Running Head: RESEARCH IN BLENDED LEARNING

The following is a draft version from a chapter soon to be printed in the Blended Learning: Research Perspectives II.

Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

Developing Models and Theory for Blended Learning Research

Charles R. Graham

Curtis R. Henrie

Andrew S. Gibbons

Brigham Young University

Contact:

Charles R. Graham

Department of Instructional Psychology & Technology

Brigham Young University

(801) 422-4110

charles.graham@byu.edu

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

Developing Models and Theory for Blended Learning Research

Charles R. Graham

Curtis R. Henrie

Andrew S. Gibbons

Brigham Young University

He who loves practice without theory is like the sailor who boards ship without a rudder and compass and never knows where he may cast.

Leonardo DaVinci

1. The Need for Blended Learning Models and Theory

Developing models and theory is essential to the knowledge creation process. Models and theory by their very nature attempt to establish a common language and focus for the activities that take place in a scholarly community (Dubin, 1976). Burkhardt and Schoenfeld (2003) claimed that a "reasonably stable theory base . . . allows for a clear focus on important issues and provides sound (though still limited) guidance for the design of improved solutions to important problems" (p. 6). Well-established scholarly domains have common terminology and widely accepted models and theories that guide inquiry and practice, while researchers in less mature domains struggle to define terms and establish relevant models.

Limited efforts have been made to understand the development and use of theory in the domain of blended learning research (Drysdale et al., 2013; Graham, 2013; Halverson, 2012). Blended learning research, though relatively new, is related to both educational technology research and distance education research (the former often focuses on contexts where teacher and learner are co-located and the latter on contexts where teacher and learner are separated in space

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

and time). For several decades educational technology as a field has struggled to find its theoretical roots (McDougall & Jones, 2006; Roblyer, 2005; Roblyer & Knezek, 2003). Most recently, a broad theoretical framework referred to as *technological pedagogical content knowledge* (TPACK) has gained some traction (Mishra & Koehler, 2006). Similarly some researchers in distance education have lamented the lack of research focus on theory (Moore, 2004). However, several prominent theories, such as transactional distance (Moore, 2013), community of inquiry (Garrison et al., 2000), interaction equivalency (Simonson et al., 1999), etc., are now driving the research questions and conversations.

This chapter does not seek to create new theory, but rather to understand and document the nature of the blended learning models and theories that are currently being developed through research. This synthesis will identify the strengths and limitations of the models and theories being developed and integrated in the blended learning research domain. This understanding can guide us in the selection and development of future models and theories.

2. Model and Theory Development in Design Fields

The definition of *model* and *theory* has been a source of debate. Some scholars have noted the interchangeable use of the terms (Dubin, 1976; Kaplan, 1964; Sutton & Staw, 1995; Whetten, 1989), while others have argued for clearer distinctions (Dickmeyer, 1989; Kaplan, 1964; Merton, 1967). We acknowledge that many researchers may prefer to use the term *model* because of the privileged status scientists associate with the term *theory*. This chapter will treat the terms *model* and *theory* as two ends of a continuum. Whetten (1989) made the case that good social science theory is built upon

- the ***what*** (variables/factors),
- the ***how*** (relationship between variables/factors),

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

- the ***why*** (underlying rationale justifying the what and how), and
- the ***who, where, when*** (context in which the theory is applicable).

The literature seems to agree that good theory creates an argument that clearly addresses the *why* undergirding the relationships it presents (Kaplan, 1964; Sutton & Staw, 1995; Whetten, 1989). Perhaps a distinction between what we feel comfortable calling a *model* vs. a *theory* lies in the strength of its argument (the *why*) and evidence supporting the claims (relationship between the *what* and *how*). As research data accumulate and arguments become more robust, researchers are more willing to refer to a model as a theory.

Educational research includes two major types of theory: technological (or design) and scientific. In *Sciences of the Artificial*, Herbert Simon (1999) distinguished between design fields (e.g., engineering, business, education, architecture, etc.) and the sciences, contrasting their processes for creating knowledge. While both design and science fields focus on systems (often the same systems), they try to solve different problems and generate different kinds of theory (Klir, 1969). Gibbons (2013) clarified by saying that "scientific theory is analytic—used to construct an understanding of the forces that drive natural and human-made phenomenon" while design theory produces "a body of synthetic principles which can be used to design, to plan, to prescribe, to devise, to invent, to create, and to otherwise channel natural forces for accomplishment of human purposes" (Chapter 6). In brief, "in [science] they are trying to understand *how and why* things happen, and in [technology, design] they are trying to discover *how to influence* things to happen" (Gibbons, 2013, Chapter 6, emphasis added).

In the domain of education, both Gibbons (2009, 2013) and Reigeluth (1999) have written extensively about the distinctive role of "instructional design theory" in informing both education practice and research. Interest has surged in design-based research that emphasizes

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

inquiry principles and processes consistent with the purposes of knowledge creation and theory building in design fields (Barab, 2006; Collins, 1992). Understanding the distinctions between scientific and design research is particularly important in education research domains because most of the design models and theories developed are poor matches for scientific theory but good matches for design theory (sometimes called *technological theory*) (Gibbons, 2003).

3. *Explore*, *Explain*, *Design*

Gibbons and Bunderson (2005) developed a taxonomy placing discussion of research and theories in perspective for design-related fields like education. They identified three important knowledge-producing enterprises: *explore*, *explain*, and *design*[1]. These three categories can be distinguished in terms of the questions for which answers are sought (see Table 2.1).

Table 2.1.
Descriptions of Three Types of Theory Used in Research.

Research-Enterprise	Model/Theory Description
Explore (scientific and technological)	· Answers "What exists?" · Defines · Categorizes
Explain (scientific)	· Answers "Why does this happen?" · Looks for causality and correlation · Works with variables and relationships between them
Design (technological)	· Answers "How do I achieve this outcome?" · Describes interventions for reaching targeted outcomes · Describes "operational principles" that make an intervention or design work

Gibbons and Bunderson (2005) noted that progress in each of the research areas contributes to further questions and research in the other areas. While *explain (*scientific)

[1] Because these words are used as specific terms labeling research, theory and models, yet are verbs that describe related actions, the labeling use is italicized throughout the chapter, and the generic use is in roman type.

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

research is commonly considered as necessarily preceding design (technological) research, there are many counter examples. For example, the Wright brothers built the first wind tunnel for experimenting with wing designs to create knowledge that Bernoulli's principle could not possibly supply (Vincenti, 1990). Similarly, a plethora of natural remedies (medicines) were developed in ancient cultures before scientists could explain their results.

