine how he would use the physical classroom space to encourage student learning and engagement. This would require him to configure his space in group, team and class workspaces

Larry further evaluated the technical aspects with the instructional activity. For example, Larry identified examples of scholarly sources to be used in the project, websites to incorporate into student readings, tutorial sites for editing and constructing project deliverables, a student response app to implement (e.g., Socrates) for class voting, and the video/audio editing app to incorporate in the class created documentary. File sharing matters also needed to be resolved among the group, as did where to house the finished documentary.

6.4.5 Assessment of Student Learning

This activity contains formal formative and summative assessment. Formative assessment was conducted via the class work sessions and student tutorial quizzes and completions, as well as feedback Larry provided to students who produced annotated bibliographies and references, script writing and individual reports on students' progress and work completed. Summative assessment occurs upon the submission of the class documentary as well as the individual students' reports and documentation of the work they produced to Larry.

6.5 Preparing for Your m-Learning Experience

A significant amount of information has been presented in this book to help inform instructors of ways in which to create m-learning spaces. To further assist you in creating such a space, Table 6.6 consists of a quick reference tool to guide some of your instructional decision-making. These questions are categorized by the topics presented throughout the book and combine some of the key areas of consideration noted in greater detail in the charts and worksheets presented here.

M-Learning Quick Reference Instructional Design Questionnaire

Mobile Devices

- What mobile devices are available on your campus?
- What professional development opportunities or technology support is available on your campus?
- What mobile devices do your students own?
- What apps might you use in the activity you are designing?
- Why do you want to create an m-learning space?
- How does it facilitate students meeting the course learning objectives?
- What challenges have you identified regarding including mobile devices in your course planning? What can you do to address those challenges?

Educational Theories

- What do you want students to learn?
- What evidence will students submit to demonstrate their learning?
- How is experiential learning accomplished with the mobile devices and apps selected?
- How do the activity, device and app(s) engage various learning styles?

Assessing Tools and Ways to Assess

- Have you consulted what the experts report about specific devices and apps?
- Have you researched the devices and apps you are considering?
- Do you wish to use a productivity/creativity, e-book, subject specific or game app to accomplish the activity? Why this app?
- How much does the app cost?
- What device(s) does it support?
- Are there help features or tutorials?
- What kind of instruction and learning does it support? Formal or informal?

Infrastructure: Learning Spaces

- How does the classroom's physical space need to be configured for the activity?
- Does the activity require students to work independently, in groups, as pairs or as a class?
- Is Internet access available? Is wifi?

Mobile Technologies and Assessment of Student Learning

- Are formative or summative assessments being conducted with mobile devices?
- Will the assessments be performance-based, portfolio or objective instruments?
- How will you collect student evidence of learning or feedback about the instructional experience?
- Where will student assignments be stored?
- How will you provide feedback to students about the assignment or learning experience?

Table 6.6: M-Learning Quick Reference Instructional Design Questionnaire

6.5.1 Training and Development Recommendations

Effective teaching requires ongoing training and development. This is especially true as it relates to various kinds of pedagogies and instructional technology like that of mobile devices and apps. Consequently, it's important that instructors remain current in their respective fields of study as well as the pedagogical strategies used to enhance student learning and engagement and the technology tools that can be used to assist students in accessing, communicating, constructing and collaborating in face-to-face and digital contexts. It is our hope that you will utilize the information in this text and complete the Quick Reference Instructional Design Questionnaire noted above to help you identify some instructional areas in need of improvement as you design your future m-learning spaces. Once you have self-assessed your abilities and knowledge base regarding the theories presented here as well as the information about mobile devices, we encourage you to locate professional development opportunities on your campus, at various conferences, workshops or nearby colleges and universities that offer courses for credit or for continuing education hours that can enhance your skillset.

6.6 Summary

In this chapter you have:

- Examined and analyzed three classroom tested m-learning case studies.
- Observed how Understanding by Design (Wiggins & McTighe, 1998) is applied to m-learning environments.
- Revisited Kolb's Experiential Learning Model (ELM) and learning styles in the context of m-learning spaces.
- Reviewed a variety of checklists and planning documents that contain variables of consideration when designing an m-learning environment. Some of these tools consist of assessing mobile devices and apps, learning space infrastructure and assessment of student learning.
- Identified some potential areas of improvement that may require you to obtain professional development and training as you transition into creating your own m-learning spaces.

