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).

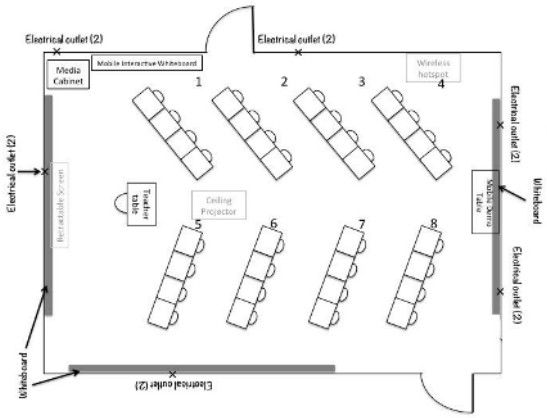

Figure 4.1. Whole class arrangement

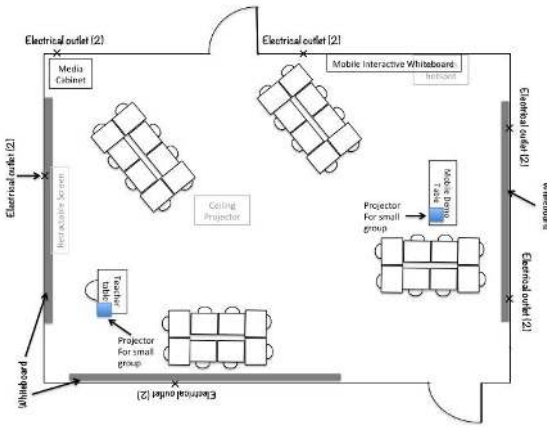

Figure 4.2. Small group arrangement

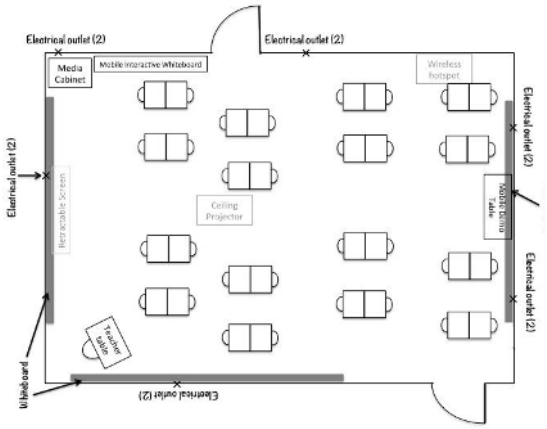

Figure 4.3. Pairs

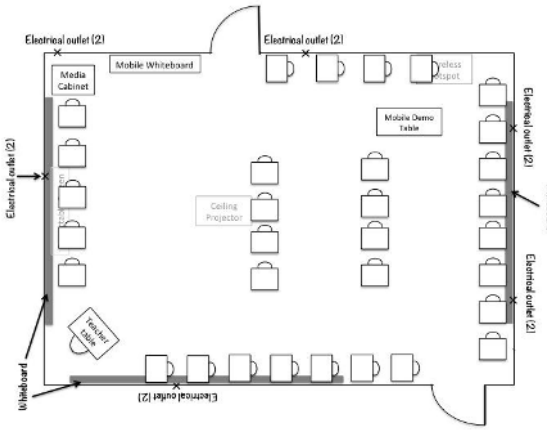

Figure 4.4. Individual

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?