3.1 *Explore*

Explore research seeks to define and categorize, identifying "what is there and what are possible groupings and relationships among what is there" (Gibbons & Bunderson, 2005, p. 927). With this kind of "natural history" research, Charles Darwin documented the similarities and differences in finches and other kinds of wildlife on the Galapagos Islands before developing a scientifically testable theory. Such research identifies patterns that become the foundation for questions in scientific inquiry (*explain*) or the basis for developing artifacts and processes (*design*), even though the underlying causal mechanisms may not be fully understood.

Figure 2.1 represents two common kinds of *explore* models: (1) attempts to define and distinguish a domain and (2) identification of dimensions that characterize types within a domain. Both models seek to identify factors that matter, emphasizing connections among the factors but not their influence on each other. In the domain of blended learning, *explore* models would (1) try to distinguish BL from other closely related domains and (2) try to characterize categories of blends within the domain.

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

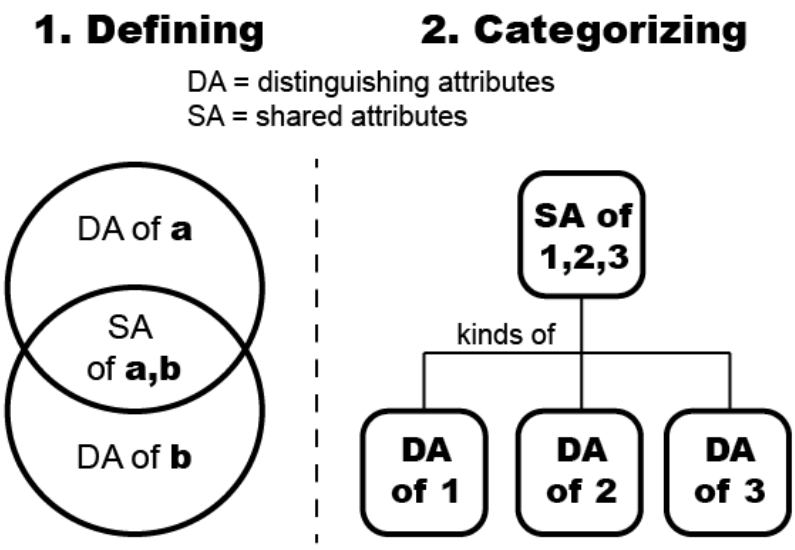

Figure 2.1. Visual representation of two kinds of *explore* models.

3.2 *Explain*

Explain research is often labeled *scientific research*; it seeks to "explain why and explain how," specifically through "experimental inquiry into cause" (Gibbons & Bunderson, 2005, pp. 927, 929). *Explain* theory articulates generalizable relationships between two or more variables, typically establishing the nature of the relationships through correlational or experimental research (see a simplified representation in Figure 2.2). Its purpose is to explain the relationship, not to identify interventions that might be designed to affect one of the variables. Typical variables explained by blended learning research include constructs such as satisfaction, academic performance, social presence, and sense of community. The example in Figure 2.3 illustrates with variables from the Community of Inquiry framework (Garrison et al., 2000). *Explain* theory might posit a positive correlation between cognitive presence, social presence, teaching presence, and student performance, explaining how these factors interrelate but not dealing with what characteristics of the intervention impact any variation in the factors.

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

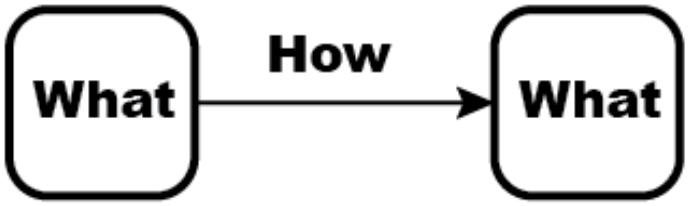

Figure 2.2 Simplified visual representation of the nature of *explain* models.

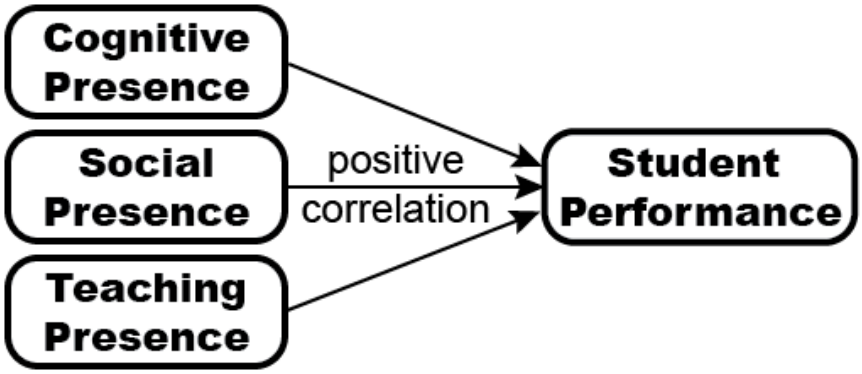

Figure 2.3 Simplified visual illustration of *explain* theory using the Community of Inquiry framework (Garrison & Vaughan, 2008)

3.3 Design

Design research describes intentional structuring of artifacts and intervention plans to increase the likelihood of particular outcomes (Gibbons & Bunderson, 2005). Design research differs from scientific research in that a target outcome is identified and interventions undergo experimentation and revision until that outcome is achieved.

Figure 2.4 is a simplified representation of *design* theory, which studies a combination of variables representing core attributes of an intervention that can be designed. Figure 2.5 demonstrates this theory using the practical inquiry model from the COI literature (Garrison & Vaughan, 2008). The model provides a specific process leading to the learning outcome of

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

developing problem solving abilities. This cyclical process begins with a triggering event, followed by exploration, integration, and resolution. Garrison and Vaughan outlined specific aspects of an intervention to create practical inquiry. For example, to create a triggering event they recommended a prereading assignment or activity on a specified topic or issue, followed by a self-assessment quiz, survey or discussion forum to help learners discover what they know. Similar interventions are proposed for exploration, integration, and resolution (see Garrison & Vaughan, 2008, Chap. 7). A design with the core attributes of practical inquiry could be tested by measuring how well it helps to achieve the desired learning outcomes. Previous *explore* research may have established the connection between practical inquiry and performance, and the purpose of the *design* research is to discover how to build an environment involving the integration of multiple variables that increases the chances that the desired outcomes will occur.

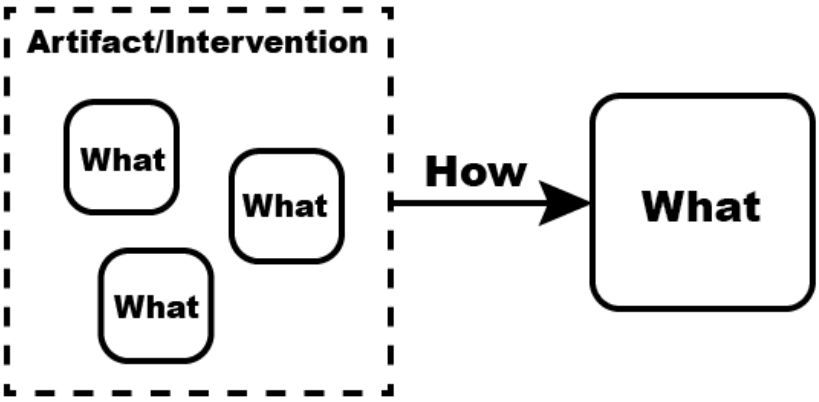

Figure 2.4 Simplified visual representation of instructional *design* models.