Reflection to Action

1. Reflect on one of the case studies in this chapter. Consider the following:
   a) If the instructor in the case study were teaching in your classroom, what changes would he/she have to make to your physical space in order to conduct the instructional activity?
   b) What changes would you make to the instructional activity in the case study so that it would work in your physical space?
   c) List all of the things that might go wrong with using this assignment and strategies the teacher might use to overcome those challenges.

2. Create your own m-learning instructional activity. Complete the M-Learning Quick Reference Instructional Design Questionnaire on page 70 to assist you in doing so.
   a) Create an action plan with timelines and locations where you may obtain the training needed.

References

Academic Impressions. (2012). Showcase: Examples of mobile technology used for teaching and learning. Retrieved from https://www.academicimpressions.com/news/showcase-examples-mobile-technology-used-teaching-and-learning

Anderson, L.W. and Krathwohl, D.R., et al (Eds..) (2001). A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives. Allyn & Bacon. Boston, MA (Pearson Education Group).

Apple Store. (2014). Retrieved from http://www.apple.com/iphone-5c/app-store/

Bloom, B.S. (1956). *Taxonomy of educational objectives: Cognitive domain*. New York: David McKay.

Breirs, G.E. (2005). Lighting their fires through experiential learning. *Agricultural Education Magazine*, *78*, 4–5.

Brown, M. (2005). Learning spaces. In D.G. Oblinger & J. L. Oblinger (Eds.) *Educating the Net Generation*. Boulder, Colo: Educause

Brysch, C.P., Huynh, N., & Scholz, M. (2012). Evaluating educational computer games in geography: What is the relationship to curriculum requirements? *Journal of Geography*, *111*(3), 102–112. doi:10.1080/00221341.2011.609998

Chavan, M. (2011). Higher education students' attitudes towards experiential learning in international business. *Journal of Teaching in International Business*, *22*, 126–143.

Chen, B., & deNoyelles, A. (2013). Exploring students' mobile learning practices in higher education. *Educause Review Online*. Retrieved from http://www.educause.edu/ero/article/exploring-students-mobile-learning-practices-higher-education

Cleveland, B. (2009). Engaging spaces: An investigation into middle school educational opportunities provided by innovative built environments. A new approach to understanding the relationship between learning and space. *International Journal of Learning*, *16*(5), 385–397.

Dempsey, J.V., & Van Eck, R.N. (2012). E-Learning and Instructional Design. In R.A. Reiser & J.V. Dempsey (Eds.) *Trends and Issues In Instructional Design and Technology* (3rd ed., pp. 281–289). Boston, MA: Pearson.

Dewey, J. (1938). *Experience and education*, New York: Macmillan.

Dewey, J. (1933) *How we think*, New York: Heath.

Dobler, E. (2013). Looking beyond the screen: Evaluating the quality of digital books. Reading Today, *30*(5), 20–21.

Doolittle, P.E., & Camp, W.G. (1999). Constructivism: The career and technical and education perspective. *Journal of Vocational and Technical Education*, *16,* 23–46.

EDUCAUSE. (2011). ECAR National study of undergraduate students and information technology 3–33.

EDUCAUSE. (2013). *ECAR Study of Undergraduate Students and Information Technology*, 1–49. Retrieved from https://net.educause.edu/ir/library/pdf/ERS1302/ERS1302.pdf

Ettling, A. (1993). What is nonformal education? *Journal of Agricultural Education*, *34*, 72–76.

Fox, S., & Rainie, L. (2014). The Web at 25 in the U.S.: About this report. Retrieved from http://www.pewinternet.org/2014/02/27/about-this-report-4/

Google Play. (2014). Retrieved from https://play.google.com/store/apps

Greeno, J.G. (1989). A perspective on thinking. *American Psychologist, 44* (2) 134–141.

Harris, M. (2009). Implementing portfolio assessment. *YC: Young Children*, *64*(3), 82–85.

Hedin, N., & Caroll, B.H. (2010). Experiential learning: Theory and challenges. *CEJ*, *7*, 107–117.