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

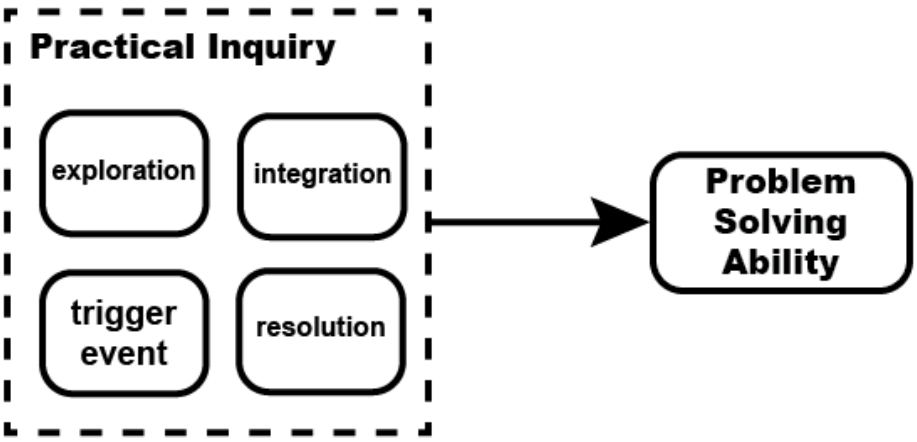

Figure 2.5 Simplified visual illustration of an instructional *design* model using the "practical inquiry model" (Garrison & Vaughan, 2008).

Design models and theory establish the core attributes of a specific design, what Gibbons (2013) referred to as the design's operational principles: what makes it work. Unlike experimental research, all variables do not need to be held constant in order to vary only one. The desired design outcome is typically understood, and one or more dimensions of the design are changed to impact the outcome. Reigeluth (1999) further elaborated that an important characteristic of instructional design theories is that they are design oriented (or goal oriented), in contrast to what most people consider to be scientific theories with deterministic cause/effect relationships. Instructional design theories specify effects resulting from flows of events in natural processes, which are almost always probabilistic (the cause increases the chances of the stated effect rather than always resulting in the stated effect).

Figures 2.6-2.8 represent three common patterns for *design* research (sometimes referred to as *design-based* research) in which the unit of analysis is the design. Figure 2.6 represents research focused on how an intervention (with a set of clearly identified core attributes) achieves a desired outcome. Figure 2.7 shows how one design might be compared to another design

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

employing a different integration of variables. Figure 2.8 shows how one design might be changed over time and compared to previous design iterations.

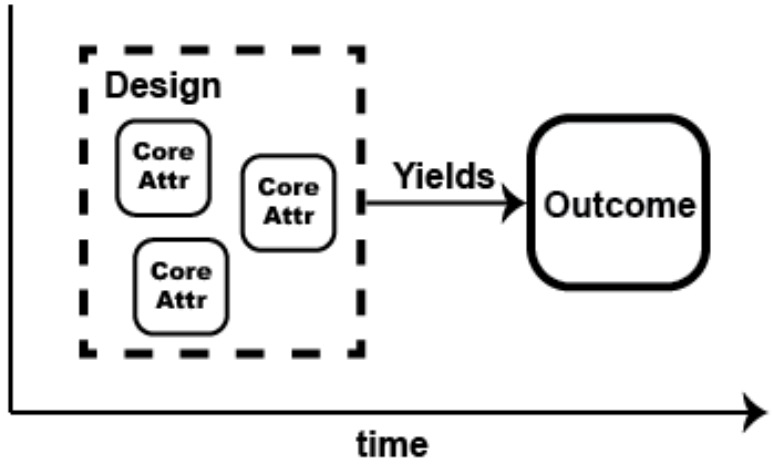

Figure 2.6 Visual representation of design research that measures the outcome of a particular design.

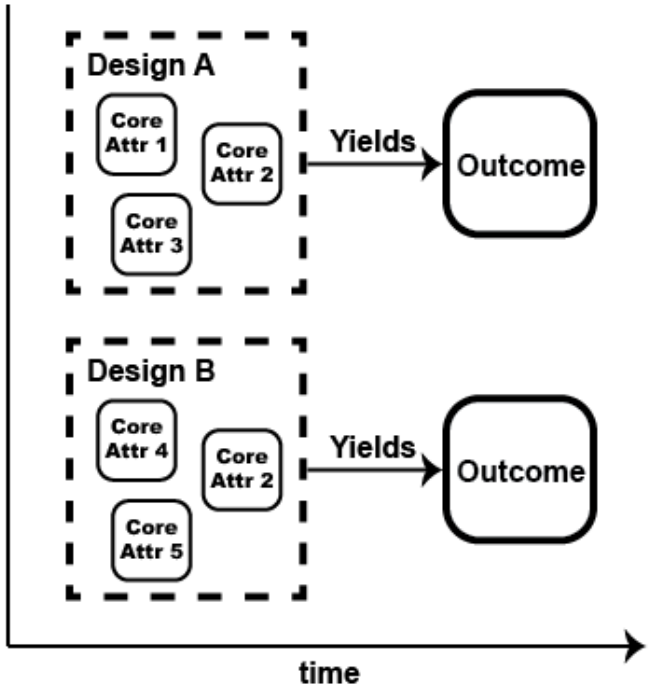

Figure 2.7 Visual representation of design research that compares two different designs.

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

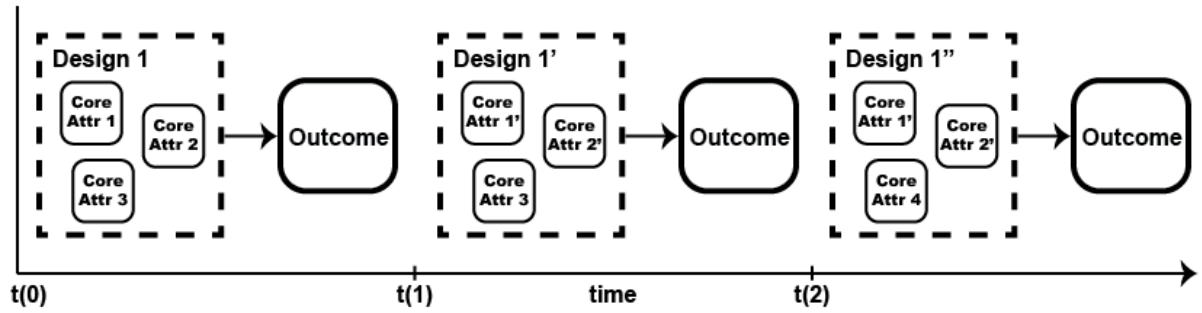

Figure 2.8 Visual representation of design research that compares iterations of a design over time.

4. *Explore*, *Explain*, and *Design* in BL Research

In several previous articles, we have sought to understand what models and theoretical frameworks are driving the research in blended learning (Drysdale et al., 2013; Graham, 2013; Halverson et al., 2012). The outcomes of this previous work have primarily pointed to the need for a more robust description and analysis of model and theory development in the blended learning domain. This section uses the *explore*, *explain*, *design* framework to characterize the current state of blended learning model and theory development.

4.1 *Explore* Models of Blended Learning

Much of the early research in blended learning has been concerned with exploring and defining the phenomenon of blended learning. Picciano (this volume) described a historical perspective on this process within the Sloan Consortium. Many researchers have observed blended learning and created models attempting to show how blended learning is distinct from both distance education and traditional classroom learning. Exploring the boundaries of a domain as well as classifications within a domain is the core of *explore* research. The models that result from this research typically (1) define what blended learning is and isn't and/or (2) provide categories of different kinds of blends.

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

4.1.1 Definitional models.

Early models began trying to define the contours of blended learning by answering the question "What is being blended?" in three competing ways (Graham, 2006, p. 4):

- Combining online and face-to-face instruction (Reay, 2001; Rooney, 2003; Sands, 2002; Ward & LaBranche, 2003; Young, 2002)
- Combining instructional modalities (or delivery media) (Bersin & Associates, 2003; Orey, 2002a, 2002b; Singh & Reed, 2001; Thomson, 2002)
- Combining instructional methods (Driscoll, 2002; Rossett, 2002)

Models adopting the first definition are the most prominent in the research, with the second definition maintaining some prominence in corporations, and the third definition rarely being used. Efforts to refine the first definition argued for reduced seat time or a certain percentage of online instruction as defining characteristics (see Graham, 2012 for a detailed analysis). For example, Picciano's (2009) definition required that "a portion (institutionally defined) of face-to-face time [be] replaced by online activity" (p. 10), while Allen and Seaman's (2007) designation identified four categories: (1) traditional as having 0% of content delivered online, (2) web facilitated as 1%-29% online, (3) blended as 30%-79% online, and (4) online as 80% or more online. Other definitions included quality descriptors such as "the *thoughtful integration* of classroom face-to-face learning experiences with online learning experiences" (Garrison & Kanuka, 2004, p. 96, emphasis added) or "courses that integrate online with traditional face-to-face class activities *in a planned, pedagogically valuable manner*" (Picciano, 2006, p. 97, emphasis added).

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

4.1.2 Model categories.

A second category of *explore* research models seeks to characterize categories of blended learning. Early work by Graham (2006) distinguished between blends at the activity, course, program, and institutional levels. Models began to emerge that identified different kinds of blended learning in terms of pedagogical rather than just physical characteristics: for example, physical and pedagogical dimensions identified by Sharpe, Benfield, Roberts, & Francis (2006). Additionally, Graham & Robison (2007) developed a model using scope, purpose, and the nature of pedagogical interventions to distinguish transforming, enhancing, and enabling blends found at a university. Other researchers developed more specific models distinguishing between types of blended learning based on both the physical and pedagogical structuring of the blended learning environment. Some of the most prominent models in the categories of higher education, K-12 education, and corporate training are outlined in Table 2.2.

Table 2.2.
Examples of Categories of Blended Learning Models.

A. Higher Education Twigg (2003)	**B. K-12 Education** Staker & Horn (2012)	**C. Corporate Training** Rossett & Frazee (2006)
A.1 Supplemental • Supplemental online materials • Online quizzes • Additional online activities • Flexibility of online activities for computer lab or home **A.2 Replacement** • Reduction of in-class meeting time • Replacement of face-to-	**B.1 Rotation** • Rotation among learning modalities, at least one of which is online • ***Station Rotation--***rotations within a classroom • ***Lab Rotation***—rotations within locations on a school campus • ***Flipped Classroom***—rotation within a given course or subject including online remote (at home) • ***Individual Rotation—*** individually tailored rotation	**C.1 Anchor Blend** • Introductory substantive face-to-face (F2F) classroom experience • Subsequent independent online experiences **C.2 Bookend Blend** • Introductory experience online or F2F • A substantive learning experience online or F2F • A conclusion that extends the learning into practice

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

face class time with online activities
- Flexibility of online activities for computer lab or home

A.3 Emporium

- Elimination of class meetings
- Substitution of a learning resource center with online materials and on-demand personal assistance

A.4 Buffet

- Several learning options from which students choose

schedule for a course or subject

B.2 Flex

- Instruction primarily online in a classroom with customized F2F support when needed

B.3 Self-Blend

- Option of an entirely online course to supplement traditional courses

B.4 Enriched Virtual

- School experience mostly online with some on-campus enrichment

at work

C.3 Field Blend

- A range of instructional assets
- Choice of when and where to use the assets as needed to meet work-related challenges
- Availability of online instructional assets
- A possible classroom experience as part of the mix

Each model represents patterns that the researchers observed in practice. Descriptions are provided of features that distinguish the kinds of blends but do not prescribe design guidance for when and how the blends should be implemented or explain why specific models work under certain conditions.

4.1.3 Discussion of BL *explore* models and theories.

One pattern we noticed among *explore* models is that most focus on surface features (physical structuring) of BL systems as opposed to the pedagogical structuring. Early definitions focused on delivery media or physical environment (i.e., face-to-face versus online). Models that have identified categories of blends have also focused heavily on surface structure. With few exceptions, the defining characteristics of the blends listed in Table 2.2 are not pedagogical, but focus on the *when*, *where* and *who* of the instructional delivery. Some models (like the flipped classroom) may imply a particular kind of pedagogy (e.g., individual feedback, lecture,

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

collaboration, etc.), but do not impose pedagogy or quality criteria. Staker & Horn (2012) explained, "[the models] set forth basic patterns that are emerging, but avoid setting tight parameters about how a model 'has to be'" (p.1).

4.2 *Explain* Theory for Blended Learning

Explain theory articulates variables and relationships among variables (see Section 3.2 and Figure 2.2), seeking to understand these relationships, *not* to design an intervention that produces one of them. We reviewed dozens of studies, including the 50 most cited blended learning articles (Halverson et al., 2012), to try and understand how *explain* theory was being used in blended learning research. We found three basic patterns: (1) mention of theory, (2) application of theory, and (3) development of theory. Table 2.3 highlights examples of each.