Holstermann, N., Grube, D., & Bogenholz, S. (2010). Hands-on activities and their influence on students' interest. *Research in Science Education*, *40*, 743–757.

Hommel, M. (2010). Video games and learning. *School Library Monthly*, *26*(10), 37–40.

Jackson, W. (2013). *Just what does NIST consider a mobile device?* Retrieved from http://gcn.com/articles/2013/06/27/nist-mobile-device-definition.aspx

Jarvis, P. (1987). *Adult learning in the social context*, London: Croom Helm.

Johnson, L., Adams Becker, S., Estrada, V., Freeman, A. (2014). *NMC Horizon Report: 2014 Higher Education Edition*. Austin, Texas: The New Media Consortium.

Johnson, L., Smith, R., Willis, H., Levine, A., & Haywood, K. (2011). *The Horizon Report*. Austin, Texas: The New Media Consortium.

Kebritchi, M. (2010). Factors affecting teachers' adoption of educational computer games: A case study. *British Journal of Educational Technology, 41*(2), 256–270. doi:10.1111/j.1467-8535.2008.00921.x

Kessler, S. (2011). *4 ways mobile tech is improving education*. Retrieved from http://mashable.com/2011/05/04/mobile-education-initiatives/

Kliebard, H. (2004). *The struggle for the American curriculum, 1893–1958*. New York: Routledge.

Kolb, D.A. (1984) *Experiential learning: Experience as the source of learning*. Englewood Cliffs, NJ: Prentice Hall.

Larson, L.C. (2012). It's time to turn the digital page: Preservice teachers explore e-book reading. *Journal of Adolescent & Adult Literacy*, *56*(4), 280–290.

Lewin, K. (1951). Field theory in social science. In D. Cartwright (Ed.), *Selected Theoretical Papers*. New York: Harper & Row.

Lewis, L., & Williams, C. (1994). Experiential learning: Past and present. In L. Jackson & R. Caffarella (Eds.), *Experiential learning: A new approach* (pp. 5–16). *New Directions for Adult and Continuing Education*, *62*. San Francisco: Jossey Bass.

Loo, R. (2002). A Meta-analytic examination of Kolb's learning style preferences among business majors. *Journal of Education for Business*, *77*, 252–256.

Martin, A. (2013). *6 reasons to try mobile devices in the classroom*. Retrieved from http://www.edudemic.com/mobile-devices-in-the-classroom/

McMillan, J.H. (2011). *Classroom assessment: Principles and practices for effective standards-based instruction*, (5th ed.). Boston, MA: Pearson.

Mishra, P., & Koehler, M. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, *108*(6), 1017–1054.

Morken, E.M., Divitini, M.M., & Haugaløkken, O. K. (2007). Enriching spaces in practice based education to support collaboration while mobile: The case of teacher education. *Journal of Computer Assisted Learning*, *23*(4), 300–311.
doi:10.1111/j.13652729.2007.00235.x

Neill, S., & Etheridge, R. (2008). Flexible learning spaces: The integration of pedagogy, physical design, and instructional technology. *Marketing Education Review*, *18*(1), 47–53.

Paulsen, M.B. (2001). The relation between research and the scholarship of teaching. *Scholarship Revisited: Perspectives on the Scholarship of Teaching*, *86*, 19–29.

Pew Research Internet Project. (2013). *Mobile technology fact sheet*. Retrieved from http://www.pewinternet.org/fact-sheets/mobile-technology-fact-sheet/

Pew Research Internet Project. (2013). Broadband and smartphone adoption demographics. Retrieved from http://www.pewinternet.org/2013/08/27/broadband-and-smartphone-adoption-demographics/

Pew Research Internet Project. (2013). Tablet ownership. Retrieved from http://www.pewinternet.org/2013/06/10/tablet-ownership-2013/

Porter, G.W., King, J.A., Goodkin, N.F., & Chan, C.K. (2012). Experiential learning in a common core curriculum: Student expectations, evaluations, and the way forward. *International Education Studies*, *5*, 24–38.

Pugsley, K.E., & Clayton, L.H. (2003). Traditional lecture or experiential learning: Changing student attitudes. *Journal of Nursing Education*, *42*, 520–523.