Table 2.3.
Examples of Explain *Research in the Blended Learning Literature.*

Use of *Explain* Theory	Examples
Mention of Theory The research mentions a theoretical framing as part of a literature review or an argument for implementing or studying blended learning, but does not attempt to apply or confirm the theory.	Oliver and Trigwell (2005): Variation theory is offered as rationale for continued research and interest in blended learning. Variation theory states that learning occurs when variation is perceived. Authors hypothesize that blended learning has proved successful because of its ability to create and distinguish variation in what is to be learned. Mortera-Gutiérrez (2006): The author states that social presence theory, media richness theory, and media synchronicity theory have the potential to explain outcomes and phenomena of interest in blended learning.
Application of Theory The research uses the variables and relationships proposed in the study to frame the collected and analyzed inquiry data as part of the inquiry, but	Lynch and Dembo (2004): Previous research indicated that self-regulation was important to learner success in distance learning. The authors looked for correlations between student performance and motivation, internet self-efficacy, time management, study environment management, and learning assistance management to understand role of self-regulation in learner success in a blended learning environment.

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

does not seek to challenge or build on the theory.	Ginns and Ellis (2007): The authors sought to better understand the correlational relationships between student perceptions of the online learning experience, student approaches to learning, and student grades in a blended learning environment. Previous research validated the relationship between student perceptions of learning experience, student approaches to learning, and the quality of the learning experience.
Development of Theory The research proposes a new theory or seeks to challenge, change, or build on current theory.	Klein, Noe, and Wang (2006): Authors built on training motivation theory and the input-output process model of learning to examine correlations between motivation and learning outcomes, and correlations between learning goal orientation, perceived barriers/ enablers, and delivery mode and motivation. So & Brush (2008): Research in distance education calls for closer attention to factors affecting psychological distance. To do so, the study examined correlational relationships among perceived levels of collaboration, social presence, and student satisfaction—variables synthesized from different theories that have been identified as important to understanding psychological distance.

Sometimes researchers would only briefly explain theoretical frameworks to provide background for the research or establish an argument for their blended approach. Another common use was in identifying variables to study, including

- social, teaching, and cognitive presence from the Community of Inquiry (Akyol, Vaughan, & Garrison, 2011;Vaughan & Garrison, 2005);
- satisfaction, learning effectiveness, cost effectiveness, etc. from the Sloan-C Pillars (Lorenzo & Moore, 2002); and
- sense of community (Barnard-Brak & Shiu, 2010; Rovai & Jordan, 2004).

Often the implied research contribution was application of theory to a new context (blended learning) in order to show its utility in that setting. Rarely was the research intended to

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

disconfirm or challenge a theory or the assumptions within a theory. In discussing what makes a theoretical contribution, Whetten (1989) stated that "applying an old model to a new setting and showing that it works as expected is not instructive by itself" (p. 493). He elaborated, "Theorists need to learn something new about the theory itself as a result of working with it under different conditions. That is, new applications should improve the tool, not merely reaffirm its utility" (Whetten, 1989, p. 493). In summary, while theoretical frameworks were often mentioned or even tested in *explain* research, studies that sought to develop specific aspects of a theory were uncommon.

4.3 *Design* Models for Blended Learning

Design models designate target outcomes and indicate core attributes of a design that affect or bring about those outcomes (see Section 3.2 and Figure 2.4). The purpose of design models is to show how to manipulate an intervention to achieve a desired result. After reviewing the design research in blended learning, including the 50 most cited blended learning articles (Halverson et al., 2012), we identified three patterns: (1) model articulation, (2) model comparison, and (3) model iteration. Table 2.4 describes examples.

Table 2.4.
Examples of Design *Research in the Blended Learning Literature.*

Use of Design Models/Theory	Example(s)
Model Articulation This research clearly articulates a BL model and the outcomes the model should achieve (see Figure 2.6).	Beatty (2013) described the HyFlex model, which was developed to provide greater flexibility to students in class participation options and course selection. To achieve the desired flexibility, Beatty identified four core attributes the course design should include: alternative participation modes, equivalency in activities, reuse of learning objects or artifacts between modalities, and accessibility to technology and participation modes.

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

	Picciano (2009) developed the Blending with Purpose Multimodal Model. The outcome of the model is a design that can reach a variety of students and learning needs. The core attributes of the model are six pedagogical objectives for which to consider blending modalities: content, student social and emotional support, dialectic/questioning activities, reflection, collaboration, and synthesis/evaluation/assessment.
Model Comparison This research compares a BL model to either a different type of BL or a non-BL model (see Figure 2.7).	Many studies compared course models distinguished by modality (blended, online, or face-to-face) on outcome measures of student performance or student satisfaction (Brown & Liedholm, 2002; Rivera & McAlister, 2002; Tuckman, 2002; Utts, Sommer, Acredolo, Maher, & Matthews, 2003). Hoxie, Stillman, & Chesal (2013, this volume) compared Rotation and Flex blended learning models in middle and high schools in a New York City school district. The authors examined differences in teacher and student experiences, noting the impact of model type on teacher practice and on student motivation, satisfaction, and learning.
Model Iteration This research articulates a BL model intended to achieve particular outcomes and systematically tested and improved over time (see Figure 2.8).	Power (2008) explained the Blended Online Learning model, developed over the course of several years as university faculty and designers worked together in developing online humanities courses. Over the course of iterations, the model progressed from a largely asynchronous distance education model to a blend of asynchronous and synchronous design and delivery.

Much of the *design* research was comprised of comparison studies attempting to test the effectiveness of a blended course design or activity against a face-to-face or online counterpart. We noted a definite need for iterative *design* research, but few studies reported on iterations and subsequent model development. This type of research can lead to identification of core attributes that influence the desired outcomes of models, which can then be tested and better understood through *explain* research. Two limitations of many of the BL *design* studies were (1) that core

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

attributes of the interventions affecting student performance or student satisfaction were neither well known nor clearly articulated and (2) that identified differences in models typically focused on physical aspects of the course (e.g., online vs. face-to-face activities).

4.3.1 Articulation of core attributes.

Commonly, qualitative case study research describes a particular design in great detail, which, although worthwhile, does not fill the *design* model role. *Design* models provide prescriptive guidance about what a design should be in order to increase the probability of achieving a desired outcome. For *design* research to be effective, researchers must clearly identify the core attributes that they postulate are making the design work along with the situational characteristics/constraints that define the context in which the design functions. Without these details, other researchers cannot test and build on assumptions and hypotheses that are part of *design* models. Additionally, the models become less useful to practitioners who are looking for guidance as they make decisions about their own BL implementations.

4.3.2 Surface features.

A prominent feature of much of the *design* research to date has been a focus on surface features, or physical attributes (e.g., online, face-to-face), of the design without articulating clearly the core pedagogical attributes. This emphasis is one of the reasons the meta-analysis commissioned by the U.S. Department of Education (Means et al., 2010) found statistically significant differences between blended, online, and traditional classrooms but was not able to identify factors leading to these findings. Such results are comparable to saying that generally "compact cars" get better gas mileage than "trucks," a claim that does not identify the core attributes that make compact cars more fuel efficient--the weight, shape, or engine size of the vehicle. Significant progress in BL research requires us to "look under the hood" and identify

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

core pedagogical attributes of our BL systems and not maintain focus entirely on the physical attributes of the systems.

4.3.3 Design layers.

Gibbons and Rogers (2009) described a theory of design layers, which posits that instructional designs contain common elements or layers and that within each layer is a body of knowledge (and theory) applied to the layer's construction and operation. We consider this an important idea for the future of *design* research in the BL domain. While Gibbons and Rogers (2009) defined seven different design layers they considered important to instructional design, we simplify the concept to focus on just two: the *pedagogical layer* (what Gibbons calls the "strategy layer") and the *physical layer* (a merging of Gibbons' "representation layer" and others). The physical layer is the presentation or delivery of instruction, while the pedagogical layer is the strategy that enables learning to take place. We believe aspects of the physical layer can impact the availability and effectiveness of the pedagogical layer. Figure 2.9 illustrates the interplay between these two layers.

The prominent focus on the physical layer in BL *design* research and models can highlight differences in access and cost effectiveness, but tells little about the pedagogical attributes that actually influence learning outcomes and can lead to many of the problems inherent in media studies (Clark, 1983; Kozma, 1991). Greater attention needs to be given to identifying the core attributes in the pedagogical layer of the design that lead to the learning outcomes of interest as well as to understanding how attributes in different design layers compliment each other and work together.

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

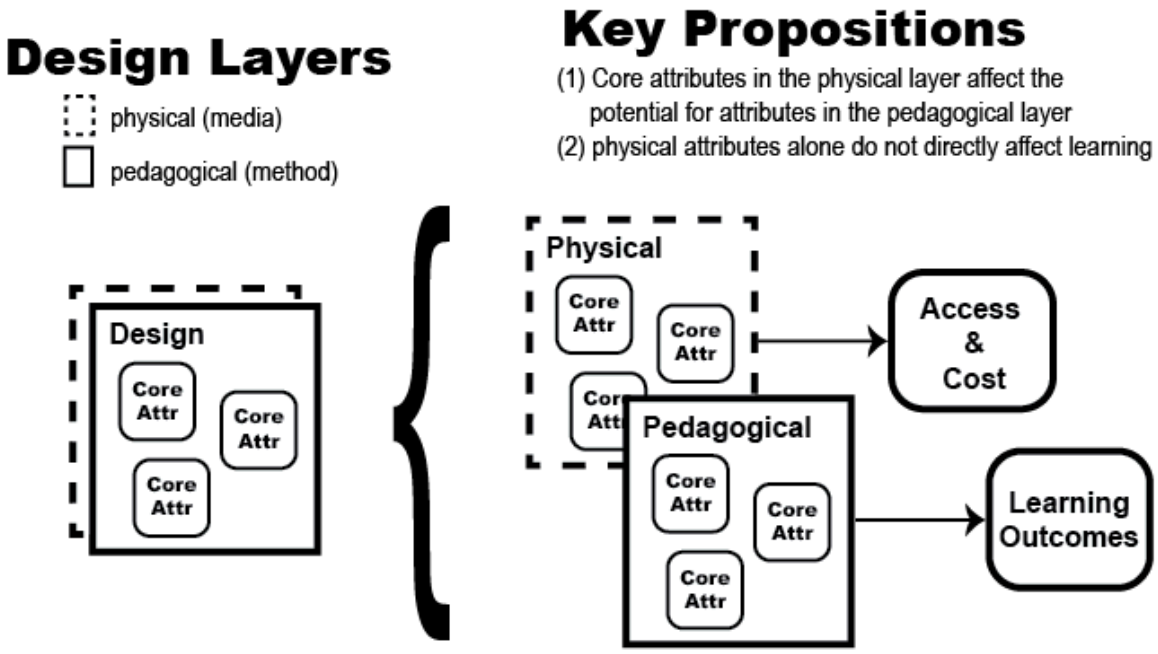

Figure 2.9 Visual representation of two potential design layers. BL design models/theory need to specify more than core attributes in the physical layer.

5. Conclusion

In this chapter we highlighted three distinct types of models/theory used in BL research: *explore*, *explain*, and *design*. We also identified some patterns suggesting ways to strengthen the models and theories being developed in the BL domain. First, many of the models and theories have not articulated clearly the core attributes, relationships and rationale behind their selection and organization. In their critique of educational theories, Burkhardt and Shoenfeld (2003) commented,

> Most of the theories that have been applied to education are quite broad. They lack what might be called "engineering power." To put it a different way, they lack the specificity that helps to guide design, to take good ideas and make sure that they work in practice. (p. 10)

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

Models and theories need to articulate more clearly and specifically the core building blocks of good theory in the social sciences identified by Whetten (1989) and recognize that they may exist within different layers of the design. (See Section 2 of this chapter.)

Second, the heavy focus in existing models on physical or surface-level characteristics rather than pedagogical or psychological characteristics is impeding progress. Distance education research was able to make significant theoretical progress when it moved its focus beyond the physical layer to the psychological layer. Moore (2013) accomplished this by proposing that the essential research construct was not physical separation, but *transactional* (or psychological) distance between the instructor and the learner, which could be defined in terms of a relationship between dialog and structure and related to other psychological concepts such as autonomy. BL models and theories need to make the same transition. We believe that the concept of design layers is a powerful approach to this problem, as it allows BL models to specify the connection between physical and pedagogical layers of a design (see Section 4.3.3 in this chapter).

Third, our examination of research specific to BL identified a solid number of *explore* models, a very limited focus on *explain* models/theories, and an increasing number of *design* models (though many lacked appropriate specificity). We did not commonly find explicit development and improvement of the models/theories across multiple studies and/or between different researchers; more commonly, models were proposed or used only once. This may be because research in the blended learning domain is relatively new or because the limited specificity of the models does not enable meaningful replication across contexts. We believe that increased attention on theory development can help to focus the discourse happening in the BL research community as well as strengthen BL practice.

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

Finally, we challenge BL researchers to critically analyze their own models and theories to determine if they are clearly and sufficiently identifying the core building blocks of good theory identified by Whetten (1989) (see Section 2 of this chapter.). We also encourage researchers to engage in more theory building, which includes systematically exploring, testing, and adjusting models and theory over time as well as seeking to develop models and theories that have wide appeal and applicability beyond a single classroom or institution.