Punie, Y. (2007). Learning spaces: An ICT enabled model of future learning in the knowledge based society. *European Journal of Education*, *42*(2), 185–199.
doi:10.1111/j.14653435.2007.00302.x

Radicati Group, *Mobile Statistics Report, 2014-2018*. Retrieved from
http://www.radicati.com/wp/wp-content/uploads/2014/01/Mobile-Statistics-Report-2014-2018-Executive-Summary.pdf

Reigeluth, C. (2012). Instructional theory and technology for a postindustrial world. In R.A. Reiser & J.V. Dempsey (Eds.) *Trends and Issues In Instructional Design and Technology* (3rd ed., pp. 75–83). Boston, MA: Pearson

Reinhart, J., Thomas, E., & Toriskie, J.M. (2011). K-12 teachers: Technology use and the second level digital divide. *Journal of Instructional Psychology*, *38*(4), 181–193.

Reitmeier, C.A. (2000). Active learning in the study of food. *Journal of Food Science Education*, *1*, 41-44.

Robinson, R. (2012). Experiential learning in a new millennium: The implications of iPad technology in instructional settings. In P. Resta (Ed.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2012* (pp. 1242–1248). Chesapeake, VA: AACE.

Rossatt, A., & Hoffman, B. (2012). Informal learning. In R.A. Reiser & J.V. Dempsey (Eds.) *Trends and Issues In Instructional Design and Technology* (3rd ed., pp. 169–178). Boston, MA: Pearson

Sagan, O. (2007). Playgrounds, studios and hiding places: Emotional exchange in creative learning spaces. *Art, Design & Communication In Higher Education*, *6*(3), 173–186.
doi:10.1386/adch.6.3.173_1

Savin-Baden, M. (2011). Curricula as spaces of interruption? *Innovations In Education & Teaching International*, *48*(2), 127-136. doi:10.1080/14703297.2011.564006

Schofield, C.P., West, T., & Taylor, E. (2011). *Going mobile in executive education: How mobile technologies are changing the executive learning landscape.* Retrieved from https://www.ashridge.org.uk/website/content.nsf/FileLibrary/C67FAE5265440F728025798000404608/$file/ABS_MobileLearning.pdf

Schrader, C., & Bastiaens, T. (2012). Learning in educational computer games for novices: The impact of support provision types on virtual presence, cognitive load, and learning outcomes. *International Review of Research In Open & Distance Learning*, *13*(3), 206–227.

Schrock, K. (2014a). *Evaluation of iPad Content Apps*. Retrieved from http://www.kathyschrock.net/uploads/3/9/2/2/392267/evalipad_content.pdf

Schrock, K. (2014b). *Evaluation of iPad creation apps*. Retrieved from http://www.kathyschrock.net/uploads/3/9/2/2/392267/evalipad_creation.pdf

Serafini, F., & Youngs, S. (2013). Reading workshop 2.0. *Reading Teacher*, *66*(5), 401–404.

Sharma, P.J., & Hannafin, M. J. (2007). Scaffolding in technology-enhanced learning environments. *Interactive Learning Environments*, *15*(1), 27–46.

Skiba, D.J. (2006). Think spots: Where are your learning spaces? *Nursing Education Perspectives, 27*(2), 103-104.

Temple, P. (2008). Learning spaces in higher education: an under-researched topic. *London Review of Education*, *6*(3), 229-241. doi:10.1080/14748460802489363

Tennant, M. (1997) *Psychology and adult learning* 2e. London: Routledge.

VanTassel-Baska, J. (2014). Performance-based assessment. *Gifted Child Today*, *37*(1), 41–47. doi:10.1177/1076217513509618

Wahlstedt, A., Pekkola, S., & Niemel, M. (2008). From e-learning space to e-learning place. *British Journal of Educational Technology*, *39*(6), 1020-1030. doi:10.1111/j.1467-8535.2008.00821_1.x

Wiggins, G., & McTighe, J. (1998). *Understanding by design*. Association for Supervision and Curriculum Development.

Wiggins, G., & McTighe, J. (2005). *Understanding by design* (2nd ed). Columbus, OH: Pearson/Merrill Prentice Hall.