References

Akyol, Z., Vaughan, N., & Garrison, D. R. (2011). The impact of course duration on the development of a community of inquiry. *Interactive Learning Environments*, *19*(3), 231–246. doi:10.1080/10494820902809147

Allen, I. E., & Seaman, J. (2007). *Online nation: Five years of growth in online learning*. Needham, MA: Sloan Consortium.

Barab, S. (2006). Design-based research: A methodological toolkit for the learning scientist. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 153-169). New York, NY: Cambridge University Press.

Barnard-Brak, L., & Shiu, W. (2010). Classroom community scale in the blended learning environment: A psychometric review. *International Journal on E-Learning*, *9*(3), 303–311.

Beatty, B. J. (2014, in press). Hybrid courses with flexible participation – the HyFlex course design. In L. Kyei-Blankson and E. Ntuli (Eds.) *Blended Learning Environments: Experiences in K-20 Education*. Hershey, PA:IGI Global.

Bersin, J. (2003). *Blended learning: What works: An industry study of the business impact of*

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

blended learning. Learning. Retrieved from http://www.bersin.com/Practice/Detail.aspx?docid=5870

Brown, B. W., & Liedholm, C. E. (2002). Can web courses replace the classroom in Principles of Microeconomics? *The American Economic Review*, *92*(2), 444–448. doi:10.1257/000282802320191778

Burkhardt, H., & Schoenfeld, A. H. (2003). Improving educational research: Toward a more useful, more influential, and better-funded enterprise. *Educational Researcher*, *32*(9), 3–14. doi:10.3102/0013189X032009003

Clark, R. E. (1983). Reconsidering Research on Learning from Media. *Review of Educational Research*, 53(4), 445-459.

Collins, A. (1992). Towards a design science of education. In E. Scanlon & T. O'Shea (Eds.), *New directions in educational technology* (pp. 15-22). Berlin: Springer-Verlag.

Dickmeyer, N. (1989). Metaphor, model, and theory in education research. *Teachers College Record*, *91*(2), 151–160.

Driscoll, M. (2002, March 1). Blended learning: Let's get beyond the hype. *e-learning*. Retrieved from http://www.ltimagazine.com/ltimagazine/article/articleDetail.jsp?id=11755

Drysdale, J. S., Graham, C. R., Spring, K. A., & Halverson, L. (2013). An analysis of research trends in dissertations and theses studying blended learning. *The Internet and Higher Education, 17*, 90–100. doi:10.1016/j.iheduc.2012.11.003

Dubin, R. (1976). Theory building in applied areas. In M. D. Dunnette (Ed.), *Handbook of industrial and organizational psychology* (pp. 17–39). Chicago, IL: Rand McNally College Publishing Company.

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *Internet and Higher Education*, *2*(2-3), 87–105.

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The Internet and Higher Education*, *7*(2), 95–105. doi:10.1016/j.iheduc.2004.02.001

Garrison, D. R., & Vaughan, N. D. (2008). *Blended learning in higher education: Framework, principles, and guidelines*. San Francisco, CA: Jossey-Bass.

Gibbons, A. S. (2003). The practice of instructional technology: Science and technology. *Educational technology*, *43*(5), 11–16.

Gibbons, A. S. (2013, in press). An architectural approach to instructional design. New York, NY: Routledge.

Gibbons, A. S., & Bunderson, C. V. (2005). Explore, explain, design. In K. K. Leondard (Ed.), *Encyclopedia of Social Measurement* (pp. 927–938). New York, NY: Elsevier.

Gibbons, A. S., & Rogers, P. C. (2009). The architecture of instructional theory. In C. M. Reigeluth & A. Carr-Chellman (Eds.), *Instructional-Design Theories and Models,* (Vol. III, p. 305-326). Mahwah, NJ: Lawrence Earlbaum Associates.

Ginns, P., & Ellis, R. (2007). Quality in blended learning: Exploring the relationships between on-line and face-to-face teaching and learning. *The Internet and Higher Education*, *10*(1), 53–64. doi:10.1016/j.iheduc.2006.10.003

Graham, C. R. (2006). Blended learning systems: Definition, current trends, and future directions. In C. J. Bonk & C. R. Graham (Eds.), *The handbook of blended learning: Global perspectives, local designs* (pp. 3–21). San Francisco, CA: Pfeiffer Publishing.

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

Graham, C. R. (2013). Emerging practice and research in blended learning. In M. G. Moore (Ed.), *Handbook of Distance Education* (3rd ed. pp. 333–350). New York, NY: Routledge.

Graham, C. R., & Robison, R. (2007). Realizing the transformational potential of blended learning: Comparing cases of transforming blends and enhancing blends in higher education. In A. G. Picciano & C. D. Dziuban (Eds.), *Blended learning: Research perspectives* (pp. 83–110). Needham, MA: The Sloan Consortium.

Halverson, L. R., Graham, C. R., Spring, K. J., & Drysdale, J. S. (2012). An analysis of high impact scholarship and publication trends in blended learning. *Distance Education, 33*(3), 381–413. doi:10.1080/01587919.2012.723166

Hoxie, Stillman, and Chesal (this volume).

Kaplan, A. (1964). *The conduct of inquiry: Methodology for behavioral science*. Philadelphia, PA: Chandler Publishing Company.

Klein, H. J., Noe, R. A., & Wang, C. (2006). Motivation to learn and course outcomes: The impact of delivery mode, learning goal orientation, and perceived barriers and enablers. *Personnel Psychology*, *59*(3), 665–702. doi:10.1111/j.1744-6570.2006.00050.x

Klir, G. J. (1969). *An approach to general systems theory*. New York, NY: Van Nostrand Reinhold Company.

Kozma, R. (1991). Learning with media. *Review of Educational Research*, *61*(2), 179-211.

Lorenzo, G., & Moore, J. C. (2002). The Sloan Consortium report to the nation: Five pillars of quality online education. Retrieved from http://www.sloan-c.org/effective/pillarreport1.pdf

Lynch, R., & Dembo, M. (2004). Online learning in a blended learning context. *International*

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

Review of Research in Open and Distance Learning, Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/189/271

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2010). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies*. Washington D.C.: U.S. Department of Education. Retrieved from http://www2.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf

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

Moore, M. G. (2004). Research worth publishing (editorial). *American Journal of Distance Education*, *18*(3), 127–130.

Moore, M. G. (2013). The theory of transactional distance. In M. G. Moore (Ed.), *Handbook of distance education* (3rd ed., pp. 66–85). Mahwah, NJ: Lawrence Earlbaum Associates.

Mortera-Gutiérrez, F. (2006). Faculty best practices using blended learning in e-learning and face-to-face instruction. *E-learning*, *5*(3), 313–337.

McDougall, A., & Jones, A. (2006). Theory and history, questions and methodology: Current and future issues in research into ICT in education. *Technology, Pedagogy and Education*, *15*(3), 353–360. doi:10.1080/14759390600923915

Merton, R. K. (1967). *On theoretical sociology: Five essays, old and new*. New York, NY: Free Press.

Oliver, M., & Trigwell, K. (2005). Can "blended learning" be redeemed? *E-Learning*, *2*(1), 17–26. doi:10.2304/elea.2005.2.1.2

Orey, M. (2002a). *Definition of blended learning*. University of Georgia. Retrieved from http://www.arches.uga.edu/~mikeorey/blendedLearning

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

Orey, M. (2002b). *One year of online blended learning: Lessons learned*. Paper presented at the Annual Meeting of the Eastern Educational Research Association, Sarasota, FL.

Picciano, A. G. (2006). Blended learning: Implications for growth and access. *Journal of Asynchronous Learning Networks*, *10*(3), 95–102.

Picciano, A. G. (2009). Blending with purpose: The mutimodal model. *Journal of Asynchronous Learning Networks*, *13*(1), 7–18.

Picciano (this volume).

Power, M. (2008). The emergence of a blended online learning environment. *MERLOT Journal of Online Learning and Teaching*, *4*(4), 503–514.

Reay, J. (2001). Blended learning--a fusion for the future. *Knowledge Management Review*, *4*(3), 6.

Reigeluth, C. M. (1999). *Instructional-design theories and models: A new paradigm of instructional theory* (Vol. 2). Mahwah, NJ: Lawrence Erlbaum.

Riffell, S., & Sibley, D. (2005). Using web-based instruction to improve large undergraduate biology courses: An evaluation of a hybrid course format. *Computers & Education*, *44*(3), 217–235. doi:10.1016/j.compedu.2004.01.005

Rivera, J. C., McAlister, M. K., & Rice, M. L. (2002). A comparison of student outcomes & satisfaction between traditional & web based course offerings. *Online Journal of Distance Learning Administration*, *5*(3). Retrieved from http://www.westga.edu/~distance/ojdla/fall53/rivera53.html

Roblyer, M. D. (2005). Educational technology research that makes a difference: Series introduction. *Contemporary Issues in Technology and Teacher Education*, *5*(2), 192–201.

Roblyer, M. D., & Knezek, G. (2003). New millennium research for educational technology: A

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

call for a national research agenda. *Journal of Research on Technology in Education*, *36*(1), 60–71.

Rooney, J. E. (2003). Knowledge infusion: Blending learning opportunities to enhance educational programming and meetings. *Association Management*, *55*(6), 26–32.

Rossett, A. (2002). *The ASTD e-learning handbook*. New York, NY: McGraw-Hill.

Rossett, A., & Frazee, R. V. (2006). *Blended learning opportunities*. American Management Association. Retrieved from http://www.grossmont.edu/don.dean/pkms_ddean/ET795A/WhitePaper_BlendLearn.pdf

Rovai, A. P., & Jordan, H. M. (2004). Blended learning and sense of community: A comparative analysis with traditional and fully online graduate courses. *International Review of Research in Open and Distance Learning*, *5*(2). Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/192/274

Sands, P. (2002). Inside outside, upside downside: Strategies for connecting online and face-to-face instruction in hybrid courses. *Teaching with Technology Today*, *8*(6). Retrieved from http://www.uwsa.edu/ttt/articles/sands2.htm

Sharpe, R., Benfield, G., Roberts, G., & Francis, R. (2006). *The undergraduate experience of blended e-learning: A review of UK literature and practice*. York, UK: The Higher Education Academy. Retrieved from http://www.heacademy.ac.uk/resources/detail/Teachingandresearch/Undergraduate_Experience

Simon, H. A. (1999). *The sciences of the artificial* (3rd ed.). Cambridge, MA: MIT Press.

Simonson, M., Schlosser, C., & Hanson, D. (1999). Theory and distance education: A new discussion. *American Journal of Distance Education*, *13*(1), 60–75.

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

Singh, H., & Reed, C. (2001). *A white paper: Achieving success with blended learning*. Centra Software. Retrieved from http://www.centra.com/download/whitepapers/blendedlearning.pdf

So, H., & Brush, T. (2008). Student perceptions of collaborative learning, social presence and satisfaction in a blended learning environment: Relationships and critical factors. *Computers & Education*, *51*(1), 318–336. doi:10.1016/j.compedu.2007.05.009

Staker, H., & Horn, M. B. (2012). *Classifying K-12 blended learning*. Innosight Institute, Inc. Retrieved from http://www.innosightinstitute.org/innosight/wp-content/uploads/2012/05/Classifying-K-12-blended-learning2.pdf

Sutton, R., & Staw, B. M. (1995). What theory is not. *Administrative Science Quarterly*, *40*(3), 371–384. doi: 10.2307/2393788

Thomson, I. (2002). Thomson job impact study: The next generation of corporate learning. Retrieved from http://www.netg.com/DemosAndDownloads/Downloads/JobImpact.pdf

Tuckman, B. (2002). Evaluating ADAPT: A hybrid instructional model combining web-based and classroom components. *Computers & Education*, *39*(3), 261–269. doi:10.1016/S0360-1315(02)00045-3

Twigg, C. A. (2003). Improving learning and reducing costs: New models for online learning. *Educause Review*, *38*(5), 28–38.

Utts, J., Sommer, B., Acredolo, C., Maher, M. W., & Matthews, H. (2003). A Study Comparing Traditional and Hybrid Internet-based Instruction in Introductory Statistics Classes. *Journal of Statistics Education*, *11*(3). Retrieved from http://www.amstat.org/publications/jse/v11n3/utts.html

Vaughan, N., & Garrison, D. (2005). Creating cognitive presence in a blended faculty

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.

development community. *The Internet and Higher Education*, *8*(1), 1–12. doi:10.1016/j.iheduc.2004.11.001

Vincenti, W. G. (1990). *What engineers know and how they know it: Analytical studies from aeronautical history*. Baltimore, MD: Johns Hopkins University Press.

Ward, J., & LaBranche, G. A. (2003). Blended learning: The convergence of e-learning and meetings. *Franchising World*, *35*(4), 22–23.

Whetten, D. A. (1989). What constitutes a theoretical contribution? *Academy of Management Review 14*(4), 490–495. doi:10.2307/258554

Young, J. R. (2002). "Hybrid" teaching seeks to end the divide between traditional and online instruction. *The Chronicle of Higher Education*, *48*(28), A33–A34. Retrieved from http://eric.ed.gov/ERICWebPortal/recordDetail?accno=EJ645445

Source: Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2014). Developing models and theory for blended learning research. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended learning: Research perspectives, volume 2* (pp. 13-33). New York, NY: Routledge.