Wysocki, J. (2009, August 27). *UBD in a nutshell*. Retrieved from http://prezi.com/k2j-lcgmgtzc/UBD-in-a-nutshell/

Yount, W. (2001). Experiential learning. In M. Anthony (Ed.), *Evangelical dictionary of Christian education* (pp. 276–277). Grand Rapids, MI: Baker Publishing.

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Appendix A – Productivity/ Creativity Apps Worksheet

Productivity/Creativity Apps

Name of App:_____
Instructions/Support: Yes No
Reported Grade Level_____
Type of app: productivity, creativity, other_____
Export Media_____
Opportunities for collaboration: Yes No
Developer:_____
Intended use: formal, informal, both
Cost:_____
Operating System:_____

	Meets Needs	Slightly Meets Needs	Does Not Meet Needs	Criteria not relevant	Comments
Relevance	The purpose of the app is relevant to the student and the instructional situation.	Limited connection between the purpose of the app and relevance to student learning.	The purpose of the app does not connect to instruction and is not relevant to students.		
Engagement	Students will be intellectually invested when using this app.	Some students might be engaged with this app.	Students will quickly lose interest.		
Utility	The app includes all the utilities and features necessary to create the desired end product.	Limited utilities and features. Students can create a basic end product.	Utilities and features are lacking. The end product that students can make is not desired.		
Usability	Students can easily manipulate the application without too many special gestures.	Special gestures are required.	It is not clear how to use the app.		
Export End Product	Student product is saved on app and can be exported to the teacher is a manner that is acceptable to the institution.	Student product is saved on app but can NOT be exported.	Student product is NOT saved on app and can NOT be exported to the teacher is a manner that is acceptable to the school.		
Unlimited student products	No limits on the number of end products students are able to make.	Reasonable limit on the number of end products.	Major limits.		

Summary of app/recommended alternatives:

Appendix B – Electronic Books Worksheet

Electronic Books

Name of Book:_____
Reported Grade Level_____ Media_____ Megabytes on device:_____
Instructions/Support: Yes No Developer:_____
Type of book: general reading, reference, textbook, other_____ Cost:_____
Intended use: formal, informal, both Operating System:_____

	Meets Needs	Slightly Meets Needs	Does Not Meet Needs	Criteria not relevant	Comments
Relevance/ Standards	The purpose of the book is relevant to the student and the instructional situation.	Limited connection between the purpose of the book and relevance to student learning.	The purpose of the book does not connect to instruction and is not relevant to students.		
Engagement	Students will be intellectually invested when using this app.	Some students might be engaged with this app.	Students will quickly lose interest.		
Usability	Students can easily manipulate the controls for the book.	Special gestures are required.	It is not clear how to manipulate the book.		
Annotations	Students can input many different types of annotations, highlight, notes, on page comments, etc.	Limited annotations.	No annotations.		
Tags	Students are able to tag specific pages.	Limited ability to tag pages.	No tagging.		
Index/TOC	Index and table of contents available.	Limited index or table of contents.	No index or table of contents.		
Search	Search feature available.		No search.		
Unlimited purchase	No limits on how long students have access to the book.	Reasonable limit on access to book.	Major limits.		
Multimedia	Multimedia extends content and contributes to learning.	Multimedia tangentially contributes to content.	No multimedia.		
Dictionary	Extensive dictionary.	Limited dictionary.	Minimal dictionary.		

Summary of book/recommended alternatives:

Appendix C – Subject Specific Apps Worksheet

Subject Specific Apps

Name of App:_____

Instructions/Support: Yes No
Reported Grade Level: _____
Type of app: general content, skill builder, simulation, other_____
Megabytes on device:_____
Username required: Yes No
Developer:_____
Opportunities for collaboration: Yes No
Cost:_____
Intended use: formal informal both
Operating System:_____

	Meets Needs	Slightly Meets Needs	Does Not Meet Needs	Criteria Not Relevant	Comments
Alignment to standards	App aligns to standards.	App is loosely tied to standards.	Not aligned to standards.		
Engaging	Students will be intellectually invested when using this app.	Some students might be engaged with this app.	Students will quickly lose interest.		
Usability	Students can easily manipulate the controls for the app.	Special gestures are required.	It is not clear how to manipulate the app.		
Students needs	This app meets an educational need of my students.	The app might meet the needs of some of my students.	Doesn't meet my students educational needs.		
Performance summary	Student specific performance summary or student product is saved on app and can be exported to the teacher in a manner that is acceptable to the school.	Student specific performance summary or student product is saved on app however data is not exportable.	Specific performance summary or student product is NOT saved on app and can NOT be exported to the teacher.		
Feedback	Specific feedback is provided to the student.	Student is provided basic feedback.	Limited feedback.		
Differentiation	App will meet the needs of all classroom groups, with multiple difficulty levels and multiple presentation styles.	App has more than one level of difficulty and/or information is presented in only one manner.	App has one level of difficulty and is presented in only one manner.		
Group or Individual	Teams of students or an individual can use this app.	Mainly intended for individual but may be ok with a group.	Only an individual can use this app.		

Summary of app/recommended alternatives:

Appendix D – Educational Game Apps Worksheet

Educational Games Apps

Name of App:_____
Instructions/Support: Yes No
Reported Grade Level_____
Type of game: skill builder, problem solving or strategy, simulation, other_____
Megabytes on device:_____
Username required: Yes No
Developer:_____
Opportunities for collaboration: Yes No
Cost:_____
Intended use: formal informal both
Operating System:_____

	Meets Needs	Slightly Meets Needs	Does Not Meet Needs	Criteria not relevant	Comments
Relevance	The purpose of the game is relevant to the student and the instructional situation.	Limited connection between the purpose of the game and relevance to student learning.	The purpose of the game does not connect to instruction and is not relevant to students.		
Feedback	Specific feedback is provided to the student.	Student is provided some feedback.	Limited feedback.		
Engagement	Students will be intellectually invested when using this game.	Some students might be engaged with this game.	Students will quickly lose interest.		
Usability	Students can easily manipulate the controls for the game.	Special gestures are required.	It is not clear how to manipulate the game.		
Replay varies	Game varies with replay.	Game is predictable when replayed.	Same game when replayed.		
Reporting	Summary data is electronically available to teacher.	Student briefly has access to summary data.	Summary data not available.		
Levels of difficulty	Wide range of difficulty that will engage ALL students in the class for a long period of time.	Some range. The game will be useful for some for some time.	Minimal range of difficulty app will not be used long.		
Thinking skills	Game encourages the use of higher order thinking skills.	Mostly lower order thinking skills.	Limited to the lower order thinking skills	Yes No	
Storyline	Game has a complex storyline with characters users care about.	Has a basic storyline.	No storyline.	Yes No	
Replicates real-world	Game replicates the real-world.	Some what realistic.	Game not realistic.	Yes No	

Summary of app/recommended alternatives:

Appendix E–M-Learning Quick Reference Questionnaire

M-Learning Quick Reference Instructional Design Questionnaire

Mobile Devices

- What mobile devices are available on your campus?
- What professional development opportunities or technology support is available on your campus?
- What mobile devices do your students own?
- What apps might you use in the activity you are designing?
- Why do you want to create an m-learning space?
- How does it facilitate students meeting the course learning objectives?
- What challenges have you identified regarding including mobile devices in your course planning? What can you do to address those challenges?

Educational Theories

- What do you want students to learn?
- What evidence will students submit to demonstrate their learning?
- How is experiential learning accomplished with the mobile devices and apps selected?
- How do the activity, device and app(s) engage various learning styles?

Assessing Tools and Ways to Assess

- Have you consulted what the experts report about specific devices and apps?
- Have you researched the devices and apps you are considering?
- Do you wish to use a productivity/creativity, e-book, subject specific or game app to accomplish the activity? Why this app?
- How much does the app cost?
- What device(s) does it support?
- Are there help features or tutorials?
- What kind of instruction and learning does it support? Formal or informal?

Infrastructure: Learning Spaces

- How does the classroom's physical space need to be configured for the activity?
- Does the activity require students to work independently, in groups, as pairs or as a class?
- Is Internet access available? Is wifi?

Mobile Technologies and Assessment of Student Learning

- Are formative or summative assessments being conducted with mobile devices?
- Will the assessments be performance-based, portfolio or objective instruments?
- How will you collect student evidence of learning or feedback about the instructional experience?
- Where will student assignments be stored?
- How will you provide feedback to students about the assignment or learning experience?